1. Examples of the practical benefits of the SRUC research programme, including their contribution to / impact on the Scottish economy

- How SRUC’s research / impact contributes to sustainable economic growth in the Scottish Economy

As noted previously, SRUC’s research/impact (from Biggar Economics Report 2016) has supported 2,590 Scottish jobs and 2,930 UK jobs in 2015/16. Knowledge generated from its R&D has generated £277 million GVA for the Scottish economy and £530 million GVA for the UK economy in 15/16.

SRUC’s work contributes to a broad scope of activity, such as livestock breeding, animal health and welfare, crop health and greenhouse gas reporting and mitigation.

A table giving examples of SRUC’s research impact can be found in Appendix 1. Further examples of the impact of SRUC’s research programme can be found at: [https://www.srz.ac.uk/info/120464/research_impact](https://www.srz.ac.uk/info/120464/research_impact).

SRUC’s research is focused on the excellence and relevance of its outputs and outcomes. This was evidenced from the 2014 REF outcome where (in a joint submission with the University of Edinburgh) SRUC was ranked first in the UK for agriculture, veterinary and food science.

-- Queens Anniversary Prize 2017

Further evidence of our excellence in research can now be revealed (this was embargoed until 30th November 2017). SRUC has been awarded the Queen’s Anniversary Prize for Higher and Further Education. This award is the highest form of national recognition open to educational institutions in the UK and is awarded to an institution as a whole. We received the award for our work on dairy genetics and improvement. The prize winning submission was based on the long-term dairy genetics study of our Dumfries-based Langhill dairy herd; this is the world’s longest running dairy study. Established in the 1970s, this dairy herd is a unique international resource for dairy cattle genetics, with studies providing valuable data on issues including milk yields, fertility, welfare standards and dairy farming’s impact on climate change.

SRUC’s research underpins many of the international developments in dairy genetic improvement and dairy cow management and has led to the adoption of new breeding goals for dairy cattle that improve the health, welfare and economic performance of livestock in the UK and beyond. The work is supported by the Scottish Government through the Environment, Agriculture and Food Strategic Research Programme, with the study to date estimated to have benefited the British dairy industry by more than £400 million.

2. Details on projects likely to be impacted by UK exit from the EU - including the nature of the impacts and loss of funds

- Likely impact of Brexit-disruption

There are four main areas that are likely to impact SRUC:

- Attraction and retention of talent
- Research funding
- Attracting students who will become the skilled and motivated workforce for the future
- The responsibility of the College to support Scottish agriculture through the long-term adjustments resulting from a post-Brexit environment.
SRUC has been an active participant in EU R&D since Framework Programme 3 was introduced in the early 1990s. A list of SRUC’s Current EU research funding from the Horizon 2020 programme is given below.

**Table1: Current secured EU R&D Funding to SRUC.**

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Project Name</th>
<th>Contract Start Date</th>
<th>Contract End Date</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1026931</td>
<td>EU: Pluridisciplinary study for a ROBust and sustainable Improvement of Fertility In Cows (PROLIFIC)</td>
<td>01/02/2013</td>
<td>31/01/2017</td>
<td>45,381.10</td>
</tr>
<tr>
<td>1028465</td>
<td>EU: Next generation European system for cattle improvement and management (Gene2Farm)</td>
<td>01/10/2012</td>
<td>31/12/2015</td>
<td>175,855.49</td>
</tr>
<tr>
<td>1028827</td>
<td>EU: Increasing adoption of mitigation options to minimise agricultural GHG emissions (INCOME)</td>
<td>03/02/2014</td>
<td>30/06/2018</td>
<td>40,000.00</td>
</tr>
<tr>
<td>1030571</td>
<td>Development of an easy to use metagenomics platform for agricultural science</td>
<td>01/12/2015</td>
<td>30/11/2019</td>
<td>15,000.00</td>
</tr>
<tr>
<td>1030692</td>
<td>iSAGE Innovation for sustainable sheep and goat production in Europe</td>
<td>01/03/2016</td>
<td>28/02/2020</td>
<td>431,030.40</td>
</tr>
<tr>
<td>1030693</td>
<td>IMAGE Innovative management of animal genetic resources.</td>
<td>01/04/2016</td>
<td>31/03/2020</td>
<td>55,600.77</td>
</tr>
<tr>
<td>1031062</td>
<td>Genomic management tools to optimise resilience and efficiency GenTORE</td>
<td>01/04/2017</td>
<td>31/03/2022</td>
<td>425,639.12</td>
</tr>
<tr>
<td>1031065</td>
<td>Redesigning european cropping systems based on species MIXtures (ReMx)</td>
<td>01/04/2017</td>
<td>31/03/2021</td>
<td>256,531.96</td>
</tr>
<tr>
<td>1031067</td>
<td>Transition paths to sustainable legume based systems in Europe (TRUE)</td>
<td>01/04/2017</td>
<td>31/03/2021</td>
<td>225,463.20</td>
</tr>
</tbody>
</table>

Therefore this funding is worth a total of £1.67m to SRUC. This portfolio has gradually built up over the past three years in H2020. It would be expected that a further £0.5-1m funding would be secured by the end of the current H2020 framework.

- It is impossible to say at present what impact the Brexit outcome will have on future R&D due to current uncertainties. For example, H2020 will have finished by the time we leave EU (so we fully expect to participate in this, up to that point) and access to any new programme will depend on our status at that point. If we were not able to participate we would lose around £2m project income and our European networks would be severely damaged. This could have consequences in the short term as we would need to find alternative income sources to maintain sustainability.

- The type of Brexit outcome will be critical to Scotland. The current debate over the soft/hard Irish border and if it sets a precedent for Scotland is just one example.

- What all this uncertainty means is that Scotland will need a strong and flexible supply of objective research to provide the evidence base quickly to underpin the necessary policy
development, testing, implementation and ultimately feedback and control. SRUC has played a strong leadership role in this area for many years. Examples include the work on the support of CAP reform under the Pack Report and the ‘Doing better’ initiative. Research outputs under the SRP 2011-16 helped underpin policy work on CAP reform. A range of potential CAP options and approaches were considered and analysed and illustrations of their potential effects were presented to policy teams. These were influential in shaping final policy decisions on the reformed CAP. Stakeholder engagement was also central to this process, and ensured consensus on regionalisation and an understanding of the impact of the reforms. SRUC also delivers the SG’s Farming for a Better Climate Initiative which draws on our research and works with farmers to find practical ways to move towards a more profitable, low carbon future, adapt to a changing climate and secure farm viability for future generations.

- Brexit will challenge UK industry - particularly the agriculture sector - to be more competitive both to secure new markets across the world and to overcome new barriers to trade with the EU. This means tackling the UK’s relative decline in agricultural productivity compared with competitor nations. One example of recent SRUC contributions to this is the work SRUC has done on the Beef Efficiency Scheme. Whilst this is currently part of the Scottish Rural Development Programme, part funded by the European Agricultural Fund for Rural Development, preliminary results from SRUC research has shown relatively high heritability for time to slaughter, suggesting that a breeding scheme could greatly improve the efficiency of Scotch beef production, its carbon footprint and potentially the quality of the consistency/quality of the product. Such work builds on SRUC’s unrivalled track record in applied animal breeding.

- Research work will be needed to develop new agricultural policies and programmes post Brexit for Scotland. It is notable that Northern Ireland is already taking initiative on this with a Sustainable Land Management Strategy. Further research will be needed to sustain and develop such strategies if they are to help support a prosperous economy post Brexit. SRUC, with its close links to the farming industry is uniquely well placed to lead such initiatives.

- Overall it is difficult to assess the exact financial impact of BREXIT on SRUC at this point. What would be more difficult to replace would be the scientific and institutional networks built up across Europe over many years. In SRUC, these have been established since Framework Programme 3 in the early 1990s. These provide valuable scientific intercourse, so are vital to the promotion of innovation, collaboration and knowledge exchange. We would wish to preserve these through opportunities to actively engage with our European partners post-Brexit.

- Changes on future agricultural policy is likely to affect Scotland disproportionally, compared to the rest of the UK. Livestock farming represents more than 50% of Scottish agricultural output and changes in policy support are likely to have a profound affect. Hence the R&D to support future upland and hill farming will need to be reinvigorated in Scotland.

3. Further views on the Challenges going forward

- Future Challenges

Absorption and clever deployment of disruptive technologies:
The rate of technology-driven change is accelerating, with continuing improvements in digital technology, analytical capacity, availability, quantity and quality of data, advances in biology and genetics. There is a need to generate a virtuous circle of acquiring better, more detailed information, used to develop better tools to analyse and use information, create new products and services, connect to land and environmental custodians so as to acquire better information. Currently the flow of information and knowledge is fragmented. Radical cultural change is required within agricultural
research institutions across Scotland to move to open sharing of data; joint ventures; collective added value; shared aspirations and objectives, alliances and collaboration. Across the UK and internationally, the agri-food industries face substantial challenges to feed a world population of up to 9bn by 2035. Solutions must be grounded in multidisciplinary, multifaceted approaches, working together in a smart connected way to address these “grand” challenges.

- We are entering a new era with new sets of challenges and opportunities that are at the nexus of human health, consumption, agriculture and the environment which are central to Scotland’s economy and societal well being.
- Addressing these challenges and capturing these new opportunities will require new ways of working, greater collaboration and a commitment to open science.

Deeper and more sophisticated collaborations:

To meet these challenges in Scotland a refreshed rural (agricultural and land-based) outward facing science-led research strategy is required. This will drive change in the agriculture and related industries, locally, nationally and globally in Scotland and beyond. It will also require the Main Research Providers (MRPs) to work and behave differently, create new collaboration models based on shared facilities, appointments and where possible co-location.

Helping Scottish agriculture to adapt:

In a Scottish context, the recent interim report published by the Scottish Agricultural Champions, recognises that agriculture faces significant challenges which will require the industry to adapt. SRUC is committed to providing the evidence base for this and other key issues to help provide creative and innovative solutions for the industry as it navigates change.

Each of the four themes of the Agricultural Champions’ report (continuity; assisting Scottish agricultural through change; enhancing Scotland's natural capital; helping to improve the productive efficiency of Scottish agriculture) covers important areas which match closely with SRUC’s capacity and expertise. We are particularly attuned to the specific needs of Scottish agriculture and committed to ensuring this is understood across the UK. SRUC is positioned to provide flexible and industry facing education, skills, services and support that will be required in this new era.

SRUC’s new strategy takes all the above factors fully into account and we have begun the process of implementing this across the organisation through our transformation plan. An example of such strategic thinking is our recent announcement of closer working with the Moredun Research Institute. We have entered a new strategic partnership to advance livestock health, welfare production and resilience in support of Scottish and global rural development, food security and food safety. The institutions already work closely together through the provision of research and veterinary disease surveillance services to the Scottish Government. A strengthened partnership will build on their complementary expertise and capacity in animal health, welfare, genetics, nutrition and pastoral farming systems. To support this, the alliance will see cross-disciplinary collaborative teams established over the coming months in areas of strength, such as biosecurity, food security and SMART farming. These teams will maximise opportunities to leverage new sources of investment from Scottish, UK, EU and global funders and share facilities, equipment and resources. The changes will drive an improvement in the quality and relevance of translational research, providing solutions for Scottish and global challenges.

4. Details of the historic and current losses related to fixed assets

Loss on disposal of fixed assets:

While the Statement of Comprehensive Income in the accounts to 31 March 2016 shows a loss on the disposal of fixed assets of £3,087. The strategic report on page six explains that the net effect on the result for the year is a net surplus on disposal of £900k once you reflect the release of the
related capital grants and negative goodwill on these assets. Note 25 in the accounts shows that there was a positive cash flow of £1.174m in relation to disposals, while notes 1 and 2 show the recognition of additional deferred capital grant income. There was therefore no drain on the resources of SRUC.

This was the first year of compliance with FRS102 and all buildings had to be reviewed in detail to split them between land value and the major component parts of the building. Under FRS102 the main components of a building are given different estimated useful lives. SRUC has a very large and detailed fixed asset register due to its diverse estate and considerable work was undertaken to perform this review thoroughly. The result of this review was the identification of old items in the fixed asset register that should no longer be carried at a value. These were accounted for as disposals and the related deferred grants were also released. The assets that were actually sold resulted in a gain on net book value of £177k after selling costs.

In the year ended 31 March 2015 the comparable loss was £253k with a positive cash flow of £1.7m.

5. Further detail/clarification re pension liabilities.

Actuarial loss in respect of pension schemes.

The figure quoted of £11.8m is the actuarial loss for the year ended 31 March 2017 which is reported in the Statement of Comprehensive income in respect of the four defined benefit pension schemes SRUC is required to account for under FRS102. The related pension liability on the balance sheet is £28.4m.

A significant actuarial loss was expected as noted in the financial statements to 31 March 2016 following the Brexit vote which had an impact on bond yields (2015-16 Financial statements: note 34. Post balance sheet events). The rest of the higher and further education sector, which reported to 31 July 2016, showed similar significant actuarial losses.

The figure is calculated by expert actuaries according to the Accounting standard FRS102; it is based on the most recent triennial actuarial valuation (from 31 Mar 2014) and updated to assess the assets and liabilities of the schemes as at the reporting date. As stated to the committee the updated pension position will be known following the next triennial valuations which are expected early 2018.

This is a figure that does fluctuate according to external circumstances as evidenced by the gain in the year to 31 March 2016 of £2.9m and the loss to 31 March 2015 of £5.2m.
## Appendix 1: Example of SRUC Research and its Impact

<table>
<thead>
<tr>
<th>Project topic</th>
<th>Summary</th>
<th>Impact</th>
<th>Contribution to SG strategic outcomes</th>
<th>Why SRUC is uniquely positioned to provide this work</th>
</tr>
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<tbody>
<tr>
<td><strong>Dairy genetics research</strong></td>
<td>Research by SRUC has led to the national adoption of new breeding goals for dairy cattle that improves the health, welfare and economic performance of livestock in the UK and beyond. This work has just won the prestigious Queen’s Anniversary Prize for Higher and Further Education.</td>
<td>The economic benefits of the College’s dairy genetic selection work have been independently evaluated to be at least £408 million. The project has received long-term support from the SG RESAS programme.</td>
<td>Wealthier and fairer: enabling Scottish dairy farms to reach their full economic potential and supporting farms in locations across Scotland.</td>
<td>The Langhill dairy herd is a genetically unique dairy herd that is a leading international resource for dairy cattle genetics and related research. The main genetic selection experiment is the world’s longest running dairy cattle breeding investigation which started in the 1970s.</td>
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<tr>
<td><strong>SRUC Hill &amp; Mountain Research Centre Collaborative work with Moredun Institute</strong></td>
<td>Since 2011, SRUC’s Hill &amp; Mountain Research Centre near Crieanlarich has been collaborating with Moredun to test the applicability in hill farming situations of taking a Targeted Selective Treatment approach to administering anti-parasite treatment (anthelmintics) to lambs. The collaboration between SRUC and Moredun on this work has been funded by the RESAS 2011-16 and 2016-21 Strategic Research Programme.</td>
<td>Resistance to anthelmintics is increasing among Scottish sheep flocks. At present, 80% of lowland flocks and 55% of upland flocks show evidence of resistance. The use of the TST approach is only one part of a wider Precision Livestock Farming approach which SRUC is demonstrating. During 2011-2016, the TST approach resulted in a marked reduction in worming costs (e.g. £13 per 100 lambs using the TST approach as opposed to £71 per 100 lambs taking a conventional approach) and a marked reduction in the amount of time – and hence labour – needed when worming lambs. The use of the TST approach did not compromise lamb growth. SRUC and Moredun are continuing to highlight to hill farmers and crofters the value of taking such</td>
<td>Wealthier and fairer: helping Scottish hill farms to reach their full economic potential. Greener: reducing the local and global environmental impact of our consumption and production. Specifically the TST approach will help ensure the availability of effective anthelmintics is sustainable into the future and improves animal welfare by not treating animals when they do not have to be treated.</td>
<td>SRUC is unique in the UK in having a research and demonstration farm which is not only focussed on such a wide range of agricultural and environmental challenges of direct relevance to hill farmers and crofters but is also seeking to develop, test and demonstrate innovative solutions to those challenges as part of a wider Precision Livestock Farming systems-based approach. [Note that other facilities exist in JHI, Bangor and Aberystwyth but none of these facilities are taking such a system approach or investigating such a wider range of challenges and solutions.</td>
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an approach. The incorporation of the TST approach has contributed to the overall labour saving of £4 per ewe per year at Kirkton & Auchtertyre.

<table>
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<tr>
<th>Scotland’s BVD Eradication Programme</th>
<th>SAC Consulting Veterinary Services (SACCVS) was instrumental in establishing the Scotland’s mandatory Bovine Viral Diarrhoea (BVD) eradication programme in 2012. The percentage of herds that cannot show freedom from the disease has reduced by 30% (from 38% to 8% currently). It is estimated that 70% of testing to support the programme has been carried out by SACCVS.</th>
<th>Annual savings to dairy farmers nationally through the eradication of BVD at estimated to be more than £11m. The work has added to the wealth of the cattle farmers of Scotland and through the improvement in calf survival and fertility, has reduced the amount of green house gas emissions per kg of beef and milk produced.</th>
<th>The BVD eradication programme contributes to three of Scottish Government’s five strategic objectives: wealthier and fairer, safer and stronger and greener.</th>
<th>SRUC was uniquely placed to input to this project through the expertise generated by their provision of farm animal surveillance to Scottish Government and the Scottish livestock industry.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural greenhouse gas reporting and mitigation</td>
<td>Since 20011, when SRUC’s Carbon Management Centre was established, SRUC has expanded its research effort around agricultural greenhouse gas reporting and mitigation with funding from Scottish Government, BBSRC, NERC, EU, CCC, DEFRA and the levy bodies.</td>
<td>Work on emissions estimates has supported an economic analysis of opportunities for GHG mitigation through Marginal Abatement Cost Curves, which have fed into UK and Scottish carbon budgets. SRUC has played a leading role in the Greenhouse gas platform programme which received a total investment of £12.6 million (2011-2015), funded by Defra, the Scottish Government and the Welsh and NI Governments. It sought to improve the accuracy and resolution of our reporting system by providing new experimental evidence on the factors affecting emissions and</td>
<td>Greener: protecting the environment for future generations; reducing the local and global environmental impact of our consumption and production.</td>
<td>SRUC is unique in the UK in bringing together the wide range of skills necessary to characterise greenhouse gas emissions from agricultural systems. Within the organisation, livestock, crop, soil and economic experts work together to provide a comprehensive analysis of farming systems. This systems approach is particularly important in the context of greenhouse gas emissions, where small changes in management can lead to important outcomes to the system as a whole.</td>
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<tr>
<td><strong>Genetic evaluation of dairy cattle for resistance to bovine TB</strong></td>
<td>SRUC has developed national bTB genetic and genomic evaluations to allow selection for genetic resistance to the disease.</td>
<td>Bovine TB costs the UK taxpayer around £40m per year. Its cost to the farming community, wildlife and society’s enjoyment of the countryside is immeasurable. It would be desirable for bTB to be under control yet it continues to rise. To date, genetic selection for resistance has not been available and so control measures rely on testing and culling. The impact of increasing the resistance of dairy cattle to bTB manifests itself through a number of routes: 1) Identification of cows that are candidates for culling based on the genetic resistance to bTB. 2) Fewer cows spreading the disease leading to increased herd health and reduced disease risk.</td>
<td>Wealthier - we realise our full economic potential; greener - We reduce the local and global environmental impact of our consumption and production.</td>
<td>SRUC is the only UK institution to provide genetic and genomic evaluation on TB and for the dairy industry more generally and has a unique network of linkages into the dairy farming sector, through which advice and knowledge may be exchanged.</td>
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<tr>
<td>QBA is a whole-animal approach to animal welfare assessment that was newly developed and validated at SRUC. QBA was adopted as an indicator for positive emotional state in pigs, cattle, poultry, sheep, goats, donkeys and horses. Last year saw the start of collaborations with Twycross Zoo and The Donkey Sanctuary, and work with OMSco (organic milk suppliers) and BPEX is about to start, to develop strategies for the uptake of QBA in daily animal welfare management.</td>
<td>Potential impacts of these projects are that the use of QBA will enhance good caretaker/stockmanship and the expression of positive demeanour in managed animals. They will also lead to new training procedures and materials. SRUC’s current QBA collaborations will serve as innovative case-studies that, if successful, are likely to inspire similar organisations to follow suit in adopting QBA. It is notoriously difficult to influence farming practice, however these projects are certain to increase QBA’s visibility, and may inspire further development and impact. There has been interest in a QBA training workshop (UK, Brazil, Ethiopia).</td>
<td>Wealthier and fairer: enabling farms to reach their full economic potential.</td>
<td>SRUC has been wholly responsible for devising and developing the QBA approach and it has now gained worldwide traction.</td>
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<tr>
<td>Causes and control of grain skinning in malting barley</td>
<td>The quality of malting barley is of paramount importance, for reasons of food safety, product quality and the competitiveness of the UK cereals industry. Barley grains have an outer coat called a husk. Loss of the husk during harvest or post-crop breeding supported by SRUC’s high quality science will help to solve this problem, as it will underpin the development of new barley varieties, with improved husk adhesion properties, and thus provide more reliable grain and</td>
<td>Wealthier and fairer: enabling Scottish barley growers to reach their full economic potential and supporting farms in locations across Scotland.</td>
<td>SRUC’s unrivalled links with growers through our network of consultancy offices allows us to identify such issues at an early stage and work closely with them to find a solution.</td>
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</table>
Harvest is called grain skinning. This undesirable condition has very serious consequences for farming and food sectors that depend on UK malting barley. Primarily, grain skinning is a serious problem in the malting process. However, its financial implications extend across the whole supply chain. Breeders invest about £2M in bringing a new barley variety to market, this spend is wasted if farmers and the malting industry no longer approve its use. Even low levels of skinning mean than loss of barley quality or malt production amounts to several £ million.

Processing quality for the UK cereals supply chain. Identification of plant screening and genetic tests will enable susceptible barley varieties to be eliminated before they are recommended for use by farmers and the malting industry. This will provide greater security for the UK barley supply chain and a more efficient development pipeline for the plant breeding of new varieties. An added benefit to farming is the promotion of more efficient use of inputs, as these will not be wasted on poor quality or rejected crops.

To address this problem SRUC will use reliable phenotypic screening with genetic analysis in order to identify loci that determine vulnerability to skinning. Longer term new varieties may be bred without this undesirable condition.