

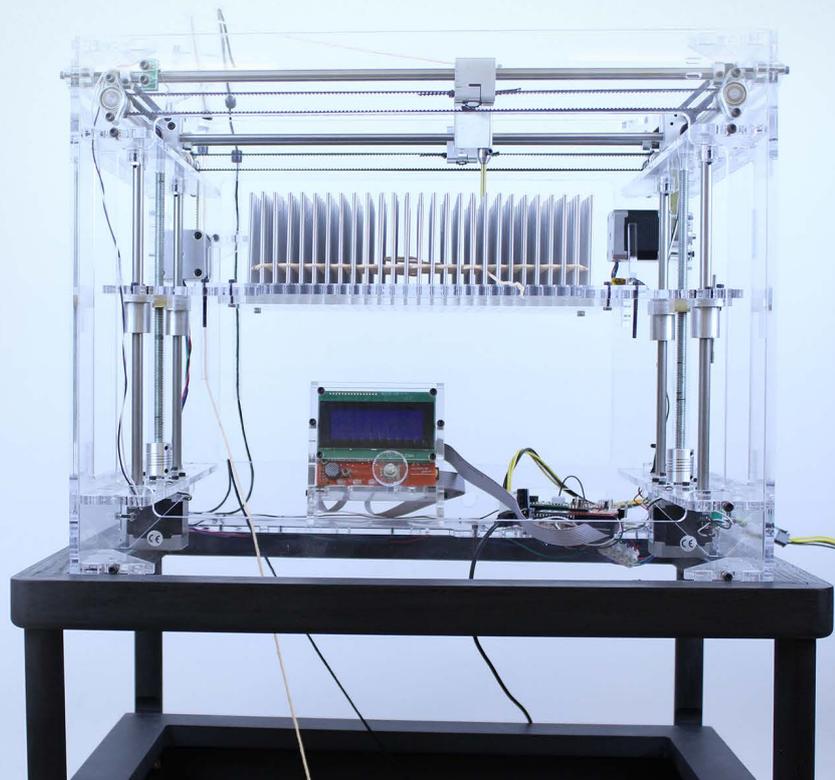


Innovation through craft: Opportunities for growth

A report for the Crafts Council

Executive summary

July 2016



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Foreword

Innovation through Craft: Opportunities for Growth

Annie Warburton, Creative Director, Crafts Council

Innovation through craft is nothing new. Across material disciplines, craft processes have always driven breakthroughs that have passed into other fields. This might seem counterintuitive. For some, not least marketing copywriters, 'craft' calls up notions of tradition at odds with the idea of innovation. Yet what David Pye (1968) called 'the workmanship of risk' – the skilled manipulation of material that affords unplanned breakthroughs – is an enduring characteristic of craft that gives it its innovative edge.

Today we see this applied in such diverse fields as digital technology, aerospace and bioscience and in examples such as an embroiderer collaborating with a roboticist to develop wearable sensors for medical and sports applications.

It is the innovations generated by these collaborations, how they occur and how we can make the most of their economic potential, that form the focus of this report.

What do we mean by innovation through craft?

Innovation *in* craft refers to evolution of technique, discovery of new materials and application of new tools. Innovation *through* craft refers to makers facilitating or catalysing innovation elsewhere. It concerns the spillover effects of craft into other industries, which are explored in this report.

If craft innovation is not new, why research the topic now? This report is timely on several counts. Recent years have witnessed acceleration in collaborative open innovation, and a transformation in making, whose scale of impact is conveyed by the label 'the fourth industrial revolution'. Alongside this, UK governments

have given increasing attention to the creative industries' considerable economic contribution, as reflected in the UK Creative Industries Council's new strategy, published in the same week as this report. In addition, 'fusion' – the combination of creative, technological and enterprise mindsets – has been identified as a key driver for successful businesses. Fusion is enabled by collaboration across sectors, as the examples in this report demonstrate.

While the Crafts Council has tracked, profiled and driven trends in craft innovation for several years, we know that with current national statistics it is not possible to reflect the full value of craft, especially that value generated through collaboration in other sectors. Further research was necessary.

For these reasons, the Crafts Council, with partners, commissioned KPMG to investigate the processes and impact of innovation through craft, to determine what, if anything, stands in the way of realising its full potential and, on the basis of its research, to identify potential policy actions to help overcome any such barriers.

In KPMG's view, based on the evidence gathered through its study, 'Craft skills and knowledge have a strong economic impact and significant potential to drive further growth and innovation in other sectors, as this report demonstrates.' There are, though, barriers that stand in the way of realising that full potential. These fall into three broad areas: lack of understanding of the value of craft innovation, positive externalities and a degree of risk that lead to underinvestment in innovation by individual firms, and underinvestment in craft education and skills.

The UK's strengths in the creative industries – and in craft – are currently unrivalled. However, international competitors are fast catching up, investing heavily in creative education, in research and development, and in facilities that bring the physical making and digital worlds together. China is a case in point. But the same is happening to different degrees in other parts of Asia, North America, Europe and Africa.

Unless we take action now we will experience a talent drain and lose competitive advantage. We therefore welcome the seven policy actions identified by KPMG, and invite partners in the public and private sectors to join with the Crafts Council in considering these and putting them into practice.

Currently most innovation through craft happens through happy accident. Our vision is to move, via strategically focused investment and the actions identified by KPMG, to an established culture of open innovation and collaboration. The potential rewards are great: improved productivity, development of new products and services, and differentiation of UK output, enabling us to access new global markets and reap both social and economic benefits.

Thanks

This report is itself the result of collaboration between experts from different fields. The Crafts Council is grateful to our commissioning partners, the Knowledge Transfer Network for Creative, Digital & Design and the University of Brighton, for their vision in investing in, and supporting, this research, and to our steering group for their guidance. We thank KPMG also for their generous support in making this report possible. The KPMG research team, Simon Trussler, Heather Sharp and Ruth Beckett, worked with assiduity to bring new perspectives and clarity to this emerging field of study. We extend our thanks also to Cara Weil and Tom McEvoy, our designers, and to Daniel Charny and Dee Halligan at From Now On who worked closely with us to translate a complex narrative into the compelling visual schematic published alongside this report. We are indebted to all those who participated in the survey, and above all to the makers and businesses profiled in the case studies who gave generously of their time and insight. Thank you all.

Executive Summary

About the study

Craft skills and knowledge have a strong economic impact and significant potential to drive further growth and innovation in other sectors, as this report demonstrates.

The creative industries are a recognised UK strength¹ in which the UK currently enjoys an international competitive advantage.² However, other nations are fast catching up.³

Until now, the UK's creative industries policy has, to a large extent, focused on media entertainment and digital industries. This has had positive effects, with associated economic benefits.

Less focus has been placed, to date, on the physical, material creative industries. But the potential for craft to make a positive economic impact, both directly and via cross-innovation driven by collaborations between craft and other sectors, is, as this report shows, significant.

The human element of craft has always lent itself to innovation and the evolution of techniques and applications. Furthermore, companies with stronger links to creative industries have been found to be more likely to introduce product innovations.⁴ Therefore, collaboration, or open innovation, involving the creative industries (including craft) can have a positive impact on innovation within other companies.

This collaboration is increasingly important in today's society, where the progressive digitalisation of the economy is shaping the way in which industry operates. This is creating new opportunities and could herald the next generation of craft, with an evolution that will drive further innovation and collaboration between craft and other sectors. In turn, this increases the potential cross-sector economic spillovers from craft innovation.

In this context, the Crafts Council commissioned KPMG to conduct a study to better understand the extent to which collaboration and innovation take place in, and through, craft and, importantly, what barriers need to be overcome to achieve the potential economic opportunities from it. Specifically, KPMG was asked, in this study, to help to:

- provide a better understanding of the firm-level economic value of cross-sector innovation and collaboration involving craft, both to the craft sector and to other sectors;
- explore the barriers to this activity, including the presence of any market failures; and
- identify potential actions which, when applied to the craft sector, could be expected to contribute towards the Government's existing commitments to support the creative industries and to promote innovation and collaboration.

To address these issues, we posed four questions at the outset of the project, based on the existing evidence and economic theory around the craft and creative industries, which we test in the study:

- 1 To what extent does cross-sector innovation and collaboration between the craft sector and other industries deliver tangible economic benefits?
- 2 What further investment in skills and education is required to achieve incremental economic benefits?
- 3 Do market failures exist which limit optimal private investment in craft skills and innovation?
- 4 What additional Government support, if any, is needed to support craft skills, innovation and collaboration in order to optimise the economic contribution of the craft industry?

These questions were tested through:

- a survey of makers, craft businesses and those involved in the craft industry (including academics and policy makers);
- case study interviews with individuals engaged in craft cross-sector innovation and collaboration;
- a workshop and meetings with key individuals engaged with craft, including academics, craft practitioners and experts from a range of institutions; and

- desktop research and analysis of relevant publicly available information, academic and industry studies and reports.

We summarise below the evidence we have identified against each of our research questions.

Use of innovative craft applications in Bentley cars⁵

Bentley, the British luxury car manufacturer, is a craft-driven organisation. Its uses of traditional craft techniques, combined with technological innovation, contribute to Bentley's value added, and helps the firm to be distinctive and competitive in an international market for luxury.⁶

Bentley has a dedicated development team of engineers who design, develop and test new innovations in the application of craft to the cars. To achieve the quality required Bentley invests heavily in the development of the required skills. While the process of delivering Bentley's bespoke products is costly, the company reports that the finished products are highly valued by customers in the international market for luxury cars. In addition, they generate significant revenues for Bentley and additional GVA for the UK economy.

Based on data provided by Bentley, we estimate that the company generated £1.1 billion of GVA to the UK economy in 2014. It is clear from the extent to which craft skills are applied at Bentley that craft innovation is an integral part of the company's revenue, GVA and employment generation.

Bentley considers several factors would help to drive the value of innovation and craft:

- **Skills:** More investment in skills and innovation is needed to ensure that Bentley, and UK suppliers, can continue to compete in the international market.
- **Awareness and communication:** There is scope for greater open innovation and collaboration across industries, including between automotive and industries such as fashion and architecture. However, for small players finding the time and budget to do so is difficult.

Sarat Babu and Betatype's fusion of craft with technology and engineering

Betatype is a business that focuses on the development of materials and innovative products through physical making, combining technical analysis and craft techniques.⁷ Its founder, Sarat Babu, has a background in materials research and engineering.

Sarat reported that the company relies on innovation through the understanding and manipulation of materials to generate value added in the economy. In the financial year 2014–2015, Betatype itself generated a total £123,600 of GVA from its own activities.

However, this does not fully capture the value generated through the application of Sarat and his company's innovations. The company has developed products for applications in a range of other sectors, in particular in the medical sector where Sarat has developed a new synthetic meniscus tissue. This is likely to have significant potential benefits for the sector.

There are a number of factors which Sarat considered could help to drive the value of innovation:

- **Skills:** Fusion of craft and technical engineering skills is at the core of the value added.
- **Communication:** Better communication and linkages are needed between sectors to maximise the value of collaboration.
- **Awareness:** Open innovation and collaboration require recognition of the value of craft skills and how their value can be optimised.
- **Funding:** To add most value, Government funding should be aligned to truly innovative processes.

Weaver and textile artist Ptolemy Mann's collaboration with Johnson Tiles

Ptolemy Mann is a commercially successful contemporary textile artist and designer known for her unique, colour-rich hand-woven artworks and textile designs.⁸ Ptolemy's knowledge of colour, developed through long-established weaving practice, has generated significant value added in other sectors.

One example of Ptolemy's diversification of her craft-based work is her collaboration with Johnson Tiles, an established UK tile company. Although not a ceramist, Ptolemy told us that she recognised the way in which her understanding of colour and pattern, developed through weaving, could translate into product design. She used this skill and understanding in her collaboration with Johnson Tiles to renew its 'Prismatic' range.

Through this one collaboration, our analysis shows that Ptolemy herself, and thus the craft sector, generated a modest total GVA impact of £3,504.

However, our analysis suggests that the benefits to the UK economy as whole have been 65 times greater. We estimate that the new tiles range generated additional total GVA for the 2014–2015 financial year of £230,590.⁹

There are a number of key factors which Ptolemy and Johnson Tiles considered help drive the value of innovation and craft:

- **Skills:** Craft skills bring a different way of thinking and a different way of problem solving, and the approach of craft practitioners to innovation and problem solving is complementary to more technical STEM skills. This can help to generate innovation in new areas.
- **Recognition:** There needs to be greater understanding of the opportunities for collaboration, among both craft practitioners and those in other sectors.

Oluwaseyi Sosanya's development of 3D weaving

Oluwaseyi Sosanya, a craft practitioner with an engineering and materials science background, has effectively combined these skills in one of his principal developments, a 3D weaver.

The loom is specially designed for weaving structures with unique properties.¹⁰ Sosanya reported that he has been approached by a number of firms, both UK and international, recognising the commercial application of his 3D woven fabrics – in sectors including health, architecture, aerospace and clothing.

The economic value from such collaborations could be significant. Moreover, the transfer of knowledge between Sosanya and his collaborators could result in greater economic benefits through knowledge and innovation spillovers.

Sosanya considers that a number of key factors may help overcome barriers to the realisation of the potential economic opportunity of craft innovation:

- **Awareness and communication:** Dialogue between sectors is needed to access the value from untapped craft talent.
- **Funding:** In order to achieve valuable innovation breakthroughs, funders of craft innovation need to be open to risk-taking.
- **Business skills:** Makers need to develop enterprise skills and experience to commercialise ideas.

To what extent do cross-sector innovation and collaboration between the craft sector and other industries deliver tangible economic benefits?

Existing research looking at the value of the craft sector to the economy has focused on the activity generated within the craft sector itself or by craft practitioners working in other sectors.

These measures, although insightful into the contribution of craft, underestimate the full value that craft generates in the economy, particularly through innovative and collaborative activity. Through these spillover effects, craft generates more value for the economy than it is currently possible to measure through official statistics.

Evidence from the KPMG survey indicates:

- The most commonly identified impacts of craft innovation and collaboration were helping the transition of an idea through to successful product development, and the development of capabilities and skills. These were particularly experienced by respondents with higher rates of innovation.¹¹
- Wider impacts for makers, craft businesses and arising for other industries as a result of cross-innovation, included improved and new products, increased revenues, employment and productivity and reduced costs.

Our case studies also highlighted wider industry applications of craft skills and the benefits of cross-sector innovation and collaboration. For example:

- We estimate that Bentley generated £1.1 billion of GVA to the UK economy in 2014. We were told that craft innovation is an integral part of Bentley's production, and so is likely to contribute significantly to its overall revenue, GVA and employment.
- Sarat Babu and Betatype's fusion of craft with technology and engineering has led to new value-adding solutions. For example, based on the application of his understanding of materials through hands-on making Sarat has collaborated with the medical sector to develop a new synthetic tissue for use in the repair of a torn or damaged meniscus.¹² This is an important

development in the sector given that existing solutions are often ineffective.

- Ptolemy Mann's application of her craft-based expertise in colour and pattern led to a successful collaboration with Johnson Tiles, an established UK tile company. Our analysis shows that the GVA generated by Ptolemy herself, and thus the craft sector, was modest. But the associated GVA generated by Johnson Tiles and through its supply chain as a whole in FY14/15 was more than 65 times higher than that.
- Oluwaseyi Sosanya, a craft practitioner from an engineering and materials science background, has effectively combined his skills to develop a 3D weaver that is attracting commercial interest from both UK and international firms across sectors as diverse as health, architecture, aerospace and clothing. We were told that firms are recognising the commercial application of his 3D woven fabrics and although in early stages of development, the economic value from such collaborations could be significant.

The case study interviews and analysis identify that collaboration between craft and other sectors is a key to innovation both now and into the future, particularly as the trends towards increased digitalisation continue to blur the boundaries between physical and digital.

What further investment in skills and education is required to achieve incremental economic benefits?

The evidence suggests that developing practical craft skills is the starting point for innovation and realising the economic potential of the craft sector.

It is the combination of craft skills with wider skills, such as engineering, science and technology, which helps to deliver even greater economic impacts.

However, by nature, craft skills take time to develop. Years of training and practical experience are required by craft practitioners before they are able to successfully deliver craft innovation. Our case studies all demonstrate this. Investment in craft skills and education are imperative should the UK want to ensure a future pipeline of makers and craft innovators.

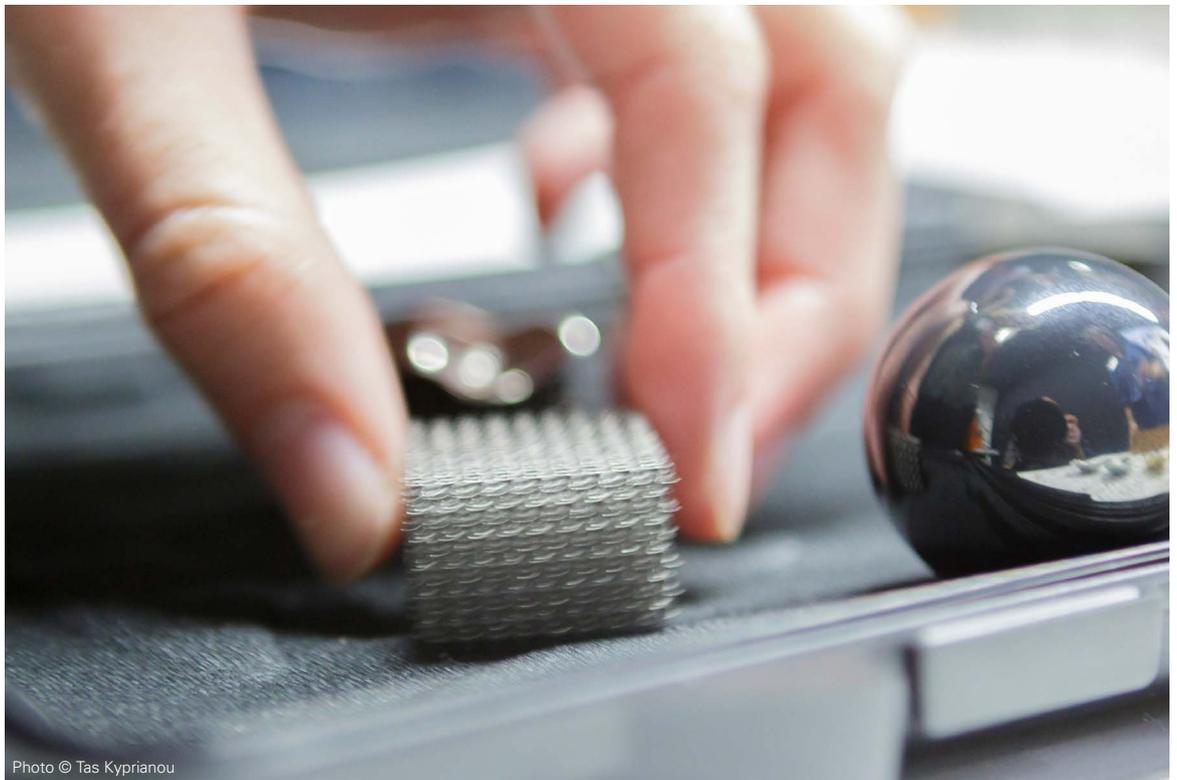


Photo © Tas Kyprianou

Materials from the Materials Library at the Institute of Making. Left: 3D printed nickel matrix. Right: silicon nitride ballbearing

There is evidence that the UK is at risk of losing its expertise in craft and of failing to take advantage of the potential that incorporating craft within broader STEM education could deliver.¹³ And our research shows that there could be a significantly positive return on investments in craft and craft related innovation.

Furthermore, it is not only craft skills that need to be developed for the economic benefits of craft innovation and collaboration to be achieved. For makers, an appreciation of the commercial realities of industry and business and enterprise skills are fundamental to successful craft innovation and collaboration. Legal and intellectual property support were particularly highlighted by the makers we spoke to. According to them, a lack of business skills acts as a barrier to the scale of collaboration that takes place.

Do market failures exist which limit private investment in craft skills and innovation?

There is evidence that a range of barriers exist in relation to craft innovation and collaboration. A number of these stem from market failures including:

- language and communication barriers to cross-sector collaboration, including the understanding and acknowledgement of the value of craft innovation;
- uncertainty regarding the timing and scale of financial returns, particularly in the case of early stage innovation associated with delivering new concepts.

Only a small proportion those undertaking innovation go on to develop a commercially successful product. This means that in order to balance the risk, a portfolio approach is required, with flexibility with regard to the timing of the payoff. However, innovation at the individual firm level may not have the breadth or scale to achieve the type of portfolio required;

- wider social and economic benefits (known as positive externalities) that arise as a result of innovation can result in underinvestment. At the firm level, investment decisions relating to innovation take into account only the firm's private returns on investment, and not the social return on investment. If an innovation is easy to copy (and cannot be protected e.g. through a patent) this reduces the incentive for businesses to innovate because they cannot fully internalise the benefits from the innovation. However, the knowledge spillovers generated through innovation have a positive impact on overall productivity. Therefore, at the economy wide level, the optimal level of innovation is higher than the optimal level for individual companies.

Many of these barriers are not unique to the craft industry but apply to R&D and innovation activity more generally.

However, the nature of craft, and in particular the iterative process and experimentation that is central to making, means that this sector may be more susceptible to some of these problems.

In our survey, over three-quarters of respondents reported being involved in innovation to develop new products, but far fewer reported going on to innovate in the commercialisation phase. This suggests that it is at these later stages of innovation where investment and support is most critical.

The risks associated with innovation mean that there can be a reluctance both among individuals themselves to innovate and among external funders to support this, given the uncertainty of realising returns.

Only a small proportion of those innovating go on to deliver innovations that have applications and uses in wider industry sectors. And even if the innovation is successful, the time period to realising returns can be lengthy; ten or more years in some cases. This can create barriers to investment in innovation due to the uncertainty of returns.

Asymmetry of information in the credit market is made worse by the uncertainties presented by investment in innovation. Access to finance barriers were highlighted in both our survey results and case studies. These were generally linked to the need to demonstrate at the outset of a project the end outcomes and commercial application. This inhibits experimentation and innovation as there is often considerable uncertainty regarding the direction a craft innovation may take.

There is also evidence to support the view that there are language and communication barriers to cross-sector collaboration, including a lack of understanding and acknowledgement of the value of craft innovation. This lack of understanding is not only confined to wider industry, but is also within the craft industry itself.

Our survey indicated that:

- around a third of respondents felt that a lack of shared language or understanding of other industries was a barrier to collaboration; and
- almost 60% of respondents identified challenges in identifying the right people with whom to collaborate.

Our case studies also highlighted that craft makers may not fully appreciate how their skills, expertise and technologies can be used within a commercial context. Sosanya, for example, developed his 3D weaver to address a specific textile issue but has now been approached by a range of companies across sectors ranging from architecture to healthcare that recognise the potential uses in their industries. It is only through collaboration that this becomes apparent.

Effective collaboration requires a common understanding and appreciation of the value this can bring to make the collaboration happen in the first place, as well as an openness of industry to accept the ways of thinking and process adopted within the craft sector. Makers also need to understand better the commercial environment and constraints of industrial processes.

What additional Government support, if any, is needed to support craft skills, innovation and collaboration in order to optimise the economic contribution of the craft industry?

The Government already has in place strategies focused on the creative industries. Many of the acknowledged problems in the broader creative industries apply equally to crafts. The evidence set out in this report indicates that the economic rationale for intervention exists due to the market failures and barriers that are constraining the potential economic opportunity for craft.

Based on our findings, we have identified a number of potential actions which, when applied to the craft sector, are likely to help the Government to deliver on its existing commitments to support creative industries and to promote innovation and collaboration. The actions specifically focus on addressing the barriers affecting the craft sector, as identified in this report. Growth in innovation relies on a network of activities to deliver change. The actions identified involve building on the support to creative industries and craft already being offered by Government departments, higher education, change agents and sector bodies, and they draw on evidence and ideas gathered from stakeholders as part of this study.

Action 1

Investing in enhanced activity to showcase and publicise the value of, and opportunities for, craft innovation through cross-sector collaboration. Activity could be undertaken by such bodies as Innovate UK, KTN Ltd, Crafts Council and Research Councils UK (RCUK), and could take advantage of, and focus investment from, other innovation funds including European funds, such as Horizon 2020.¹⁴

Action 2

Brokering and co-ordinating business-to-business collaborations between craft experts and businesses from other sectors, with lead bodies in engineering, technology and manufacturing working together with bodies such as the Crafts Council, Innovate UK and KTN.

Action 3

Ensuring that development of industry strategies by the Department for Business, Innovation and Skills (BIS) on, for example, manufacturing, synthetic biology and additive manufacturing involves makers and materials experts in order to harness the opportunities of cross-sector innovation and fully realise the benefits of new technologies.

Action 4

Developing the role of Higher Education Institutions (HEIs) as network hubs for driving innovation and collaboration between craft and industry, with encouragement and support from RCUK and through craft-focused creative economy research and knowledge exchange schemes, for example similar to those currently delivered by the AHRC.¹⁵

Action 5

Offering innovation vouchers or competitions to facilitate and incentivise business-to-business collaborations between craft and other sectors. Such schemes, which might be run by Innovate UK, HEIs, Crafts Council, KTN or funded through European initiatives, would be expected to add most value if accessible to the small and micro-enterprises that can drive innovation.

Action 6

Developing the 'fused' education agenda to ensure that all levels of the education system support students to develop their creative, practical talents alongside their scientific, technological and enterprise skills. Industry, DfE, BIS and DCMS are well placed to continue to work together to help to achieve this, including through the Creative Industries Council, and by RCUK and HEIs encouraging greater cross-pollination between the arts, sciences and business at university level.

Action 7

Facilitating the collaboration between businesses and other sectors at a local level, potentially through Local Enterprise Partnerships, local authorities and growth hubs, with support from the Crafts Council to help to ensure business support, training, advice and mentoring is fit for purpose.

It is likely that each of these actions would, individually, make a difference by addressing specific barriers in the market. However, a more comprehensive response combining several of these possible actions may have a greater impact still in terms of making a step change in craft innovation.

A combined approach is likely to contribute more significantly to establishing an eco-system in which collaborative open innovation and cross-sector innovation is enabled and supported.

References & footnotes

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- 7 <http://www.craftscouncil.org.uk/artists/dr-sarat-babu>
- 8 www.ptoleymann.com
- 9 Total GVA includes direct, indirect and induced effects. Direct GVA estimated using *The Blue Book 2014: Chapter 02: The Industrial Analyses*, based on SIC 23.3, manufacture of clay building materials, which includes the manufacture of ceramic tiles. Indirect GVA multipliers are derived from ONS 2010 input-output tables. Induced GVA multipliers are derived from Scottish Enterprise 2012 GVA multipliers. Multipliers are based on SIC 23.3, manufacture of clay building materials, which includes the manufacture of ceramic tiles.
- 10 <http://www.sosafresh.com/3d-weaver/>
- 11 We have defined low levels of innovation as less than 25% of activity resulting in innovation, and high levels of innovation as 25% or more of activity resulting in innovation.
- 12 Meniscus is the cartilage within the knee that cushions and stabilises the knee joint.
- 13 Studying craft: trends in craft education and training
- 14 <https://ec.europa.eu/programmes/horizon2020/>
- 15 AHRC Creative Economy Knowledge Exchange Projects
www.ahrc.ac.uk/innovation/researchinthecreativeeconomy/keprojects/

Commissioning Partners



The Crafts Council

Founded in 1971 and incorporated by Royal Charter, the Crafts Council is Britain's national agency for contemporary craft. Through exhibitions, publications, research, and innovation projects, we champion the UK's foremost makers and present contemporary craft in new ways, challenging perceptions of what craft is and can be.

The Crafts Council is committed to equal opportunities and diversity.

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