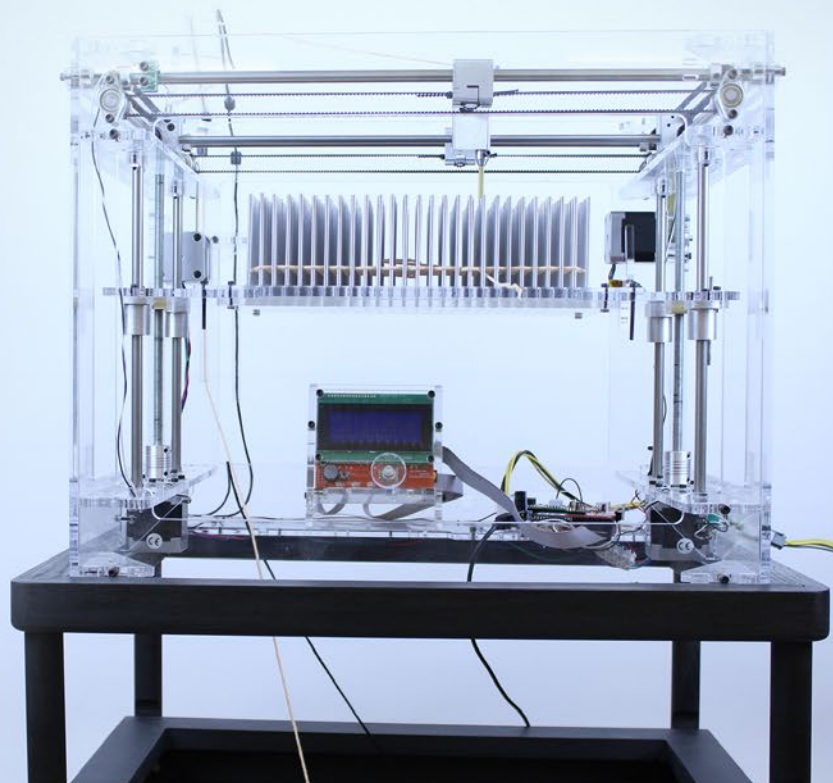




Innovation through craft: Opportunities for growth

A report for the Crafts Council

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.

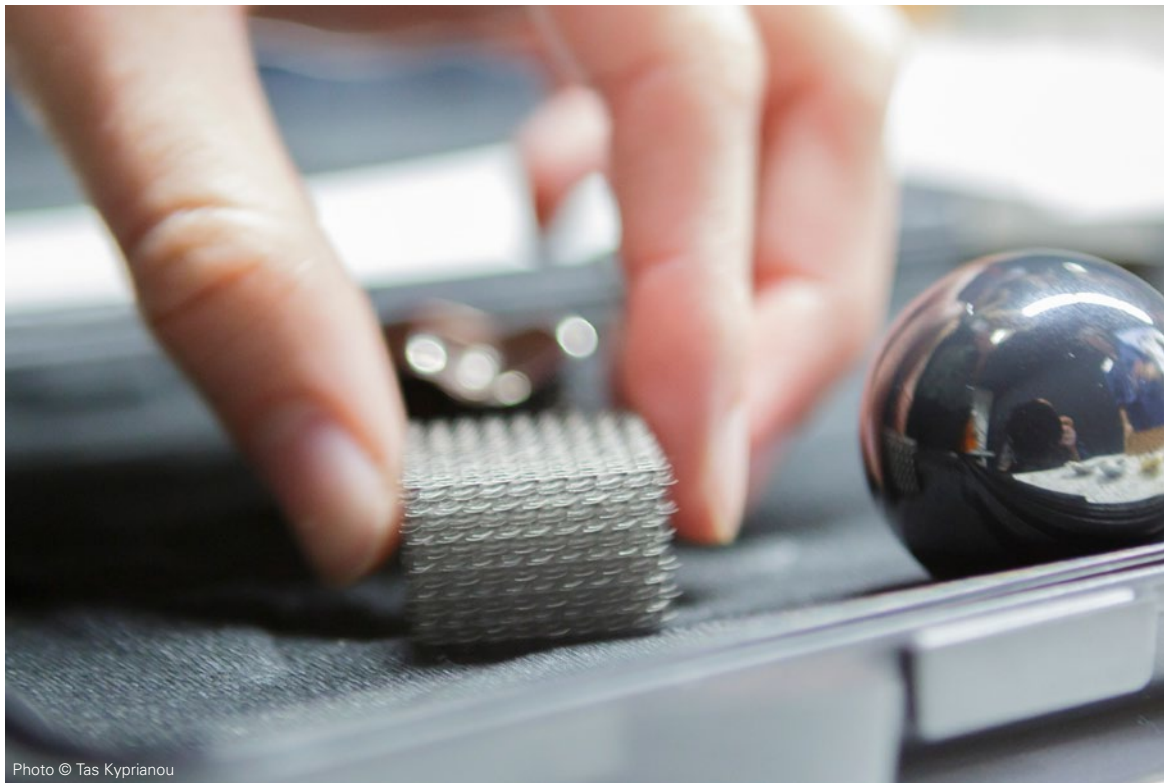


Photo © Tas Kyprianou

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.

Introduction

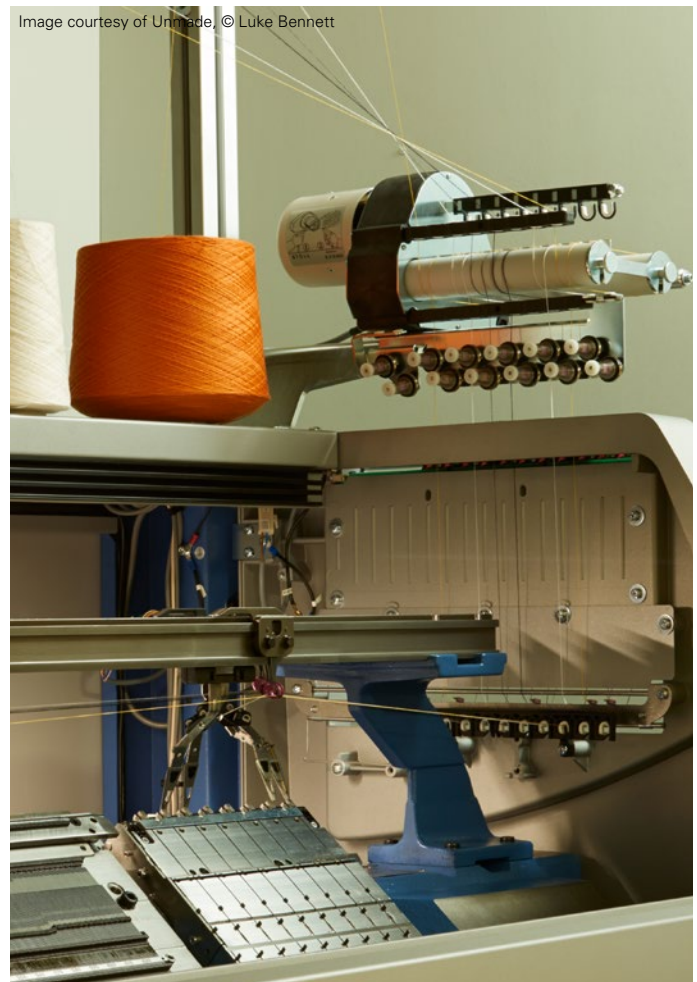
1.1 The Crafts Council commissioned KPMG to conduct a study into the economic contributions of craft to innovation and barriers to realising the sector's potential in this context

The Crafts Council has the goal of making the UK the best place to make, see, collect and learn about contemporary craft. It believes that there is a real opportunity to harness the potential of the sector and to realise the economic benefits associated with a strengthening of the craft sector, and in particular craft innovation and cross-industry collaboration.

The creative industries are a recognised UK strength¹⁶ in which the UK currently enjoys an international competitive advantage.¹⁷ However, other nations are fast catching up.¹⁸ 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, to date, has been placed on the physical, material creative industries. The Crafts Council, consequently, commissioned KPMG to undertake an independent 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 through collaborative activity;
- explore the barriers to this activity, including the presence of any market failures; and
- identify potential actions which could be expected to contribute towards the Government's existing stated objectives and commitments to support the creative industries and to promote innovation and collaboration.



Unmade is the first fashion brand and platform designed for the digital revolution, creating individual pieces on demand in the heart of London.

1.2 Craft, and craft innovation, play an important role in the UK economy

Craft is an activity involving skill in making things by hand

The dictionary definition of craft is any activity involving skill in making things by hand.

Craft, in its traditional sense, continues to play an essential role in the fabric of the economy, but its role, and the way it contributes to economic activity and growth, is evolving.

Craft innovation and the fusion of craft with digital and technology is creating new economic opportunities

Activities ranging from the development of new products to using new methods or materials during the production process, or changes in the way something is sold, can be considered as innovation.

Innovation plays an important role in the growth of the craft sector and wider economy. Existing empirical research¹⁹ identifies the main areas in which craft makes a positive contribution via its innovations:

- through the generation of innovative ideas, which contribute to an economy's potential to generate new projects and services;
- through the services they provide, which may support the innovative activity of other enterprises and organisations; and
- through their role as intensive users of bespoke technology, meaning they often require adaptations to existing technology, or drive the demand for new technology, which spurs innovation.

- The human element of craft has always lent itself to innovation and the evolution of techniques and applications.

There is a body of evidence relating to the positive relationship between the creative industries and innovation. For example, companies with stronger links to creative industries are more likely to introduce product innovations, and those firms that spend double the average amount on creative products (6% versus 3%) are 25% more likely to introduce product innovations.²⁰ Therefore, collaboration with 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. Opportunities for the craft sector are being enhanced by what has been coined the 4th industrial revolution ('Industry 4.0'): a digital revolution characterised by a fusion of technologies blurring the lines between the physical, digital and biological spheres.²¹ This will increasingly change the craft industry's nature and potential in a number of ways. For example, new technological processes, converging and combining technologies and newly developed materials are changing 'making'. 3D printing, 3D weaving and biotechnologies are just some examples. Digital technologies are also allowing makers greater access to customers, for example through online sales, and equally this greater closeness to customers allows them to be more involved in the design process, facilitating value-adding customisation and personalisation.

Graphene

Graphene, single-atom thick sheets of bonded carbon, was used to create kirigami (a form of origami that involves cutting), as part of a research collaboration led by Cornell University. The strength and flexibility of graphene, combined with the kirigami structures, has opened the realms for flexible nanoscale devices that could be, for example, placed around human cells, or in the brain for sensing.²³

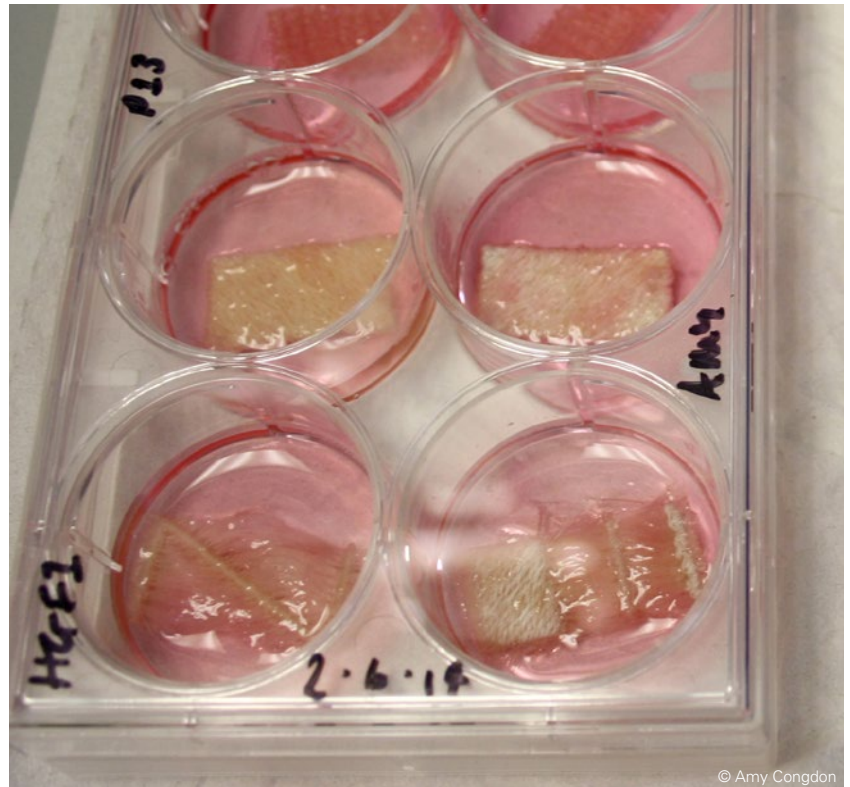
Healthcare

As part of Elumotion, a robotics hardware company, Dr Graeme Whitely has used model-making as the underlying methodology for developing new forms of limb prostheses that form the basis of the company's robotics and replicate biological motion. These have potential applications in the healthcare and security sectors, for use with amputees, or for use in dangerous security operations such as mine clearance.²⁴

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. A report by the Brighton Fuse²² finds that 'fusion' – the combination of creative arts and design and technology – has a positive impact on the growth of the creative digital economy and that 'fusion' is a critical driver of innovation and growth in the creative digital economy. 'Fusion' is a term and a concept that is increasingly recognised and used by those involved in the sector, for example by the Creative Industries Council, Innovate UK and the Crafts Council.

As we explore in this report, there are a number of examples where craft when *combined* with modern methods of business, provides mutual benefit. The film industry, the animation industry and London's theatre are examples of where the UK has benefited on an international scale from combining the craft with industrial processes. However the impacts span a much wider set of fields including medicine, technology, engineering and manufacturing, where significant craft-based innovations, such as in materials, are allowing UK firms to achieve competitive advantage on a global stage.

The examples across the bottom of the page, highlight that craft innovation can have applications and positive impacts across a range of sectors.



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Constructed Lab Experiments, Amy Congdon, 2015

Craft-related innovations and collaboration tend to benefit not only the innovator, but also other stakeholders

As the examples demonstrate, craft innovation can generate positive impacts in a wide range of other sectors. However, these wider impacts rely, to some extent, on open innovation, defined as: '*... reaching out to take advantage of talent beyond the firm (or responding to such outreach opportunities) ...*';²⁵ as well as: '*... a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology*'.²⁶

Responsive textiles

Lauren Bowker, a Royal College of Art graduate in textiles, has developed compounds that respond to seven environmental parameters: heat; friction; UV; pollution; moisture; chemicals and sound, and which can be applied to textiles. These have applications in a ranges of sectors. In the automotive sector they can be used to test aerodynamics. While in the medical sector (including in the NHS), they have the potential to be

used to monitor the body and to detect changes, for example bandages that allow wounds to be monitored, and devices that monitor changes in the body related to the early stages of certain conditions, for example the onset of an asthma attack.

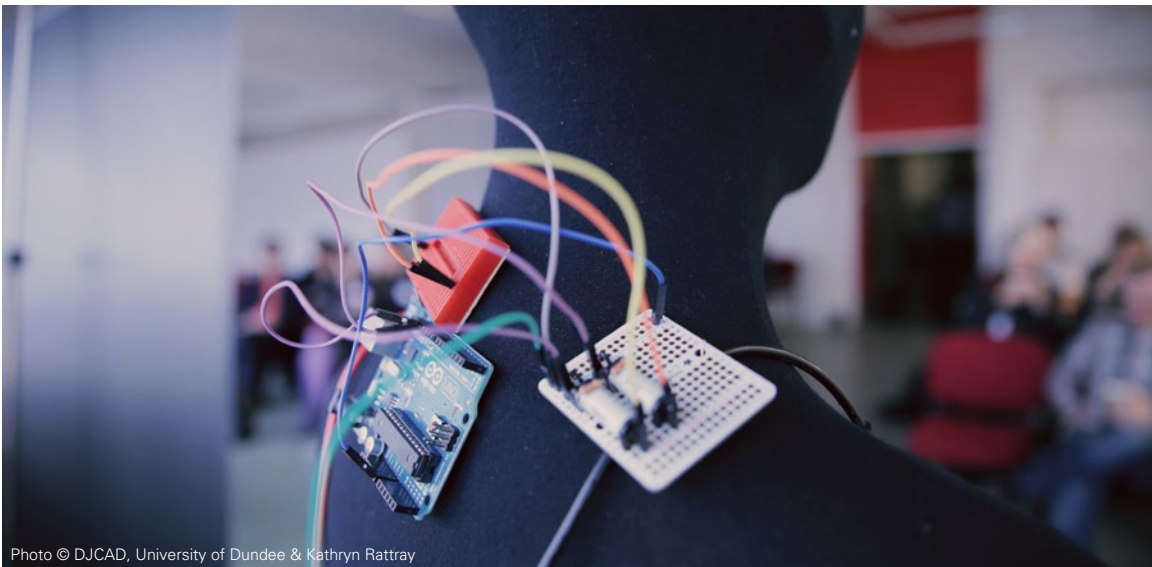


Photo © DJCAD, University of Dundee & Kathryn Rattray

Arduino and breadboards for controlling heating elements in a 'smart costume' by Dr Lynsey Calder. Make:Shift:Do, Dundee, 2014

A number of studies have shown that collaboration can be a key source of innovation in craft.²⁷ They indicate that the benefits of collaborating during the innovation process can be vast and mutually experienced, including:²⁸

- increasing the scale and scope of activities;
- spreading cost and risk between parties; and
- improving the parties' ability to work with complexity.

A deep understanding of materials and making, as developed through craft, has applications across industry. For example, there are clear links between craft and the 'Eight Great Technologies',²⁹ identified in the UK Government's Industrial Strategy as technologies in which the UK is set to be a global leader. In particular, advanced materials, robotics and synthetic biology are areas in which craft skills and the depth of material knowledge of makers can play an important role.

Collaboration, when organised and managed correctly, can enhance the innovative activities of the collaborating partners, increasing the odds of an innovation being realised.³⁰ A feature of innovations in craft is, therefore, that the benefits to the UK economy as a whole could be substantially greater than the benefits to only those who invest in them. We explore in this report how this can create a barrier to investment and how a step change in attitudes to collaboration between the creative industries and other sectors, including science and technology, could help to drive further similar economic benefits.

Through wider spillover effects, the economic benefit of craft related activities is likely to exceed the £3.4 billion of Gross Value Added attributed to craft skills alone

Even without taking account of the scale and potential for craft innovation and collaboration, craft already

contributes to economic growth and employment. Further to which, it enhances the country's skills and innovation capabilities.

The craft economy generated an estimated £3.4 billion (or 0.3%) of GVA in 2012/13 and supported 149,510 jobs.³¹ This estimate captures not only the craft industry itself but also craft related activity in other sectors.³²

However, this excludes the significant wider spillover impacts generated by craft within other industries, in particular the wider impacts generated through the extensive innovation undertaken by makers, spillovers through supply chain linkages (vertical spillovers) and economic benefits arising from their collaboration with other sectors (horizontal spillovers).

This study aims to provide a deeper understanding of how the economic benefits associated with innovation in craft can be enhanced.

A number of economic research questions were tested to build an evidence base of the economic contribution of craft innovation, the inhibitors, and how these could be overcome

The Crafts Council commissioned this study to enhance the understanding of the potential economic impact of the craft sector and the ways in which the opportunities associated with craft innovation and cross-industry collaboration can be harnessed.

To assess this, we posed four questions at the outset of the project, based on the existing evidence and economic theory around the craft and creative industries, to test in the study:

- 1 To what extent does cross-sector innovation and collaboration deliver tangible economic benefits to both the craft industry and to other industries?

- 2 What further investment in skills and education is required to achieve incremental economic benefits?
- 3 Do market failures exist that limit private investment in craft skills and innovation? Specifically, is it the case that:
 - there is a time delay between skills and innovation investments and their payoff?
 - only a small proportion of skilled makers are able to go on and drive innovation with a positive impact on other industries, therefore, is a portfolio of approaches needed to foster craft innovation?
 - there are language and communication barriers to cross-sector collaboration, including the understanding and acknowledgement of the value of craft 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?

Our analysis was based on surveys and workshops with experts in their field

Our study comprised:

- a survey of existing makers and those involved in the craft industry, e.g. academics, policy makers and businesses;
- case study interviews with individuals engaged in craft cross-sector innovation and collaboration and economic analysis drawing on data and information they provided;
- a workshop and meetings with key individuals engaged with craft, including academics and craft practitioners and experts from a range of institutions including Northumbria School of Design, Nottingham Trent School of Art & Design, the University of Brighton, Royal College of Art the KTN and Crafts Council; and
- desktop research and analysis of relevant publicly available information, academic and industry studies and reports.

Audience member holds one of Matt Durran's glass moulds at the Crafts Council's Make:Shift innovation conference 2014



Photo © Tas Kyprianou

Craft Innovation and Collaboration

Survey and Case Study Findings

While there is some existing evidence of the positive economic contribution made by the craft industry to the UK economy, and studies on the role that innovation plays in the creative industries, the evidence base around craft innovation and the positive economic spillover effects to other industries is limited.

Therefore, to provide a picture of the current levels and types of innovation and collaboration among craft practitioners, and the challenges faced, KPMG, in collaboration with the Crafts Council, conducted a survey of a selection of individuals and organisations involved in craft.³³ These individuals, identified by the Crafts Council, included makers, craft businesses and a broader group of individuals involved in the craft industry e.g. academics, policy makers and businesses.

While the results of the survey are not representative of all craft practitioners and organisations in the UK, they do provide indicative evidence of innovation and collaboration in UK craft.

This evidence was supplemented with four case studies that provide deeper insights into the value of craft innovation and collaboration to the UK economy and the challenges faced. The case studies were identified through a workshop with a selection of individuals and organisations involved in craft, and suggestions provided by survey respondents. KPMG contacted a long list of potential case study candidates to understand the nature of their activity and relevance of their experiences to the issues being explored in this study. The final case studies were selected through

discussion between the Crafts Council and KPMG to represent a cross-section of craft innovation activity and to provide insights on the research questions of our study. We gathered evidence for the case studies from a series of interviews with the individuals named, from information and data provided by these individuals, and from publically available sources.

2.1 Scale and scope of craft innovation and collaboration

Innovation and collaboration is prevalent among respondents.

The survey found strong evidence of significant craft innovation and cross-sector collaboration:

- The majority of respondents spent more than half their time engaging in innovative activities.
- Almost two-thirds of survey respondents reported that 50% or more of their organisation's activities results in innovation taking place.
- A similar proportion reported that 50% or more of their innovative activity involves collaboration with people outside of their organisation.
- Organisations that engaged in higher levels of innovative activity tended also to have high levels of collaboration.

The most common type of innovation among survey respondents was the development of new products using new materials, techniques or technologies, reported by over half of respondents. Respondents with higher rates of innovation tended to undertake innovation focusing on development of new tools and products, while those with lower rates of innovation tended to report development of innovations that use new materials or components in the manufacturing of existing products.

Innovation and collaboration were most commonly reported in the early stages of concept delivery. However, there were high levels of innovation at all stages of the product process, including over 50% of respondents involved in commercialisation.

Craft innovation and collaboration take a range of different forms and for many respondents is externally supported

The most common way for respondent organisations to engage in innovation was through external facilitation such as through funding partners, Government support or through networking at relevant events.

However, sole traders and micro business respondents were most likely to engage in innovation through their

own initiative. This is important given that over 50% of businesses involved in craft industries are micro businesses operating below the VAT and PAYE thresholds.³⁴

Where collaboration does take place, respondents do so with a range of different types of organisations, most commonly with universities and Government agencies. Collaboration by respondents was most likely to have originated through organisations contacting potential partners themselves. This result is even higher among those respondents who identified themselves as sole traders or micro businesses.

The survey evidence suggests a range of different formats for collaboration are used:

- Those respondents with high levels of collaboration tend to use shared workshops/ labs and formal commercial models.
- Organisations with lower levels of collaboration tend to use networks, partnerships and consortiums.
- Formal commercial models were only used by those respondents for whom over 50% of innovation involves collaboration (i.e. the innovation collaboration takes place on a higher scale).
- One-to-one partnerships were most common among those respondents that identified themselves as sole traders or micro businesses, with 50% of sole traders and a third of micro businesses collaborating in this way.

2.1.1 Impact of innovation and collaboration

There are positive impacts stemming from innovation and collaboration, for both the individual firm and for other firms and industries.

All respondents saw positive impacts stemming from their innovation and collaboration activity:

- The most commonly identified impacts of innovation were the transition of an idea through to successful product development, and the development of capabilities and skills.
- The development of capabilities and skills was also a commonly identified impact resulting from collaboration, alongside the sharing of technical expertise and knowledge with others. This suggests that there are substantial knowledge spillovers as a result of collaboration across the majority of firms responding.
- In line with the types of innovation undertaken, respondents with higher rates of innovation³⁵ reported that the greatest impacts of innovation are the successful creation of new products and the development of skills and capabilities.
- Respondents with a lower rate of innovation tended to report impacts on the efficiency of their processes.

Figure 1 and Figure 2 show the results of innovation within an organisation's own industry and in other industries according to the level of innovation.

The impacts of collaboration also varied depending on the level of collaboration. In particular, respondents with higher reported levels of collaboration (engaged in for over 50% of innovation activity) were more likely to report increased revenues as a result of their collaboration.

And as shown in Figure 3, the survey results suggest that the benefits of craft innovation are also realised in other industries. Respondents with high levels of craft innovation indicated that an impact of their craft innovation was to create new or improved products in other industries. One could infer from this that these innovations create knowledge spillovers, thus benefiting other industries further through sharing of technical expertise and knowledge and increased profits.

Figure 1: Actual or expected results of innovation within own industry for those exhibiting high and low levels of innovation (34 responses)

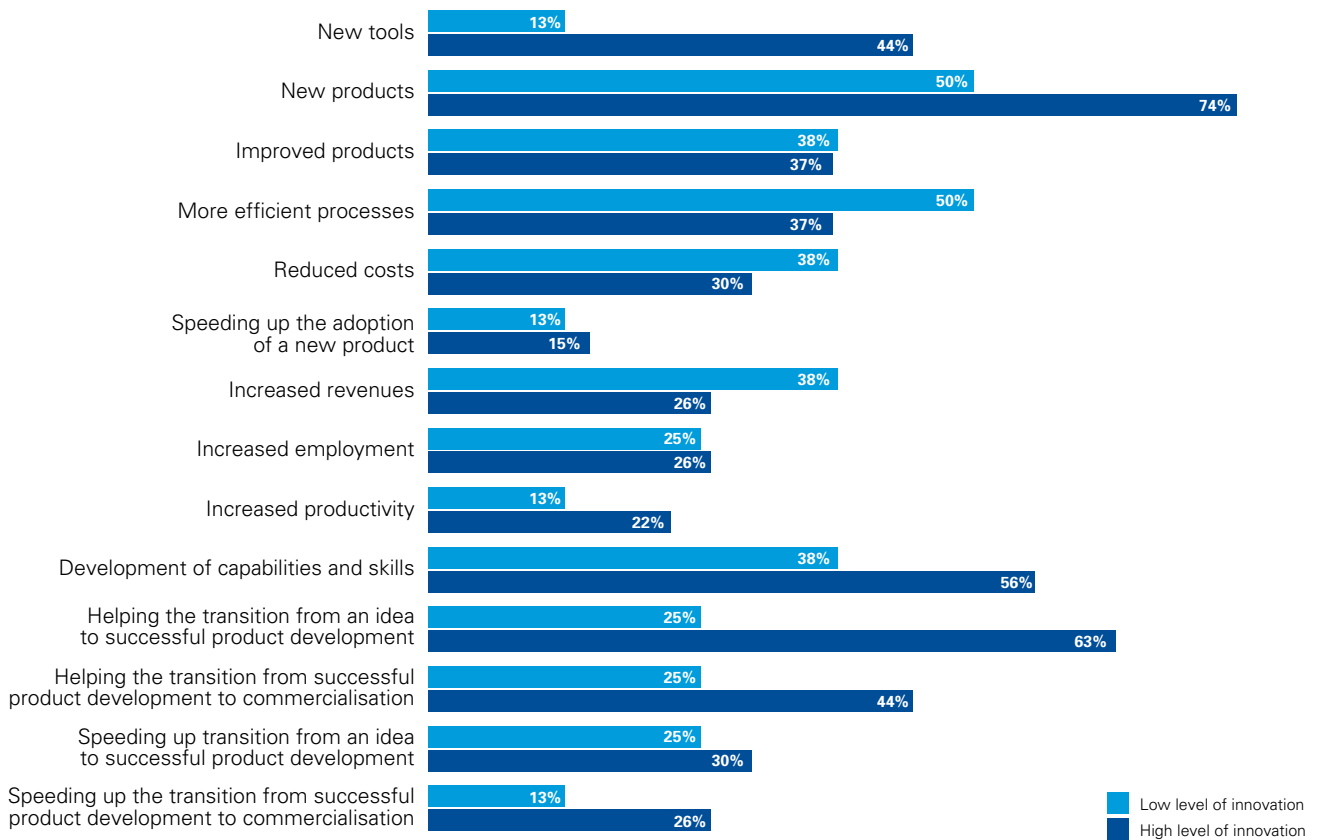


Figure 2: Actual or expected results in other industries (31 responses)

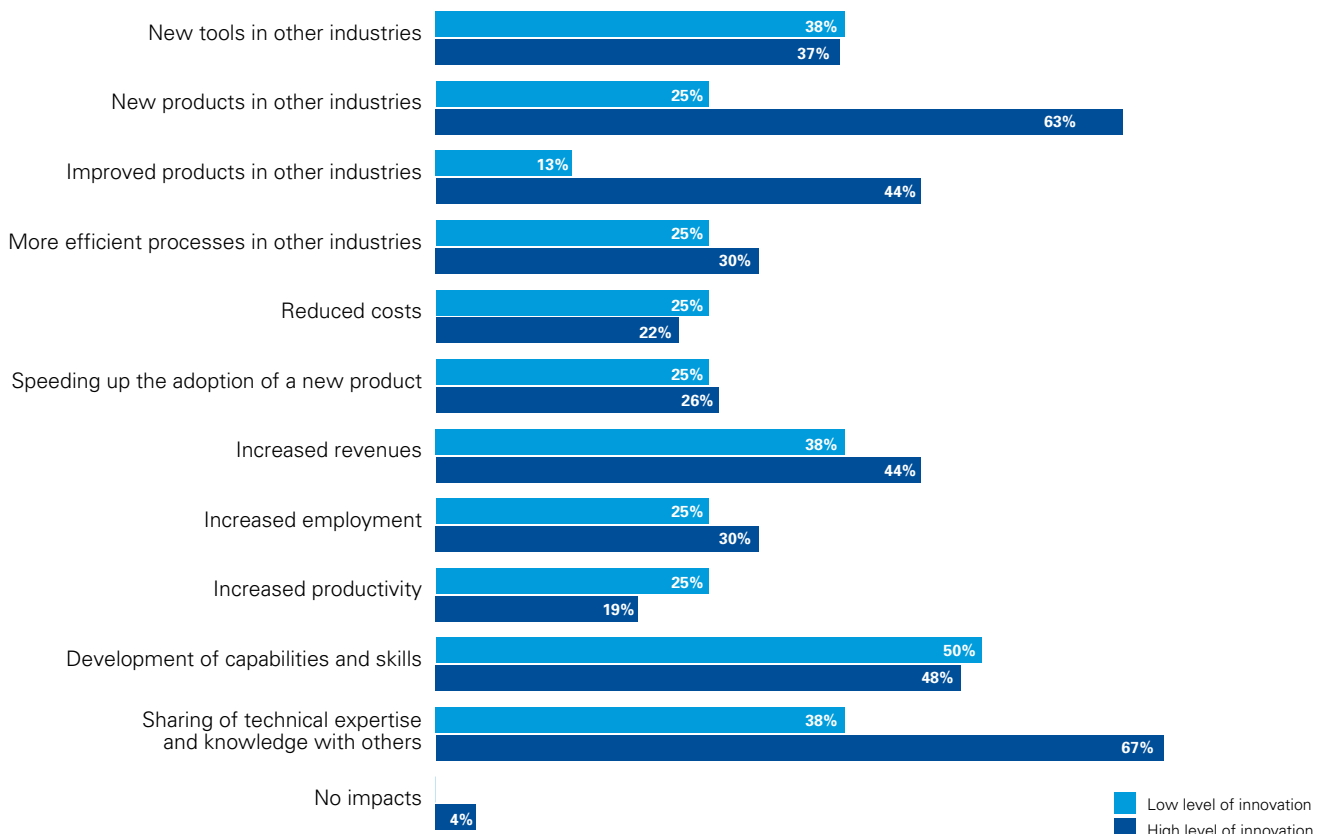
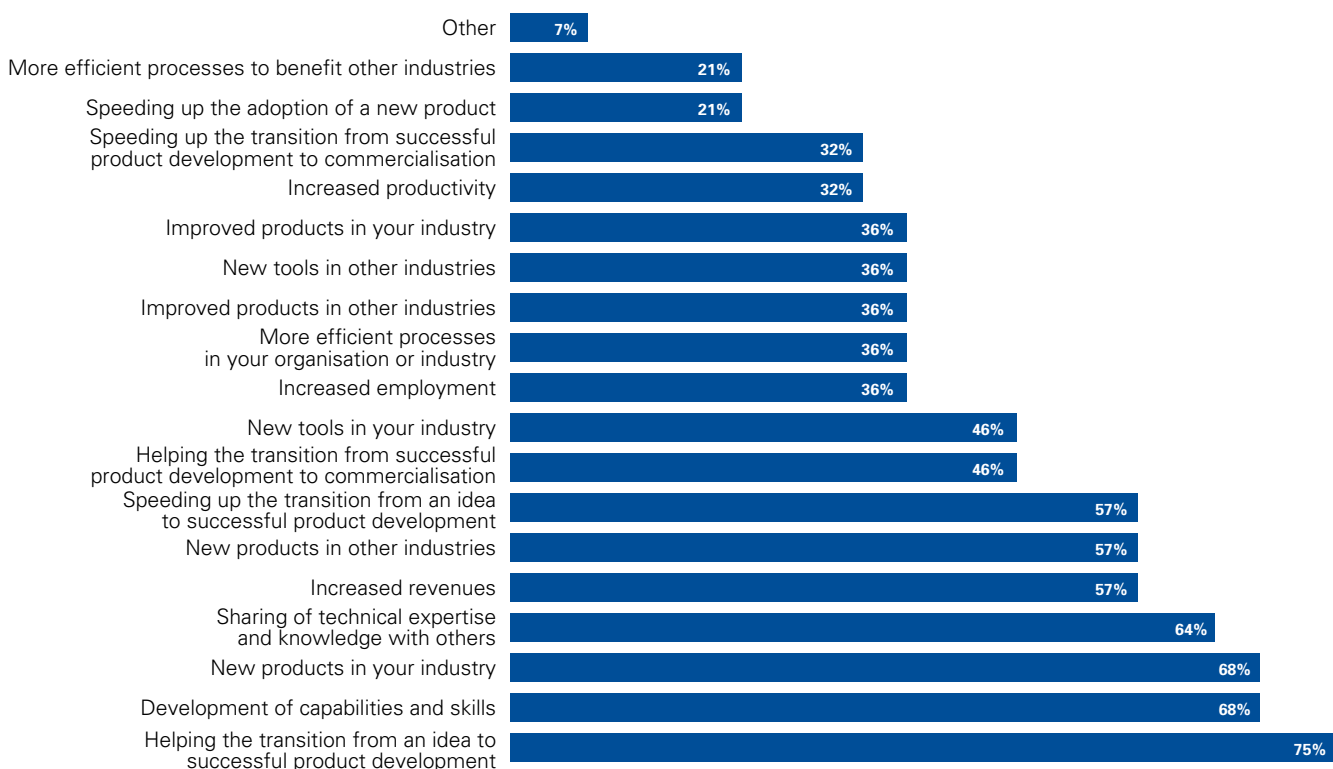


Figure 3: Actual or expected results of collaboration (28 responses)



2.1.2 Barriers to innovation and collaboration

A lack of funding or resources was the most frequently cited barrier to innovation, reported by 85% of survey respondents.

We have hypothesised that access to finance problems may arise from market failures, in particular the risk associated with innovation, the time delay between investments and realising a return, and information asymmetries that occur in financial markets. The survey responses confirmed this to be an inhibitor to further innovation in craft. SMEs – the majority of respondents to our survey – can be particularly susceptible to these problems. We explore these issues further in Section 3.

The main barriers reported in relation to collaboration were time constraints and a difficulty in identifying suitable collaborators.

While almost two-thirds of respondents reported that 50% or more of their innovative activity involves collaboration with external parties, the survey responses suggest that there are barriers to engaging in successful collaboration. Support in overcoming these barriers may result in increased levels of collaboration and/or more success, allowing innovative firms to more effectively capitalise on, and deliver, the benefits cited in the survey responses.

Figure 4: Barriers to innovation (34 responses)

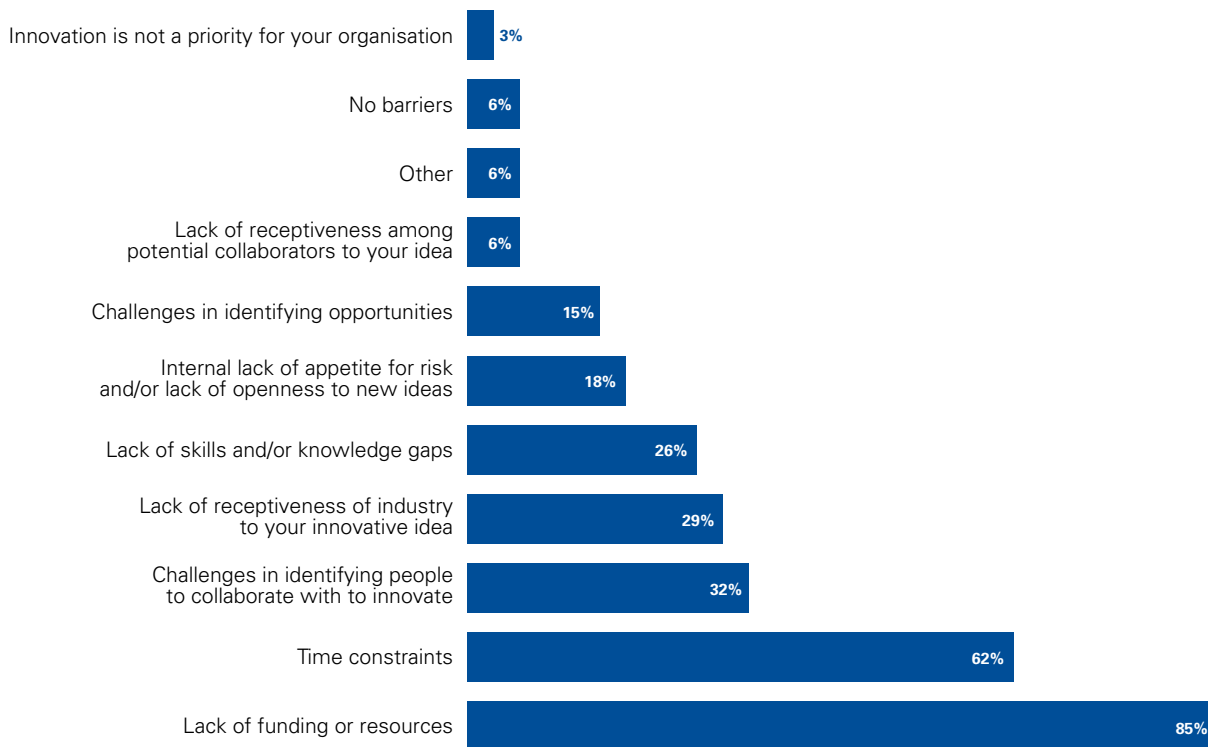


Figure 5: Barriers to collaboration (28 responses)



2.2 Overcoming the barriers to innovation and collaboration

In line with the identified barriers, organisations believe that additional support is needed to support innovation and collaboration activity

Almost all respondents indicated that funding support was needed to help innovation and collaboration in the craft industry. However, the key issue to assess is whether there is a market failure creating underinvestment in craft innovation and collaboration. If there is a market failure then this may create a rationale for Government intervention to address it. We explore this in Section 3.

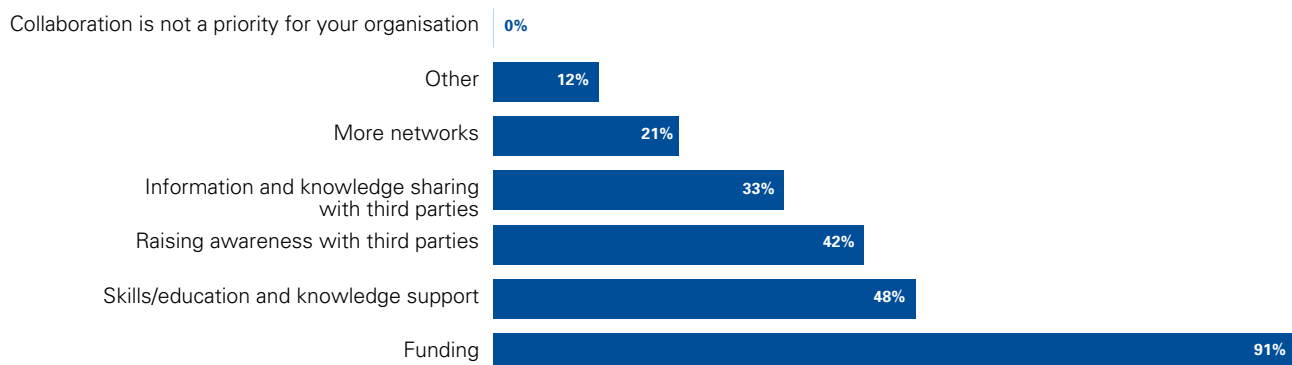
The other main types of support required were identified as skills, education and knowledge support, and raising awareness with third parties. Equally, there may be a market failure rationale to justify further intervention in this area to help to facilitate greater levels of innovation and realise the economic benefits of craft innovation and collaboration.

When asked about who is best placed to provide support, respondents most commonly identified the Crafts Council; however, industry bodies and Innovate UK were also identified as well placed to support innovation and collaboration.

The potential for effective support in the form of multi-agency partnerships or from collaborations between specific industry/sector bodies and the craft industry itself, were also highlighted.

Figure 6: Types of additional support needed to help innovation and collaboration in the craft industry

(33 responses)



2.3 Use of innovative craft applications in Bentley cars³⁶

Bentley, the British luxury car manufacturer, is a craft-driven organisation³⁷

Bentley combines its use of traditional craft techniques with technological innovation to help it to be distinctive and competitive in an international market for luxury cars. For example, we were told that every new veneer, carbon fibre finish, seat cover or steering wheel involves craft innovation, the key objective being to maintain Bentley's premium status for interior, exterior and colour and materials attributes.

It is through innovation in craft techniques and applications that much of Bentley's value is added

Bentley has a development team of engineers dedicated to the design, development and testing of new innovations in the application of craft to the cars. The skill and innovation that go into this, and into the subsequent application on the production line, are substantial. For example, we were told that three-quarters of Bentley's production line staff (equating to 30% of Bentley's total employment) use craft skills, applying innovative techniques in paintwork, woodwork, leatherwork and needlework, as well as combining craft with more technical skills in engine production.

The process of delivering these highly bespoke products is costly; however, their production using craft techniques generates significant revenues for Bentley and additional GVA for the UK economy.

We estimate that Bentley generated £1.1 billion of GVA³⁸ to the UK economy in 2014. Of this, £376.8 million was direct GVA from the company's own activities, an



Photo © Bentley Motors Ltd

estimated £582.9 million was indirect GVA generated through Bentley's spending on its UK supply chain, and an estimated further £183.2 million of induced GVA was generated through employee spending in the wider economy.



£1.1 billion

GVA to the UK economy generated by Bentley in 2014, of which...



£376.8 million

Direct GVA from Bentley's own activities



£582.9 million

Indirect GVA generated through Bentley's spending on its UK supply chain



£183.2 million

of induced GVA was generated through employee spending in the wider economy

While not all this is directly attributable to the craft skills that go into the cars, Bentley considers that the craft element is an integral part of Bentley's production, both in terms of the skilled labour which goes into production of the cars, and the quality of the Bentley brand, which

allows the company to compete at an international level in a crowded market for luxury, high-performance cars. The company sees its craftsmanship as a fundamental part of its proposition that allows Bentley to maintain its premium position in a global market.

Bentley considers several factors 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

- Bentley invests heavily in skills by offering apprenticeships in all areas of craft, including through a specialist Manufacturing Craft Apprenticeship facility at a local college. Despite this, it has an ageing workforce and has difficulty in recruiting skilled craft engineers. Specialist training in the high specification craft that Bentley requires will be needed for Bentley, its suppliers and similar companies to compete within international competition.
- For many of Bentley's specialist features, supplies are procured from Europe rather than the UK due to greater levels of innovation and expertise among firms there. The economic impacts are, therefore, 'leaking' out of the UK.

Awareness and communication: There is scope for greater open innovation and collaboration

- Bentley recognises that more can be gained from synergies across industries, including between automotive and industries such as fashion and architecture. However, for smaller players, finding the budget with which to invest in product development, innovation and, importantly, collaboration is difficult. Bentley reports that technologies and developments rarely transfer from one industry to another. But with support for open innovation and cross-sector craft clusters, there are further gains to be achieved.



Photo © Bentley Motors Ltd

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

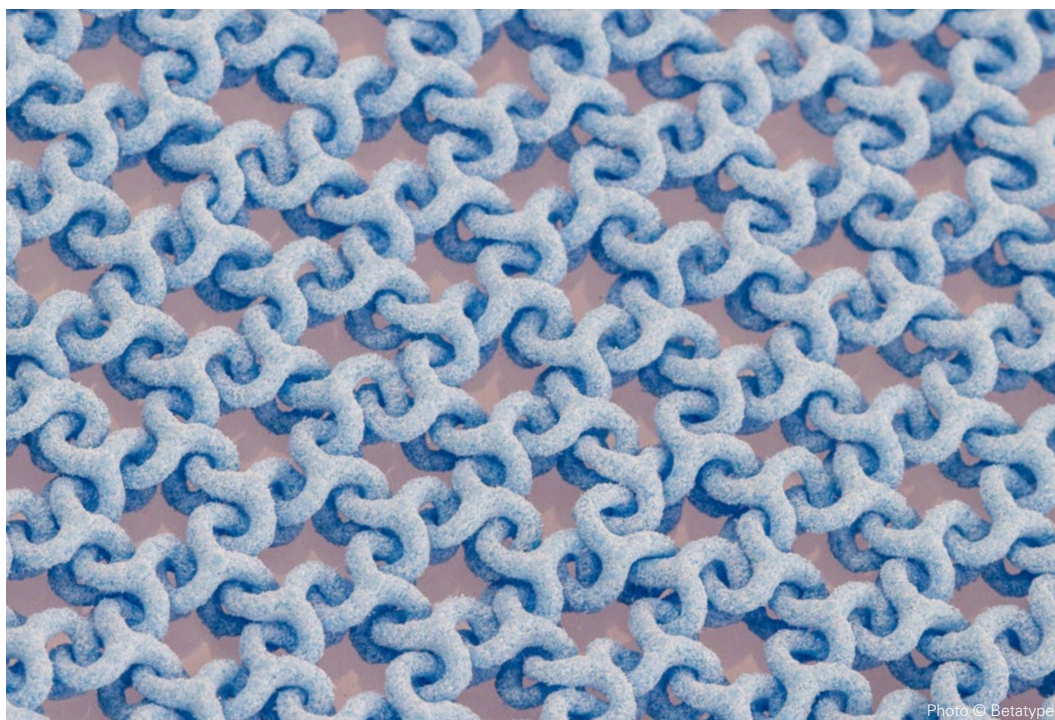
Craft 'fused' with technological and engineering thinking generates cross-sector innovation and adds substantial value.

Betatype is a business that focuses on the development of materials and innovative products through physical making, combining technical analysis and craft techniques.³⁹ Its founder, Sarat Babu, has a background in materials research and engineering. Sarat sees the value of innovation being driven by working through complex problems using physical manipulation.

Sarat reported that the company relies on innovation through the understanding and manipulation of materials to generate value added in the economy. In financial year 2014–2015 Betatype itself generated a total £123,600 of GVA from its own activities, an estimated £62,400 of indirect GVA in its supply chain and a further £43,500 of induced GVA through the additional spending of its own employees and those of its suppliers in the wider economy. However, this does not fully capture the value generated through the application of Sarat's, and his company's, innovations.

An example of this value added is through the company's work with the medical sector where, in collaboration with Imperial College London, Sarat has developed a new synthetic meniscus tissue for use in the repair of a torn or damaged meniscus.⁴⁰ He told us that his understanding of materials through hands-on making has enabled him to take a new approach to the use of microkinetics – a diverse range of materials capable of changing their physical property due to their microscopic structures.

Demand for synthetic meniscus replacement is high,^{41, 42} however, evidence suggests that to date, existing synthetic meniscus implants have been unsuccessful in effectively simulating the mechanics of the meniscus.⁴³ The new synthetic tissue aims to address the problems experienced among existing solutions, and, if successful, could have significant market potential. So far, the innovation has resulted in a successful patent application⁴⁴ and a spin-out company, Orthonika, which was launched in 2015 with seed-funding of £150,000 raised from a groups of angel investors.⁴⁵



Nylon



Photo © Betatype

Aluminium

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

Skills: Fusion of skills is at the core of the value added

- Sarat's experience shows that the fusion of craft skills with other disciplines, such as science and technology, generates additional value and helps the wider benefits of craft innovation and collaboration to be realised. His own experience and background in materials science, engineering, design and craft is a good example of how different disciplines can be converged in to a single practice to add greater value.

Communication: Better communication and linkages are needed between sectors to maximise the value of collaboration

- Sarat considers that specialised and refined craft skills are needed, but broader communications skills are just as crucial in order to be able to appreciate and understand other subjects and disciplines. This applies to all parties involved in a collaboration. Sarat considers that there is an information asymmetry and co-ordination failure in terms of the linkages between science and the arts. He observed that with greater cross-pollination and collaboration between scientists, technologists and crafts, for example within educational establishments and organisational networks, valuable interconnections and synergies would manifest themselves more naturally.

Awareness: Open innovation and collaboration requires a recognition of the value of craft skills and how their value can be optimised

- Sarat believes that it is important that potential collaborators understand the value of craft and design, as this openness to other ideas and disciplines can enhance the value of their work. However, he felt that this understanding is lacking and he indicated that in his experience organisations have a pre-defined vision of what they want to achieve, which acts as a constraint on the potential for real innovation. More than with technological innovation, in craft and design innovation there is less of a clear view at the outset of the potential final result and firms' lack of recognition of the value of this can be restrictive to innovation.

Funding: To add most value, Government funding should be aligned to truly innovative processes

- While there is recognition within Government of the economic value of innovation, and the market failures that exist, Sarat considers that support for more blue-sky innovation is limited, and grant funding tends to require tangible outputs. His experience is that this has the result of diverting resources away from routes of innovation, which, through a portfolio approach, can deliver the greatest value.

2.5 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.⁴⁶ Ptolemy reported that the skills she has learnt through practising craft, particularly the understanding and application of colour in her work, have enabled her to add value in other sectors through collaborations with a range of organisations.



Photo © Tim Ainsworth
Ptolemy Mann with the Johnson Tiles Prismatic Landscape Installation, Clerkenwell Design Week

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 worked with Johnson Tiles to renew its ‘Prismatic’ range, resulting in a c.£300,000⁴⁷ increase in sales revenues between 1 April 2014 and 31 March 2015.

Through this one collaboration, Ptolemy herself, and thus the craft sector, generated direct GVA of £1,887⁴⁸ with a further £952 of indirect GVA and £664 of induced GVA.⁴⁹ This implies a modest total GVA impact of £3,504.

However, the benefits to the UK economy as whole have been 65 times greater. We estimate that the new tiles range generated additional direct GVA of £104,860.⁵⁰ This represents the impact from Johnson Tiles activity alone. Based on GVA multipliers,⁵¹ we estimate that a further £87,250 of indirect GVA was generated within the company’s UK supply chain, and £38,480 was generated in the wider economy through additional spending by Johnson Tiles’ and their suppliers’ employees (induced effects). This results in a total GVA impact for the 2014–2015 financial year of £230,590.

It is strikingly clear from this that in only capturing the value from activity carried out in the craft sector or by craft practitioners (i.e. by Ptolemy herself), the true value that craft activity and innovation can generate is hugely underestimated.



£3,504

total GVA impact, from £1,887 direct GVA



£230,590

total GVA impact for the 2014–2015 financial year



65x

greater benefit to the UK economy – the new tiles range generated additional direct GVA of £104,860

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

Skills: Craft skills bring a different way of thinking and a different way of problem solving

- Ptolemy spent many years studying formally and developing her techniques and knowledge through craft practice. She considers that the skills she learnt during this time were key to her ability and flexibility in her approach to colour and weaving now. There is no shortcut to this tacit knowledge that craft practitioners develop, through repetition of the process.
- Johnson Tiles credits the success of the collaboration to both Ptolemy's application of her craft knowledge and her ability to adapt her application and designs to commercial and industrial requirements. Both are required.
- The approach of craft practitioners to innovation and problem solving is complementary to more technical STEM skills and 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

- Ptolemy identified a need to educate craft practitioners in the wider opportunities open to them, and of the value of their skills. This could be aided by the development of tools to help enable collaborations, such as a sophisticated and searchable database of those interested in collaboration, and case studies of collaborations between craft practitioners and industry.
- Johnson Tiles, from its experience, also considered that support is needed to help craft practitioners to be more involved in industry and to support them in making practical steps towards broader commercial applications of their craft skills.



Photo © Tim Ainsworth

Johnson Tiles Prismatic Landscape installation by Ptolemy Mann, Clerkenwell Design Week

2.6 Oluwaseyi Sosanya's development of 3D weaving

Fusing new technological developments and craft to deliver new commercial opportunities

Oluwaseyi Sosanya, a craft practitioner from an engineering and materials science background, has effectively combined his skills in one of his principal developments, a 3D weaver. This loom is specially designed for weaving structures with unique properties.⁵²

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.

New and improved products resulting from such collaboration would be expected to generate additional revenues, and hence GVA and employment. Moreover, the transfer of knowledge between Sosanya and his collaborators could result in greater economic benefits through knowledge and innovation spillovers as the developments are further commercialised and adopted by a broader range of firms and sectors.

Barriers exist which may inhibit the realisation of the potential economic opportunity of Oluwaseyi Sosanya's, and wider, craft innovation. Sosanya considers that a number of key factors may help overcome this:

Awareness and communication: Dialogue between sectors is needed to access the value from untapped craft talent

- Sosanya considers that there is exceptional talent among UK makers, but to deliver the potential economic benefits it is crucial to open up dialogue between makers and those in other sectors. He indicated that this is particularly needed to translate craft innovations into an industrial context, where his experience is that the potential for applying craft, and its value, is not easily accepted.
- Sosanya told us that he has also struggled to engage successfully with UK universities, as many are highly prescriptive in terms of the identification of tangible outcomes, which he feels stifles innovation. He has found universities in the Netherlands and Germany to be more open to innovation.
- Schemes such as the Queen Elizabeth Scholarship Trust, in his experience, provide valuable support, for example in providing a pool of people to potentially collaborate with. Any mechanism for helping to identify contacts and establish linkages can help to reduce the time and cost barriers associated with collaboration.

Oluwaseyi Sosanya with his Single lace shoe; the sole is made from a single thread



Photo © Guillaume Couche

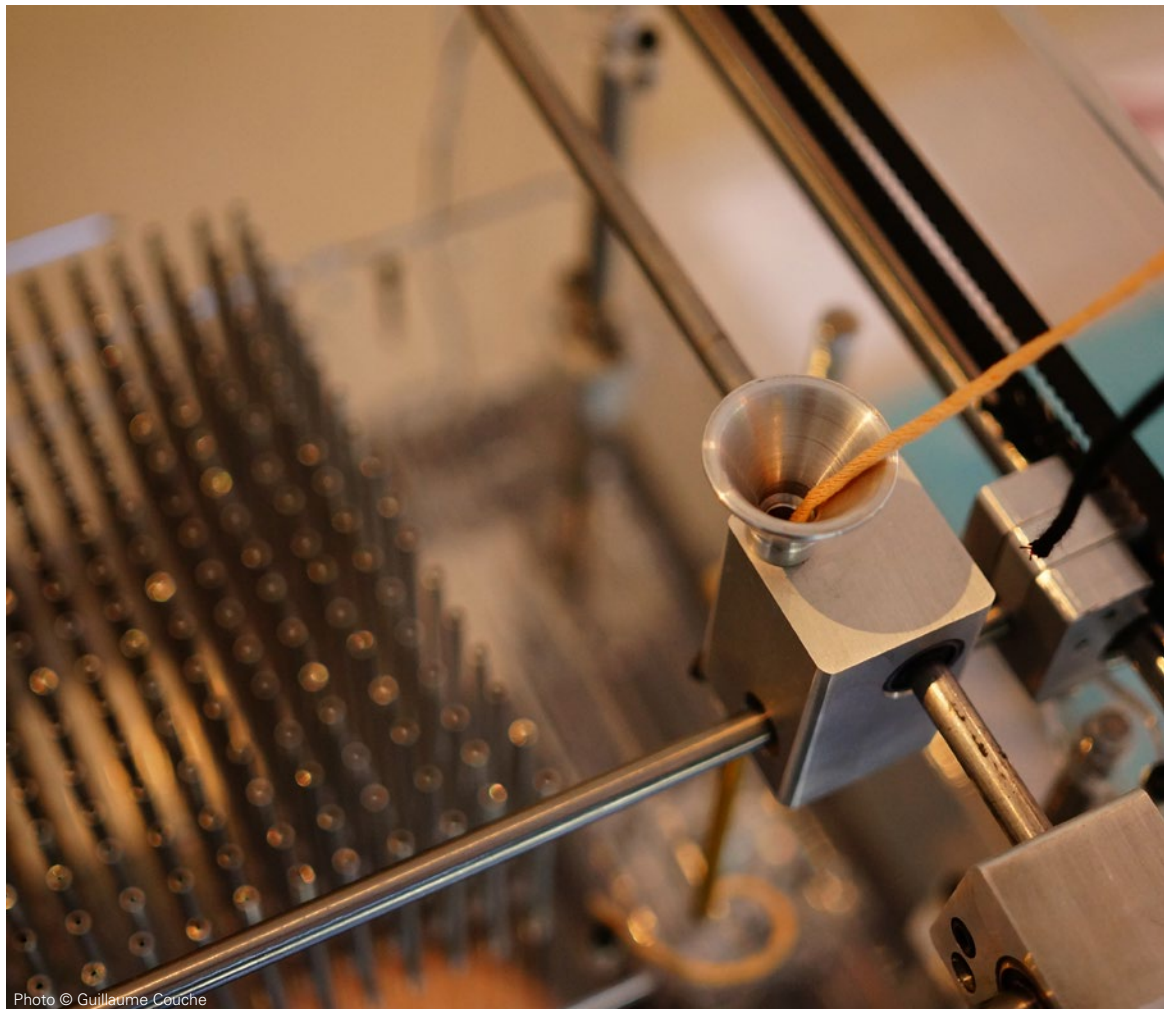


Photo © Guillaume Couche

Oluwaseyi Sosanya's 3D weaver

Funding: In order to achieve valuable innovation breakthroughs, funders of craft innovation need to be open to risk taking

- Sosanya told us that he has faced difficulties in securing funding to take his innovations to the commercial level. His experience is that Government funding for craft activity tends to have criteria relating to traditional applications and the cultural heritage of craft and that technical innovation and R&D funding tends to require greater certainty around the end product (and its commercial potential and almost guaranteed success) than craft innovators can offer. He considers that craft innovation sits in a territory between traditional craft and product innovation, making appropriate funding difficult to obtain.
- In terms of industry funding, Sosanya's experience is that the riskiness of the innovation means that no single company or industry is willing to invest. However, without investment to bridge the gap between concept and product development, the

potential returns cannot be realised. It was only through financial support from the Queen Elizabeth Scholarship Trust and, later, the James Dyson Foundation that Sosanya was able to develop his craft innovation.

Business skills: Makers need to develop enterprise skills and experience to commercialise ideas

- In looking to commercialise his craft innovation and collaborate with industry, Sosanya identified difficulties in accessing business support. In particular, he identified the issue of intellectual property (IP) as one of the biggest barriers to collaborating with industry. Without legal support in this area he considers that he risks losing the IP relating to his innovations. Support in this area would help to protect his innovations and ensure that the value is recognised in the UK.

Barriers to Cross-Sector Craft Innovation

While there is evidence to suggest that the economic opportunity associated with craft innovation is significant – not only within the craft sector but more widely in other sectors when skills and experience are fused – there is also evidence that this is being constrained.

The results of our survey and case study interviews highlighted some of the barriers. This is supported by an extensive body of existing evidence on barriers in the broader creative industries.

Some of the barriers that are inhibiting the realisation of the economic potential of the creative industries, and the craft sector within that, are associated with market failures. These market failures lead to a sub-optimal level of allocation of resources, and so activity. Innovation in

particular can be prone to market failure.

These market failures may provide a rationale for Government intervention, with the aim of correcting or compensating for the market failure in order to deliver the socially optimal level of investment in these activities. We explore this further in Section 4.

We set out below the broad categories of barriers to craft innovation and collaboration identified as part of this study.

3.1 Issues with access to finance and external funding sources

Funding was identified in our survey as a barrier to both craft innovation and collaboration by the majority of respondents. It was also the area where the most respondents felt that support was needed. This was echoed in our case studies.

Ptolemy Mann, Sarat Babu and Oluwaseyi Sosanya have all benefited from funding grants, either at the start of

their careers or during their work. For each element of funding, they were able to identify the benefits gained from the support and how it enabled them to either continue to develop their work or take it in a different direction. However, they all reported challenges in accessing funding, specifically for innovation in craft.

One recurring reason cited for this was due to the restrictive criteria for grants that do not allow for innovation without a clear, fixed commercial application in mind at the outset. Grants tend to be output focused and require a clear end goal for the innovative activity, with little appetite for risk regarding the potential outcome. This creates a barrier to craft innovation, particularly more 'blue-sky' innovations, and thus risks the economic benefits associated with this. It also limits the types of innovations that do materialise in the market. Sosanya has identified this as the key barrier that he now faces.

It was also felt that innovation through craft falls in a middle ground between more traditional craft activities and technical innovation and R&D activity. While there is some funding available targeted at preserving traditional craft techniques as part of the arts, we understand that this tends to be linked to the delivery of specific projects rather than allowing for experimentation and innovation. And Sarat identified that a lot of the physical science grants tend to be on the technology side, which largely excludes craft innovation that tends to be more experimental, with less certainty regarding the direction it will take.

There are a number of economic explanations for why funding difficulties exist for craft innovation.

Innovation can be subject to high levels of uncertainty regarding the timing and scale of financial returns. This means that in order to balance the risk, a portfolio approach is required, with flexibility with regard to the timing of the payoff. This is a luxury that many businesses, particularly small businesses, cannot afford. Even large businesses, with potentially greater scope to undertake this type of activity, face pressure from shareholders to deliver short-term gains, which is detrimental to long-term R&D investments and risk taking.⁵³

For those businesses that are willing to take these risks internally, further challenges are faced when trying to access credit. Difficulties accessing finance are not necessarily a sign of a market failure – they may be the result of an unviable proposition, which is not expected to generate sufficient economic return. However, there

are a number of market failures that affect finance markets, and which are likely to be of relevance to the craft sector.

Asymmetry of information in the credit market is made worse by the uncertainties presented by investment in innovation. Like many businesses themselves, loan providers are risk-averse, which can result in businesses with viable propositions not receiving credit. Availability and the cost of finance have been shown to be one of the main barriers to innovation activity in Europe over time.⁵⁴ Smaller firms have also been shown to be more disadvantaged by external credit constraints on R&D investment,⁵⁵ and general finance⁵⁶ than larger firms. Results from the UK Innovation Survey shows that on the whole small firms struggle to innovate, with 13 percent engaging in internal R&D compared with 23 percent of large firms. This is despite some evidence to suggest that smaller firms are more innovative. For example, research by the RSA suggests that small firms create more innovations for every unit of R&D expenditure, and also extract more financial value from innovation.⁵⁷ This indicates an even greater need to assist small firms overcome these barriers.

The European Commission⁵⁸ also finds, on top of the issues facing SMEs in accessing finance, that specific characteristics of cultural and creative sector organisations reinforce the problem of access to finance. This is despite the study finding no evidence that, in general, the cultural and creative industries in Europe underperform in terms of profitability and financial health compared to other sectors.

3.2 Communication and awareness of the potential for craft innovation

The overriding message, from the case studies in particular, is that there is an issue regarding awareness among both craft practitioners and those in other sectors regarding the value of innovation in craft and what it can contribute to other sectors.

The case study interviewees highlighted that although they themselves are active in craft innovation, their experience is that many craft practitioners do not recognise the value that innovation can deliver both to themselves and to those in other sectors, meaning they often remain narrow in their focus and the potential to add economic value more widely may be lost. Examples of this include Sarat's experience engaging those from other sectors on the value of the design innovation and Sosanya's experience in struggling to get the required support to commercially develop his innovations. And just over two-thirds of survey respondents cited a need for additional support in raising awareness among third parties.

Furthermore, a lack of appreciation of the value of fusing craft and STEM skills was highlighted. Sarat, for example, has observed that STEM subjects are treated completely separate from craft, whereas in practice he feels they should be intertwined. Ptolemy also noted that the approach of craft practitioners to innovation and problem-solving is complementary to these more technical STEM skills.

This role for the expertise that the craft industry can provide to broader industry groups extends to a wide range of areas of Government focus. For example, additive manufacturing (AM) – more commonly known as 3D printing – is an area where the UK has been a world leader in developing technologies and in driving applications for their commercialisation. It has been suggested that the UK AM market has the potential to reach £5.7 billion by 2020.⁵⁹ It also underpins important

and growing sectors in the UK economy, such as High Value Manufacturing as well as impacting on the majority of the main sectors⁶⁰ identified in the UK Government's Industrial Strategy. Makers and material experts could contribute positively to the development of the UK's capabilities in these areas through integrating material knowledge with broader technological and digital skills. However, in order to deliver economic value, these opportunities need to be acted on.

Again, there are arguments from economic theory as to why craft innovation may be undervalued.

Wider social and economic benefits (known as positive externalities) that arise as a result of innovation, for example through knowledge spillovers, can result in underinvestment. This is because 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. The incentive to innovate will often depend on how easily a competitor will be able to copy the innovation through knowledge transfers. If an innovation is easy to copy (and cannot be



Johnson Tiles Prismatic Landscape installation by Ptolemy Mann, Clerkenwell Design Week

protected, e.g. through a patent) then 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 productivity. Therefore, at the economy wide level, the optimal level of innovation is higher than the optimal level for individual companies.

These are well-recognised concepts generally applying to R&D and innovative activities. In all these cases, the level of private investment in innovation, R&D and collaboration is lower than is optimal for the economy and society as a whole, due to the presence of these market failures. Although all types of businesses may be affected, these issues are likely to have a greater impact on the ability of small businesses to innovate. And yet, as noted above, there is evidence to suggest that smaller

firms are more efficient at innovation.⁶¹

Information asymmetries can hinder collaboration by making it difficult to identify collaboration partners. Firms must choose the right partner to collaborate with; however, they may be faced with limited information on the value that the other party can bring to them. In this case, information asymmetries make it difficult for a firm to make the optimal decision of who to collaborate with.⁶² Often as a result of the asymmetries, a collaborative partner will be chosen based on socio-organisational factors, commonly geographic and social proximity,⁶³ but these selection criteria may generate suboptimal collaborations. When asked about the challenges to collaboration, over half of survey respondents reported a challenge in identifying the right people to collaborate with.

3.3 Skills

There is a risk that underinvestment in the development of craft skills, and in the facilitation of a fusion between traditional craft skills and STEM subjects, will have a detrimental effect on the UK's currently strong international competitive position in the creative industries and craft. The rapidly evolving nature of industry means that the provision and application of craft skills needs ongoing investment for the UK to remain competitive.

As highlighted in the Education Manifesto for Craft and Making,⁶⁴ developed by the Crafts Council, education and training in craft-related subjects has declined in recent years. Evidence suggests that between 2007 and 2013 student participation in craft-related GCSEs fell by 25%. In higher education the number of craft courses fell by 46%. The future pipeline of craft practitioners and innovators is therefore at risk.

Skills, education and knowledge support was identified by around half of survey respondents as an area where support is required to help drive innovation and collaboration in the craft industry. Throughout our case

study interviews, there was recognition of the wealth of talent among craft practitioners in the UK, across a range of disciplines. However, there were concerns:

- Bentley noted that highly skilled leatherwork and woodwork is required for luxury car interiors but new talent is not being generated and these skills could be lost as the current workforce with these skills ages.
- Sosanya highlighted that his experience of working at the mills that serve Burberry and Paul Smith was that the youngest worker was aged 42, and with no new talent entering the industry there is a risk of these industries diminishing in the UK due to skill shortages.

This means that if this is not addressed, these businesses may have to search for these skills outside the UK, negatively impacting the UK economy.

The time it takes to develop the required skills was also recognised. In Bentley's case it is addressing this directly by taking on and training apprentices, but Bentley recognises that, particularly for the higher skill levels, the

returns will come over the long term and there is a risk that individuals will leave and the talent it cultivated may be lost to competitors. Furthermore, for smaller firms, the long timescales required for skills development and the risk of knowledge spillovers may make investment of this kind unviable.

In terms of education, there is a concern that practical and creative subjects are being sidelined in favour of other skill areas, such as STEM. However, craft can play an important role within STEM subjects, as bridging creative, technical and scientific practicalities. Providing the support to help individuals overcome the barriers to building the skills, to enable the fusion of these disciplines – both in school and higher education and throughout makers' careers – should help the sector capitalise on the opportunities in craft and its application in wider commercial contexts across other industries.

Our research also highlighted that the potential for craft innovation and collaboration may also be inhibited due to insufficient broader commercial and enterprise skills among craft practitioners.

Sosanya highlighted his need for legal support and advice relating to patenting, in order to protect his intellectual property. This is a key concern for him in relation to collaborating with industry and has so far held him back.

Darren Clanford at Johnson Tiles also highlighted that while his collaboration with Ptolemy Mann has been very positive for both parties, his previous experience collaborating with crafts practitioners has been less successful due to a lack of understanding by the craft practitioner of the commercial aspects of the collaboration, and a failure to appreciate the constraints of industrial production.

Without the appropriate commercial experience and business support in developing their craft companies, craft practitioners are unlikely to be able to take full advantage of the opportunities available for craft innovation and collaboration, leading to a sub-optimal level of activity.

Conclusions

The findings from the survey, case studies and wider research presented in this report provide evidence regarding: the nature of cross-sector innovation and collaboration involving craft; the value this generates both for the craft sector and in other sectors; and the factors which influence successful cross-sector innovation and collaboration.

They also provide evidence of some of the key barriers to craft innovation and suggestions as to how these could be addressed. The market failures identified may provide a rationale for Government interventions that aim to correct or compensate for these sources of inefficiency in order to deliver the socially optimal level of investment in craft innovation and collaboration.

Support for the Craft industry from Government in these areas would be in line with the Government's objective to: *'... reinforce the UK's place as a world leader for the creative industries ...'*⁶⁵ and its commitments to: *'... support the energy, innovation, skills and talent in our creative industries'*⁶⁶ and to *'... make the UK the best place in Europe to innovate, patent new ideas and set up and expand a business, and to protect intellectual property'*.⁶⁷

However, in order to limit the risk of Government failure – when Government intervention is unsuccessful at addressing a market failure, and may have the effect of distorting the market further – the policy response needs to be carefully considered.

The most appropriate type of support depends on the market failure being addressed and the specific objectives of intervention, but examples that have been used previously include loan guarantees, grants, subsidies or tax credits for innovative activity and the creation of tradable property rights.⁶⁸ Collaboration or coordinated activities in the innovation process can also address market failures. As collaboration shares the cost and risk of R&D between the collaborating parties, the individual risk exposure of each firm is reduced.

We summarise below the findings of our report against each of the hypotheses we developed at the outset of the project, tested through our survey and case studies. Linked to these findings we then consider how various policy actions may help to support Government's priorities and objectives in the context of innovation and collaboration within the Craft sector and how they may help to further enhance the economic value generated from such activity.

4.1 Summary of findings against our research questions

At the outset of the project we posed research questions to test through our survey and case studies, and to provide a focus to our research and evidence gathering.

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

To what extent does cross-sector innovation and collaboration deliver tangible economic benefits to both the craft industry and to other industries?

Evidence from the survey and case studies suggests that there are potentially substantial benefits generated from innovation and collaboration involving craft, and that these impact both the craft practitioners themselves, and also can have wider impacts on other industries through collaboration and knowledge sharing.

Existing research looking at the value of the craft sector to the economy has focused only on the activity generated within the craft sector itself or by craft practitioners working in other sectors. What this report highlights is that these measures are likely to underestimate the real 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 is currently possible to measure through official statistics.

Collaboration is the key to craft innovation both now and in the future as the trends towards increased digitalisation continue to blur the boundaries between physical and digital products and processes. The fusion of different skills, expertise and approaches are leading to new developments with both commercial and wider economic value. The case studies provide some examples of this in addition to the examples of recent craft innovations, such as graphene, responsive textiles and in healthcare, cited in Section 1.2. There is a potentially significant economic opportunity associated with the fusion of craft with other disciplines. Evidence suggests this will drive innovation and growth, thus delivering tangible economic benefits.

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

Our evidence suggests that developing practical craft skills is the starting point for innovation and realising the economic potential of the sector. However, it is the combination - or 'fusion' - of craft skills with wider skills, such as engineering, science and technology, that is critical to delivering greater economic impacts.

While some of the individuals we interviewed for our case studies, such as Sarat Babu and Oluwaseyi Sosanya, had a combination of skills themselves, other individuals rely on the collaboration with industry to bring these wider perspectives and expertise.

Craft skills add value through the way in which problems are approached which brings something different to industry. By working iteratively and solving problems by working by hand, craft practitioners have a unique way of approaching tasks and this experimentation can lead to breakthroughs and new solutions. It also allows for a differentiation of products in the market.

By nature, craft skills take time to develop. Therefore, it is important to invest in skills and education in these areas to ensure a future pipeline of makers and craft innovators. As noted in Section 3.3 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. Therefore, there is a case for further support and investment in this area going forward.

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 enhanced appreciation of the commercial realities of industry and business and enterprise skills are fundamental to successful craft innovation and collaboration. A lack of these skills acts as a barrier to the scale of collaboration that takes place, as well as its success.

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

Specifically, is it the case that:

- **there is a time delay between skills and innovation investments and their payoff?**
- **only a small proportion of skilled makers are able to go on and drive innovation with a positive impact on other industries, therefore, is a portfolio of approaches needed to foster craft innovation? and**
- **there are language and communication barriers to cross-sector collaboration, including the understanding and acknowledgement of the value of craft innovation?**

As outlined in Section 3, there is evidence that a range of barriers exist in relation to craft innovation and collaboration. A number of these stem from market failures, many of which are not unique to the craft industry but apply to R&D and innovation activity more generally. The nature of craft, 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.

Each of the case studies highlights the background and experience that needs to be built up before successfully delivering craft innovation. Not only does it take time for craft skills to be developed to then be put in to practice in wider industry contexts, but the process of innovation can be lengthy and without guaranteed commercial success.

Innovation, by nature, is experimental and is not always successful. This is particularly the case for early stage innovation associated with delivering new concepts. In our survey, over three-quarters of respondents reported being involved in innovation at this stage of the product process. Fewer, reported going on to innovation in the

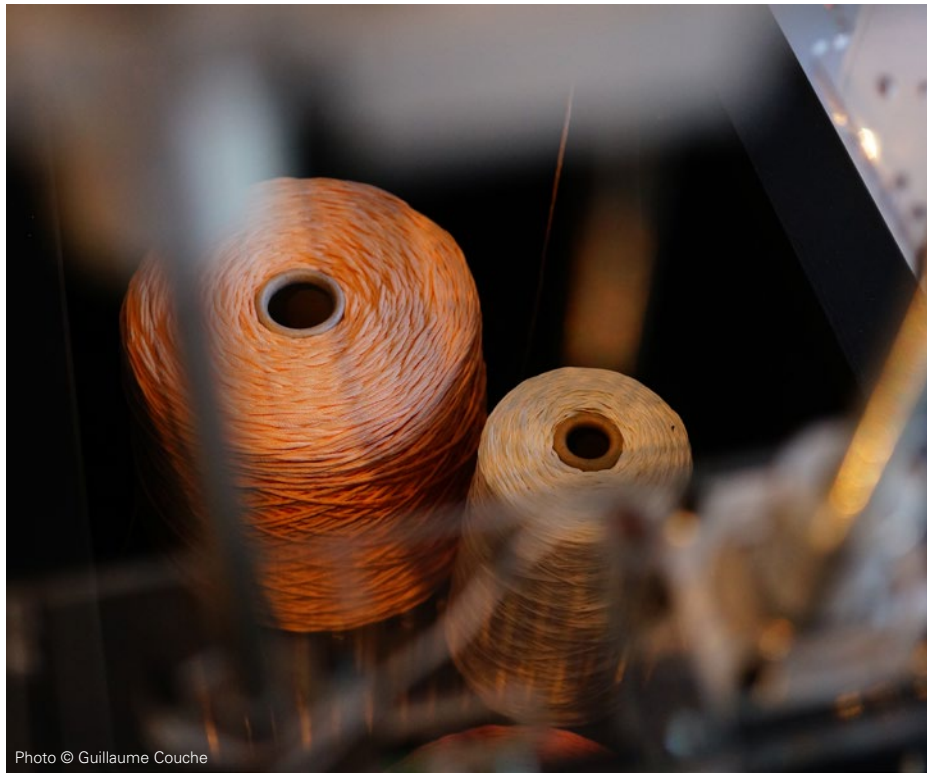


Photo © Guillaume Couche

Spools for Oluwaseyi Sosanya's 3D weaver

commercialisation phase. The risks associated with innovation mean that there can be a reluctance of both individuals themselves to innovate, but also of external funders to support this given, the uncertainty of realising returns. Asymmetry of information in the credit market is made worse by the uncertainties presented by investment in innovation.

And even if the innovation is successful, the time period to achieve this success can be lengthy.

Even where craft innovation takes place, it is only a small proportion of the overall craft community that goes on to deliver innovations that have applications and uses in wider industry sectors. Many craft makers focus only on the traditional outputs of craft. Our survey showed that it tends to be the organisations that engaged in higher levels of innovation that also tended to have higher levels of collaboration.

There is some evidence to suggest that the extent of craft innovation and collaboration may be hindered by a lack of understanding and acknowledgement of the value of craft innovation.

This lack of understanding is not confined to wider industry, but is also found within the craft industry itself.

Our case studies highlighted that makers may not fully appreciate how their skills, expertise and technologies can be used within a commercial context. Oluwaseyi 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, who recognise the potential uses in their industries. It is only through collaboration that this becomes apparent. However, it requires a common understanding and appreciation of the value this can bring to make the collaboration happen in the first place, and an openness of industry to accept the ways of thinking and processes adopted within the craft sector. It also requires for craft makers to understand the commercial environment and constraints of industrial processes.

This lack of understanding of the value of craft innovation and cross-sector collaboration is added to by a market failure that would also lead to underinvestment. Wider social and economic benefits (known as positive externalities) that arise as a result of innovation, for example through knowledge spillovers, can result in underinvestment. This is because the return to the private individual, company and/or investor can be lower than the overall returns to society.

It is recognised in the creative industries that investment in creative businesses requires a legal framework allowing intellectual property to be protected and commercialised. This should provide a fair return for investors and create the right incentives for innovators. IP was an issue of concern highlighted in one of our case studies. Protecting the craft innovation is an important consideration when collaborating with industry, and is vital to create the right incentives to commercialise craft developments.

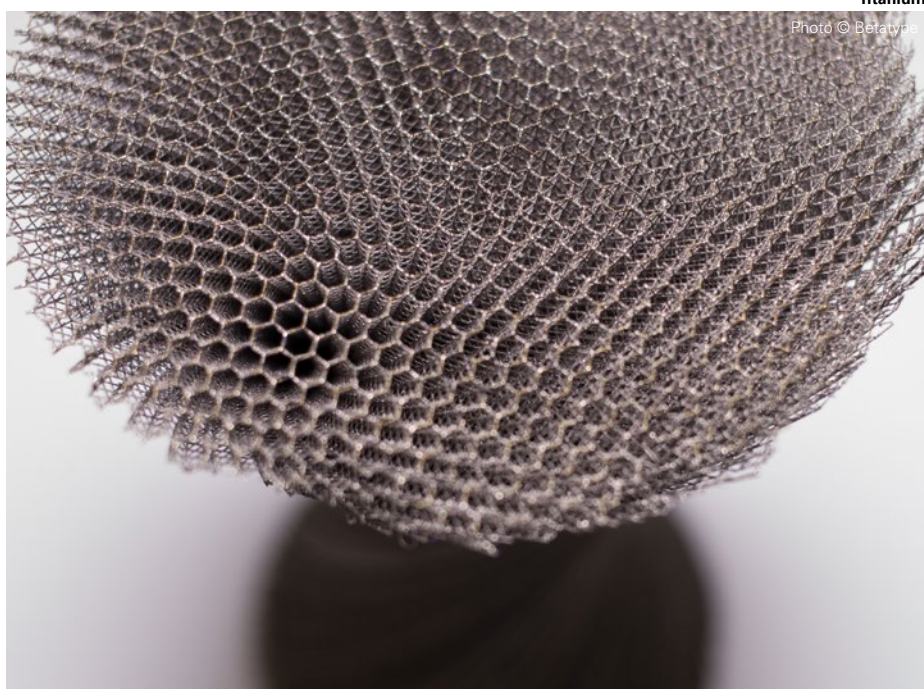
What additional Government support, if any, is needed to support craft skills, innovation and collaboration in order to optimise the economic contribution of the craft industry?

Given the existing market failures and barriers that are constraining

the potential economic opportunity for craft innovation, there is a case for intervention. Evidence around the broad categories of barriers and market failures identified within the craft industry through our study is set out in Section 3.

The Government already has in place strategies focused on the creative industries, of which craft forms a part. Indeed, in the Create UK Creative Industries Strategy craft is recognised as: ‘...a core component of the UK’s thriving creative industries’. And with the aim to ‘reinforce the UK’s place as world leader for the creative industries’, there is a clear case for targeted action to enable this to happen in relation to craft.

Many of the acknowledged problems in the broader creative industries apply equally to crafts. Issues such as access to finance and skills and education needs require Government support to facilitate and drive change. However, a broader, more co-ordinated approach is needed involving the industry itself, bodies such as Innovate UK and the Crafts Council, and research and higher education institutes.



4.2 Policy tools to enhance the value of craft innovation and collaboration

Evidence from the survey and case studies suggests that there are potentially substantial benefits generated from innovation and collaboration involving craft, and that these not only impact craft practitioners themselves but can also have wider impacts on other industries through collaboration and knowledge sharing.

Based on the evidence against each of our research questions, the following actions could be expected to help maintain and enhance the economic benefits of craft innovation and collaboration. The potential actions are grouped in to three main areas, linked to the barriers and market failures we identified in our study, and draw on the suggestions made by stakeholders as to the type of additional support required. It is likely that each of these actions would, individually, make a difference by addressing specific barriers in the market. However, it may be that a more comprehensive response would have a greater impact in terms of making a step change in craft innovation. A combined approach is likely to contribute more significantly to establishing an ecosystem in which collaborative, open innovation and cross-sector innovation is enabled and supported.

4.2.1 Awareness of the value of craft innovation and the opportunities associated with collaboration

Despite evidence of the economic opportunity associated with craft innovation and the positive impacts collaborative, open innovation and cross-sector innovation can deliver, our study suggests that one of the main barriers to this activity taking place is a lack of understanding and appreciation of this value.

Evidence from our study suggests that in order for this cross-sector innovation and collaboration to take place there needs to be appreciation on both sides of the partnership of the benefits it can deliver, and how fusing the respective skills, expertise and approaches of craft and commercial industry together can deliver better outcomes

and new solutions. Raising awareness of the opportunities for physical-meets-digital in the context of the evolving industrial landscape is likely to garner more interest in collaboration between craft and industry and enhance the mutual understanding of opportunities that can be unlocked by bringing together the different skill sets.

A range of activities are likely to help to achieve this, from showcasing the value of cross-innovation and highlighting examples of where this successful collaboration has delivered benefits, to bringing greater awareness of how craft skills, when fused with other disciplines such as science and technology, can lead to unique ways of solving industry problems.

Other examples of potential initiatives that we would expect to help develop a culture of collaboration and innovation in the craft sector include events and competitions. These can drive activity as well as provide support to help facilitate craft practitioners in becoming more involved in industry and to take steps towards creating broader commercial applications of their craft developments.

There is a range of different bodies that may be well-placed to raise awareness of the value of craft innovations, due to the strategic fit with their existing roles in relation to crafts, the creative industries and/or in supporting innovation and economic growth more broadly.

This includes a role for universities as potential hubs for bringing together different disciplines and encouraging the joining of skills and expertise. The Royal College of Art and Imperial College have done this with success, and the increasing focus on the fusion of skill sets and backgrounds is delivering innovative outcomes. To develop his 3D weaver, Oluwaseyi Sosanya benefited from this university collaboration and the ability to access both craft and art and design learning with engineering and materials science. The most prominent examples of craft innovation that we came across in this study drew on a range of multi-disciplinary skills.

The greatest value is likely to be achieved if awareness is raised across the UK, at both national and regional levels, and aimed at wider industry as potential beneficiaries of craft

innovation as well as the craft industry itself to encourage their greater involvement and collaboration with industry.

- **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 2020.⁶⁹
- **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.

4.2.2 Financial support

As noted in the Creative Industries Council's Create UK strategy,⁷¹ access to finance is one of the major challenges to future growth of the UK creative industries. And evidence gathered as part of this study suggests that these problems also exist in relation to the craft industry, particularly the funding required to innovate and develop new applications of craft developments for use in wider industry.

The market failures identified in relation to access to finance lead to a lack of private sector funding. These include the time delay between skills and innovation investments and their payoff; and the inherent risk associated with innovation, which means that, in the knowledge that some innovations will fail, a portfolio approach is needed to balance the risk. Evidence also suggests that the existing funding available, for example through grants, is not easily accessed by craft practitioners due to the focus of the criteria.

The availability of funding, particularly for more 'blue sky' craft innovation, experimentation and early stage collaboration appears lacking and is an area where it is likely that Government support would be needed, as private sector funding is unlikely to be forthcoming. Facilitating a portfolio approach to investment in

- **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.⁷⁰

recognition of the risks involved, and opening up grants criteria so that they are not tied to particular outcomes but allow for greater innovation and experimentation without an end commercial output in mind at the start, is likely to make a difference.

In addition to this, innovation in general needs to be incentivised if the market failures are to be addressed. Providing incentives, potentially in the form of innovation vouchers, would help to offset some of the risk involved and encourage greater take-up of activities to stimulate new innovation spillovers from craft into other industries. This, in turn, would generate and capture currently untapped economic value.

There is a need to ensure that this support is available to businesses of all sizes, particularly smaller businesses that typically have greater problems in accessing finance.

Innovation voucher schemes are used already at national and local levels across the UK as a lever to support business growth. For example, Innovate UK has schemes in place aimed at sectors such as cyber security, and BIS put Growth Vouchers in place to help small businesses to find strategic advice from private

sector suppliers to help their business to grow. While innovation vouchers are untested in the context of craft, there could be merit in adopting in the crafts sector a similar approach to that successfully tested elsewhere, in order to help to facilitate collaborations between craft practitioners and businesses in other sectors.

4.2.3 Skills

Ensuring a future pipeline of people with craft skills is fundamental to delivering the benefits of craft innovation in the future. This entails ensuring that arts and the creative industries are embedded in curricula and given sufficient focus and recognition.

Our study suggests that the greatest economic value is to be achieved when different skillsets are fused together. This means bringing arts and STEM subjects together at all levels of education and encouraging individuals into careers in the creative industries. This is not a new idea. The Creative Industries Federation in their Creative Education Agenda⁷² states: *'We need creative scientists and engineers as well as artists and designers who understand the affordances of materials and the uses of technology.'* The Creative Industries Council's Create UK strategy⁷³ also recommends this and highlights the, *'... marginalisation of creative subjects in the curriculum, insufficient training for teachers and lack of consistent careers advice can mean many young people are discouraged from following a creative path.'*

Craft skills take time to develop. Therefore, in order to prevent heightened problems in the future, early action is required. While larger companies like Bentley can invest in developing the skills themselves, for example through apprenticeship programmes, this is not a viable option for the vast majority of UK businesses that are SMEs. The long timescales required for skills development and the risk of skills leakage to other firms or sectors are likely to make investment of this kind unviable.

It is not only craft skills that need to be developed to ensure that the economic opportunities associated

– **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.

with craft innovation and cross-sector collaboration are realised. Craft practitioners also need to build their commercial skills, adapt their designs and processes to industry and ensure that they are well-placed to capitalise on the opportunities. Support to help fledgling businesses commercialise craft innovation has also been identified as important. This could range from enterprise skills to more specific support in terms of IP advice to ensure that craft practitioners, and collaborating businesses, are incentivised to invest in innovation, are rewarded for the risks they take and are adequately protected when seeking to commercialise their innovations.

– **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.

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- 32 The current DCMS creative industries statistics measure (a) the creative industries sector and (b) the creative economy (that is, the whole of the creative industries plus creative occupations in other industries). DCMS acknowledges there are limitations in the data, especially for craft, due to inadequate SIC and SOC codes, which means that these figures are underestimates. For this reason DCMS, with support from the Crafts Council is working to influence future revisions to the categories to better represent the creative industries.
- 33 The survey was sent to 184 individuals. In total, 40 responses were received, giving an overall response rate of 22%. The response rate for questions within the survey differed. The number of responses received for each question is noted in the analysis.
- 34 http://www.craftscouncil.org.uk/content/files/Measuring_the_craft_economy-v4.pdf
- 35 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.
- 36 We spoke to Graham Sichel, Bentley's Head of Materials, Trim Development and Mulliner Workshop about the innovative approaches they employ in developing new products and approaches.
- 37 <http://www.bentleymotors.com/en/world-of-bentley/our-story/crewe/craftsmanship.html>
- 38 Of this, £376.8 million is direct GVA from the company's own activities, an estimated £582.9 million was indirect GVA generated through Bentley's spending on its UK supply chain, and an estimated further £183.2 million of induced GVA was generated through the additional spending by Bentley's own employees, and those in its supply chain, in the wider economy. This analysis is based on Bentley's annual accounts for the year ending 2014 sources from FAME. 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 29, manufacture of motor vehicles.
- 39 <http://www.craftscouncil.org.uk/artists/dr-sarat-babu>
- 40 Meniscus is the cartilage within the knee that cushions and stabilises the knee joint.
- 41 Incidence rates for hospital admission due to meniscal injury vary between 0.35 and 0.7 per 1,000 person-years, and 85% of hospital admissions requiring surgery. The most effective approach to this currently is to use donor cartilage allograft transplantation. However, problems related to graft availability, size matching, high costs and disease transmission limit the widespread practice of this intervention.
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- 46 www.ptolemy.com
- 47 Data supplied by Johnson Tiles
- 48 The Blue Book 2014: Chapter 02: The Industrial Analyses, based on SIC 13, textiles.
- 49 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 13, textiles
- 50 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.

- 51 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.
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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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The Knowledge Transfer Network connects people, speeds up innovation and finds markets for new ideas. It brings together what had been 14 disparate business sectors. The sharing of knowledge and expertise across those sectors puts the KTN in the unique position of being able to further explore the impact of the creative industries and creativity across the whole economy and demonstrate how creativity drives innovation across a range of sectors. Interventions which foster collaboration and cross-over between creative businesses with the capacity for growth and technology companies which would benefit from creative innovation are central to a thriving UK creative economy.

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