

GUIDANCE FOR APPLICANTS

The Environmental Biotechnology Network
– a BBSRC/EPSRC NIBB

Business Interaction Vouchers



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Introduction

Background

The Biotechnology and Biological Sciences Research Council (BBSRC), in association with the Engineering and Physical Sciences Research Council (EPSRC), have committed approximately £11M to fund six unique networks for a second phase of Networks in Industrial Biotechnology and Bioenergy (NIBB Phase II).

The second phase of the BBSRC NIBB will continue to build capacity and capability in the UK, supporting research and translation in biologically based manufacturing. Their aim is to continue to foster collaboration between academic researchers and business at all levels, in order to find new approaches through excellent research to tackle research challenges and help deliver key benefits in IBBE. Details of all of the Networks can be found on the BBSRC website:

(<https://bbsrc.ukri.org/research/programmes-networks/research-networks/nibb/>).

- Algae-UK: Exploiting the algal treasure trove
- BBNet: Biomass Biorefinery Network
- CCNet: Carbon Recycling - Converting waste derived GHG into chemicals, fuels and animal feed
- E3B: Elements of Bioremediation, Biomanufacturing & Bioenergy – Metals in Biology
- EBNet: Environmental Biotechnology Network
- HVB: High Value Biorenewables Network

The Networks will run from 2019 to 2024, will provide flexible funding for projects and are open to new members throughout their lifetime.

About EBNet

Microbial systems provide a range of environmental protection and bioremediation services, forming the basis for some of the world's largest industries across the Water-Wastes-Soil nexus. Development of such systems to date has been largely empirical and incremental, but the pace is changing in response to the need to match expanding global demand with finite resources. There are also new challenges to address, ranging from the emergence of new micro-pollutants to the requirement for efficient closed-loop systems that combine treatment with resource recovery.

The current revolution in biological and analytical sciences is creating tools that give unprecedented insights into these systems from genetic to community level, and into factors that can potentially be used to control and harness them. At the same time, new approaches allow enhanced measurement and modelling of engineering phenomena such as mixing and mass transfer, while advances in materials science and separation technologies offer the potential for selectively retaining microbial biomass and/or removing final and intermediate metabolic products. These developments thus offer a chance to optimise existing treatment processes and to create more sustainable 'future-proof' technologies in new areas of application. Successful exploitation of these opportunities depends, however, on bringing together an enhanced knowledge of the underlying science with the ability to apply this in large-scale engineered systems, which must meet both societal expectations and increasingly stringent economic and environmental requirements.

The aim of EBNet is thus to develop and strengthen links between advanced molecular and applied microbiology, engineering and systems optimisation to maximise the societal impacts and benefits. Its overall goal is to take fundamental discovery science towards practical application in key areas of the human/environment interface.

Principal Investigator

- Professor Sonia Heaven, University of Southampton, Faculty of Engineering and the Environment

Co-Investigators

- Professor Frederic Coulon, Cranfield University, School of Water, Energy and Environment
- Professor Tom Curtis, Newcastle University, School of Engineering
- Dr Tony Gutierrez, Heriot-Watt University, School of Engineering and Physical Science
- Dr Jhuma Sadhukhan, University of Surrey, Centre for Environmental Strategy

Business Interaction Voucher (BIV)

What is a BIV?

EBNet BIVs are a BBSRC/EPSC-funded initiative aimed at connecting industry and academic partners. Essentially, the voucher enables industry partners to 'buy' an academic's time and expertise to look at a clearly defined and specific industry problem. Meetings and consortium building can form part of a BIV, but should not be the sole purpose. The work must also be relevant to the aims of EBNet.

Priority will be given to proposals that foster industry/academic links by supporting the implementation of new technology through troubleshooting and problem-solving research. It is hoped that projects will unlock the potential of academia to provide novel expertise, solutions and resources which would otherwise be unavailable to the industry partner. We are particularly looking for progression through TRL levels 1-4 and projects with the potential for further development and impact will be prioritized.

EBNet have a total of £100,000 (at 80% FEC) for BIV projects. BIV projects may range from £5K to a maximum of £20K with individual calls specifying the maximum project value. The BIV is paid to the academic at 80% FEC. Matched funding (to the 80% FEC EBNet contribution) is required from industry, with a minimum of 50% in cash and the remainder can be in kind. Thus, at the maximum value, a £20K BIV would require a minimum of £16K in matched industry funding, of which a minimum of £8K must be in cash as illustrated in the table below. All contributions must be auditable.

	100% FEC	80% FEC EBNet Contribution
Academic Contribution	£20,000	£16,000

	In Kind	In Cash (50%)	Total
Industry Contribution	£8,000	£8,000	£16,000

The duration of the BIV must be no longer than 6 months.

Aims and Objectives of the BIVs

The BIV vouchers are intended to help resource confidence-building measures between an academic partner and an industry partner that are likely to lead to outcomes of:

- a longer-term relationship
- improved interaction
- new research technology transfer projects

To be clear, BIVs are not intended to support research but rather to support the Industry partner to access academic expertise and resources to examine a specific industry issue. The grants should fund new collaborations as a priority, but can be used to fund continued collaborations.

Eligibility

All participants named on the application must be members of EBNet and based in the UK.

The funds are awarded to the academic partner who must be a lecturer eligible to receive BBSRC funding. Eligibility guidelines can be found at www.bbsrc.ac.uk/web/FILES/Guidelines/grants-guide.pdf. The industry partner must be UK-based. All sizes of business are considered, from micro-SME to large companies.

BIVs are considered as *de minimis* aid and industrial partners need to ensure they are not in breach of *de minimis* aid rules by accepting the BIV. Further information can be obtained at www.gov.uk/state-aid.

To register as an EBNet member, visit www.ebnet.ac.uk, or contact Angela Bywater/Dr Louise Byfield at EBNet@EBNet.ac.uk for further details. Membership is free and you can join at any time.

If you have questions regarding your eligibility, please [contact us](#).

Common Queries

1. Do I have to apply for the maximum amount?

No. You can apply for any amount depending on your circumstances. It may be that matching funds available from the industry partner are limited or that academic resource for the job is limited, e.g. a PhD student will be utilised, so will be limited by the 6 hour rule. Alternatively, if the industrial partner is offering a substantial commitment (e.g. through the contribution of equipment or equipment time), the academic partner is under no compulsion to ask for a similar amount if it is not required. This is a flexible amount provided that genuine matching funds from industry are met or exceeded.

2. Why is this at 80% FEC – I am sure that these are sometimes 100% FEC?

Different Phase II NIBBs have different rules, with some offering BIVs at 100% FEC and others offering them at 80% FEC. However, EBNet can only offer BIVs at 80% FEC. Read the guidance carefully – there are different limitations and conditions in place compared to previous NIBB Networks and to other NIBB II Networks.

3. As the Industry partner, I intend to provide £x worth of material to the project – is it counted as in cash or in kind?

The *cash* contribution must be paid over to the University and form part of the project audit trail, otherwise we do not count it as *in cash*.

4. What kind of expenses can be included for the industrial 'in kind' contribution?

'*In kind*' contributions can include items such as the loan or gift of equipment, provision of samples & sampling, travel expenses, staff time for meetings, contributions to reports or other work on the project. The figures should be reasonable and justifiable for the amount of work required or equipment loaned.

5. Can a PhD student be used to do the work?

PhD students are covered by the '6 hour' rule. Thus, they are limited in the amount of work they can contribute to a BIV project. Also, work conducted through a BIV may not form part of their thesis. Within these limits, a PhD student can be used to do the work. If known, please be sure to specify under what conditions the PhD(s) will be working (i.e. separate contract) on your application to avoid delays to the process.

6. *Does the project have to run for 6 months?*

No. It could be a short project of 1 month, a full 6 months or anything in between.

7. *What happens if my project exceeds 6 months?*

BBSRC/EPSRC will only pay for work within 6 months of the agreed start date. This funding stream is intended as an introduction between industry and academia. If you anticipate a longer project, please seek alternative funding, e.g. through Innovate UK.

There is the possibility of negotiating a discontinuous BIV where the work is “cut” into segments. This would only be considered if it was inherent and essential to the project (e.g. a growing trial with 1 month of work in spring and 1 month of work in autumn but no activity between). This would need to be discussed with us and negotiated with BBSRC/EPSRC *prior to application* on a case-by-case basis.

8. *My industry partner is worried about confidentiality and intellectual property. What is the situation?*

The publically available summary of your application will be sent to reviewers and may be publicised widely. It should not contain any commercially sensitive information. Reviewers are asked to declare any conflict of interest and maintain confidentiality.

Should you be funded, we will ask for a publically available report on the work, but you are free to omit sensitive or confidential information from it.

We make no claim on your IP rights. We do ask you to state that you have a collaboration agreement in place between you and your partner, specifying relative contributions and IP ownership, before you start work. We do not need to see this.

9. *I already have a BIV running. Can I ask for another with a different industry partner?*

Yes. As long as this is not a continuation of a previously funded BIV and is a separate and clearly defined piece of work, you can apply for as many as you wish, with as many different industry partners as you wish. We strongly encourage new interactions.

10. *I have applied for several BIVs from other NIBBs. Will this affect my chances of success?*

No. We understand that there is substantial overlap between areas of biotechnology and expect that active institutions will make multiple applications.

The only way this could be relevant is if you have applied to multiple NIBBs for BIVs with *the same industry partner*. BBSRC/EPSRC may then ask for clarification to determine why these count as new interactions, which would delay the process of approval. There are some global companies with large IB interests in diverse areas. It could be the case that applying to different departments with varying proposals would make sense, but please give us as much context on the application as you can and be patient if we need to seek more information.

11. *Can I claim estates and overheads?*

Speak to your Finance Department for a full explanation of the rules regarding Research Council funding in the UK. As this will be paid at 80% FEC, your level of overheads should be stated in the financial breakdown section of the application.

12. I have a partner in mind but I don't know which NIBB to apply to.

You can email or call us and we will be happy to run through the options. Details of all the NIBBs are available through the BBSRC website.

13. I have an idea for a useful project but don't have an academic partner. Can you help?

Yes. We may be able to suggest a partner immediately or we could circulate a detailed or anonymous request among our members or through our newsletter. We have many academic members who could be interested in a partnership. We may also be able to approach specific EBNet members with appropriate expertise on your behalf, depending on the nature of the project. Contact us to see how we can help.

For more help, you could try konfer. Konfer was created by the National Centre for Universities and Business (NCUB), Research Councils UK (RCUK), Higher Education Funding Council for England (HEFCE), and Innovate UK. See: <https://konfer.online/>

Application Process

How to apply

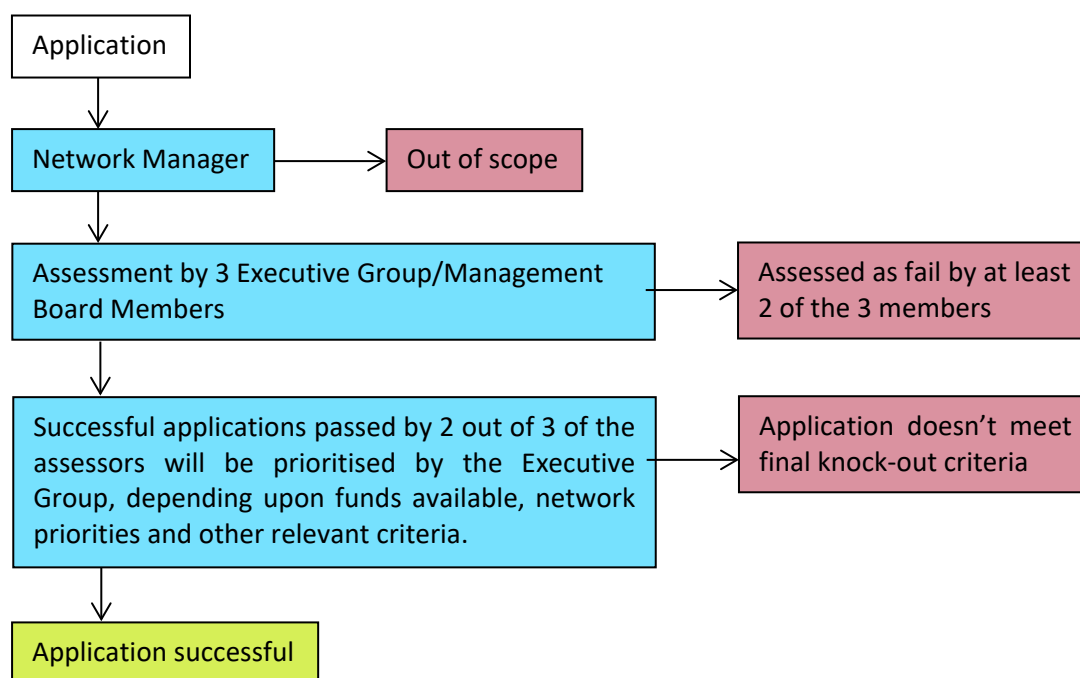
Application is through a simple application form available from <http://ebnet.ac.uk/> or by emailing EBNet@EBNet.ac.uk.

Calls will be advertised to the membership through the newsletter and website.

A “Letter of Support” signed by the industrial partner detailing their matching contribution must be sent with the application.

Applications should be sent to EBNet@EBNet.ac.uk as a Word or PDF email attachment and will be acknowledged by email upon receipt with a reference number (BIVYYYYXX) which should be used in any further correspondence. Should an acknowledgement not be received in good time, please contact the Network Managers directly to ensure your application is processed.

Process for BIV review



Submissions will first be sifted by the Network Managers to ensure they are consistent with the aims and objectives of the Network. They will then be grouped according to their chosen theme and passed to 3 non-conflicted Executive Group/Management Board members for assessment.

These three members will assess the applications on a simple pass/fail basis, with a majority required in order to be passed to the Executive Group for final assessment and prioritisation. Applications which are successful are sent for final approval by the BBSRC.

We aim to assess proposals within 6-8 weeks. No feedback will be given on the proposal, but unsuccessful applicants are able to re-apply once more in a subsequent call.

Reviewers will be expected to adhere to the highest standards of scientific integrity as laid down by the BBSRC (<https://bbsrc.ukri.org/about/policies-standards/good-scientific-practice/>). Briefly, in the event of a conflict of interest, this must be declared to the Executive Group who will reassign the proposal to an alternative reviewer.

The BIV Application Form

General guidance

This section explains the structure of the application form and offers guidance on the information to include in each section. To help you, the guidance below provides an explanation of what is required for each field. The guidance notes are not intended to be exhaustive; you should develop your own responses based on your skills, knowledge and experience. You may refer to other sections of the form in your answers if this will help avoid repetition. Incomplete forms will be rejected.

Once filled in, the application can be returned to EBNet@EBNet.ac.uk by email as a Word attachment or PDF. Please do not send a scanned document.

Application form field guidance

BIV Application Form		
Required Fields	Guidance	Maximum word limits/ further clarification
Application details		
Proposal Title	Please give a title for your application. The title may be made publically available.	Word limit - 25
Proposal Summary	Please summarise the aims of your project. This may be made publically available.	Word limit – 250
Contact details – Academic Partner(s)		
Contact Details – Applicant(s)	Enter the full name, address, postcode, e-mail address and telephone number of the primary contact between EBNet and the proposal. This will be the grant holder in the event of a successful bid. According to BBSRC conditions, this should be a lecturer (or equivalent) from a UK university. Further contact(s) are allowed, but are for informational purposes only.	No word limit
Please confirm that you are a member EBNet and eligible for BBSRC/EPSC funding	See Eligibility	Yes/No
Are you aware of any conflicts of interest that should be considered with regard to this proposal – e.g. associations with Management Board members?	If 'Yes', give details. This section enables us to manage potential conflicts of interest during the review process.	Yes/No and separate space for details of any conflict of interest.
Contact details – Industrial Partner(s)		
Contact Details – Industrial partner(s)	Enter the full name, address, postcode, e-mail address and telephone number of the partner(s) in descending order of priority.	No word limit

Please confirm that you are a member EBNet and eligible for BBSRC/EPSRC funding	See Eligibility	Yes/No
Company reference number	This can be obtained from Companies House. If not a limited company, enter 'n/a'	This is an 8 digit number
No. of Employees	Please state number of employees on payroll. If none, state zero. Use Full Time Equivalent (FTE).	If multiple part-time employees, please use FTE
Turnover	Please state the company annual turnover for the last financial year. This should be clearly marked: ACTUAL and include the year. If a new company without a full year's accounts, please give your estimated 1 st year turnover. This should be clearly marked: ESTIMATED	In pounds sterling e.g. £10K (ACTUAL 2018-2019) or £10K (ESTIMATED)
Chosen Theme		
Chosen Theme	The theme you select will help us determine which experts will assess your proposal.	Please select one or more
Proposal Details		
Project Abstract	Give the main aim of your project and summarise the proposed methodology and potential outcomes. Provide as much detail as possible for reviewers to assess your proposed project and ensure that the industry problem is clearly stated and that the proposed work is clearly defined. If there are any ethical or social issues or if the project involves the use of animals, please provide further information here.	Word limit – 1 page
Expected timeline	Please provide a brief timescale and justification for this. Expected start date and end date. Maximum 6 months.	Word limit - 100
Proposal Sections		
<i>Each of the following questions is worth 10 points for a total of 40 points.</i>		
Section 1: Relevance to the aims of the BBSRC/EPSRC EBNet NIBB	1. Explain how your proposal contributes to technology transfer by working towards solutions to technical problems or adapting existing technology for new applications. What makes this Environmental Biotechnology? 2. Indicate how you believe the proposal will result in a new association within the Network or assist in development of a pre-existing relationship. Specify if this is a new collaboration.	Word limit - 200
Section 2: Benefit to research and industrial partnership	1. Describe how the project is a genuine partnership in terms of the respective contributions of knowledge, skills, tools and/or materials etc. and what both parties will gain from the association. a. State what the outcome of the project will mean to the <i>industrial partner</i> in terms of savings,	Word limit - 200

	<p>efficiencies, profitability, potential new markets or other benefits</p> <p>b. State what the outcome of the project will mean to the <i>academic partner</i> in terms of enhanced knowledge, greater impact deeper understanding etc.</p>	
Section 3: Outputs and deliverables	<p>1. What TRL levels will you transit between over the course of the project?</p> <p>2. Explain the intended outcome of this project in terms of the technical content, change in understanding/process/testing regime etc.</p> <p>3. Describe how the proposal is likely to build trust, deepen understanding or lead to further work in the future. Include any future sources of funding, support, development and interaction that you would be considering as a next step.</p>	Word limit - 200
Section 4: Value for money	<p>1. Explain why the proposed work would be unlikely to happen without BBSRC/EPSRC NIBB funding and why UKRI support is essential. Can you outline for the reviewer why this project is outside the scope of standard available commercial or consultancy services?</p> <p>2. Justify the level of expenditure requested and explain what steps have been taken to ensure value for money.</p>	Word limit - 200
TRL Level at start/expected at finish	State current TRL level and what you envisage the TRL to be at the end of the project. See appendix for TRL definitions.	TRL (1-5)
Financial Details		
Financial Breakdown – Academic Partner		
<p>Please provide a brief financial breakdown of your proposal in the table in pounds sterling (incl. VAT). The rules on VAT for universities can be complex with research activity and consumables classed separately – please seek specialist advice from your institution if unclear.</p> <p>The ‘Details’ column can be used for any breakdown of an individual cost as outlined below. There is extra space in the ‘further details’ section for any other relevant information.</p> <p>Staff costs should be at official University approved costings, e.g. 3 days/Mr A N Other: Technician/£120/day = £360. Please make clear – if using a PhD student – the extent of their involvement. PhD students can work on BIV projects for 6 hours a week or under (“6 hour rule”), with the BIV forming a distinct piece of work and requiring an employment contract separate to their stipend.</p> <p>Travel costs should state the purpose of travel, e.g. 3 progress meetings for 2 staff/£100pp = £600. Consumables should be broadly defined e.g. Media and lab consumables £500; specific equipment time £400.</p> <p>BIV funding cannot be used to purchase equipment. This means equipment of any kind, even single complete pieces under £10k. Salary, travel and purchase of consumables (defined as ‘an item used up in the course of the project’) are acceptable.</p>		

Please note that BIV funding cannot contribute in any way to a research degree. The purpose of the BIV scheme is essentially for industry to buy academic time (similar to contract research) and due to the nature of this, we wouldn't expect these projects to form part of a PhD or MSc thesis.

The figure in the total of the '80% FEC' column will be used to check the matched funding from the industry partner(s). A minimum of 50% of this total must be matched in cash by the industry partner, with the remainder in kind.

The total of the 80% FEC column should equal 0.8 times the 100% FEC column

The figure in the total of the 'EBNet Contrib. @ 80% FEC' column is the figure requested from EBNet and the maximum figure invoiced to the Network at the end of the project.

Occasionally, there may be instances where further academic resources are allocated to the project from elsewhere which pushes the total higher than the BIV 100%FEC total. If so, do not change the 100% FEC total. You are encouraged to explain the source and further amount in "further details".

Finance/Research Office contact: It is helpful for us to have the contact name and email address of the person responsible for invoicing and the person responsible for signing the grant acceptance letter, if known.

Financial Breakdown – Industry Contribution

Please provide a brief financial breakdown of the industry contribution in pounds sterling (incl. VAT, where applicable).

The 'Details' column can be used for any breakdown of an individual cost as outlined below. There is extra space in the 'further details' section for any other relevant information.

Estimated staff costs should be stated e.g. 3 days/ Mr A N Other: Director /£200/day = £600.
 Travel costs should state the purpose of travel e.g. 3 progress meetings for 2 staff/£100pp = £600.
 Consumables/Contributions should be broadly defined e.g. Value of donated feedstock for trial £50; use of specific company equipment value: £400 etc.

Applicants are advised that where bids incorporate a large "in kind" commitment from the Industrial partner, this should be a meaningful contribution that reflects value for money and is apparent to a reviewer.

The total in the 'Cash (£)' column should be a minimum of 50% of the total in the 'Financial Breakdown – EBNet Contrib. @80% FEC (£)' column. As it is matched funding, the TOTAL industry contribution should agree with or exceed the value in the academic 'EBNet Contrib. @80% FEC (£)'.

Checklist

Please ensure that you have sent us all documents. The following checklist may be helpful.

Please check....	√
BIV Application (as Word or PDF)	
Letter of Support* from industry partner	
Are all named applicants, including the industry partner(s), EBNet members?	
Does the finance section reconcile, with the industry partner providing a cash contribution of at least 50% of the academic's 80% FEC figure? Do all totals add up correctly, horizontally and vertically?	

*See Section 2.14 BBSRC Grant Guide for guidance

If the Award is successful

Offer, contract and collaboration agreement

If successful, the Primary Contact will be informed via email and provided with a reference number (BIVYYYYxx) which should be used on all further correspondence. Any further stipulations specific to the offer will also be outlined. The Primary Contact will also be sent a Conditional Grant Offer Letter. This must be signed and returned **within 3 months** to indicate acceptance of the award.

The Conditional Grant Offer Letter will stipulate that there is a Collaboration Agreement in place.

The Collaboration Agreement should be created between the project participants and it should incorporate the operation and exploitation of the outcomes of the project. EBNNet does not need to see a copy, but you are required to state that you have in place a document specifying the relative contributions to, and IP ownership issues regarding, the project. EBNNet accepts that any Intellectual Property arising from the bid is owned by the applicants.

It can take some time to reach agreement on this document within the consortium participants, especially considering the involvement of applicants' legal and finance departments. You are therefore strongly advised to allow sufficient time. An example of collaboration agreement can be found on the Lambert Agreement website at: <http://www.ipo.gov.uk/lambert>.

Before the project begins, a start date must be agreed with the EBNNet Network Manager. Projects **must** be completed within 6 months of this date. No expenditure will be reclaimable for activities outside of this 6 month period. This is a BBSRC/EPSRC requirement.

Reporting and Invoicing

Although no interim reporting is required for these short projects, we do ask to be informed by email immediately should there be any delays/problems envisaged.

Once the project is completed, the academic partner must submit a Final Report on the work carried out and the resources used, which must be countersigned by the industrial partner. This includes a brief publishable summary for use by the BBSRC/EPSRC, posting on the EBNNet website and other promotional activities. Please include as a separate attachment high-resolution, copyright-free images or photographs, if possible. Photographs contained within the report are not generally suitable for us to utilise for publicity purposes.

The Final Report will be passed to the Executive Group to be signed off prior to funds being released. An invoice for the full amount to be claimed from EBNNet must accompany the Final Report to enable transfer of funds. The invoice figure must agree with that shown on the financials in the Final Report.

Invoices will not be forwarded for payment until the Final Report has been approved.

Partners will be encouraged to present the results and promote the BIV scheme at Network events. During its lifetime, EBNNet may also send an occasional survey in order to ascertain any additional impact from the BIV, such as publications, product development, further funding applications and so on.

Data Protection Regulations

The PI of the BBSRC/EPSRC NIBB grant has the responsibility for keeping data relating to the grant secure and safe. Copies of the applications will be made available to the BBSRC/EPSRC, who will use this information for research related activities, including but not limited to, transfer of funds, statistical analysis in relation to evaluation of the BBSRC/EPSRC NIBB, study of trends and policy and strategy studies.

Copies will also be made available to reviewers, the Executive Group and Management Board for the purpose of assessment and evaluation such as processing the proposal, the award of any consequential grant and for the payment, maintenance and review of the grant.

They will be expected to adhere to the highest standards of scientific integrity as laid down by the BBSRC. These include guidelines for data sharing: <https://bbsrc.ukri.org/about/policies-standards/data-sharing-policy/> and good scientific practice: <https://bbsrc.ukri.org/about/policies-standards/good-scientific-practice/>.

To meet the Research Councils' obligations for public accountability and the dissemination of information, details of funded awards may also be made available on the Research Councils' websites and other publically available databases, and in reports, documents and mailing lists.

Contact Details

For any queries, please email the Network Managers, Angela Bywater/Dr Louise Byfield at EBNet@EBNet.ac.uk or telephone 02380 591281.

Appendix – TRL Levels

	Description	Defining activities	TRL achieved when
TRL 1	Basic principles observed and reported: Transition from scientific research to applied research.	Basic scientific principles observed. Research Hypothesis formulated. Scientific background and rationale for the research. Fundamental scientific investigation within an academic environment.	Potential outcomes and use of research is defined (e.g. clear elevator pitch).
TRL 2	Technology concept and/or application formulated: Applied research. Theory and scientific principles are focused on specific application area to define the concept.	Applied scientific investigation within an academic environment. Preparation for technology needs (market dependant). Analytical techniques to test reproducibility of research. Practical concepts or applications are formulated, markets identified. Patent applications filed to protect invention. Basic process/product specifications drawn up.	The relevance of the research to an application has been proven. The value of the technology to a customer is defined.
TRL 3	Analytical and experimental critical function and/or characteristic proof-of concept: Proof of concept and demonstration of technical feasibility	Technology development within an academic environment. Demonstrate reproducibility of technique and or technology Analytical studies to predict the performance of separate elements of the technology in appropriate context. Patent applications filed to protect invention. Preliminary techno-economic modelling. Explore commercial partnerships or collaboration opportunities. Data collection in line with industry expectations e.g. electronic lab books, analytical equipment records.	The technology concept has been proven but process components have not been integrated. The value of the technology to a customer is confirmed (e.g. market need and opportunity).
TRL 4	Component/subsystem validation in laboratory environment	Technology development within an industrial (or industry simulated) environment Bench scale validation. Basic technological components are integrated to provide evidence that the concept will work. Build data on reproducibility of process. Implementation of GLP processes. Understand the impact of the regulatory impact on the process. Scale up issues are understood, and mitigation plans developed. Initial techno-economic analysis using process data. Market analysis performed.	The technology concept has been proven with basic component integration. An investment case to attract private investment has been developed.
TRL 5	System/subsystem/component validation in relevant environment:	Technology development within an industrial environment (technology transferred to commercial partner and undertaken by their staff to test robustness of science and process). Basic technological components are integrated with reasonably realistic supporting elements. End to end process validation to provide evidence that the concept will work. Pilot scale experimentation. Detailed techno-economic analysis. Detailed market analysis performed.	The technology transferred to an industrial environment. A refined investment case to attract private investment has been developed.