# Designing a Future Economy

## Developing design skills for productivity and innovation

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# Contents

# Executive Summary

The pace of development in the digital, biological and technological world are bringing significant change and disruption to the way we work and live. From 3D printed buildings to self-driving taxis to vertical farming, there are few parts of the economy that won't be touched by this 'fourth industrial revolution'. Tomorrow's innovative companies and organisations need individuals who can marry subject expertise with skills and knowledge from outside their individual specialisms, and who are comfortable deploying creativity and creative methods within teams and projects. Tomorrow's innovative companies need design skills.

Modern design is no longer confined to particular sectors or occupations. The skills, principles and practices of design are now widely used across many parts of the economy, from banking to retail. Designers, too, have always drawn on a range of different skills, tools and technologies to deliver new ideas, goods and services. This is what makes design so unique, and is how it makes products, services and systems more useful, usable and desirable in advanced economies across the world.

This research examines the skills that differentiate design from other sectors in the UK economy. It builds on our 2015 *Design Economy* study, which presented a comprehensive analysis of the value that design adds to the UK economy. The design economy refers to the value created by those employed in design roles across a wide variety of industries – from design-intensive sectors, such as animation or web design, to designers and design-engineers in sectors not always thought of as using design, such as automotive or aerospace companies.

This report draws on an in-depth analysis of a range of data, both in the US and the UK. It utilises the US O*Net dataset of job characteristics to investigate the skills which are distinctive for design. It also uses data from the Office for National Statistics (ONS) and other UK sources to then investigate the link between skills and economic value. Based on the analysis of distinctive design skills, the study proposes a more developed definition of design and then builds the evidence base utilising this definition. This means the study adds value to the previous work and creates new insight, providing policy makers and other stakeholders with key intelligence regarding the role of design in promoting economic growth, productivity improvements and stimulating innovation.

## Key findings

The findings are structured into three sections: the skills associated with design, the value of design skills to the UK economy and skills acquisition and development.

### The skills used for design

Our research suggests that designers augment their technical skills through their knowledge of the design process and their creative thinking. As such those employed in the design economy use a wide range of skills in their work – from the ability to visualise future possibilities or understand user need, to technical skills using digital technologies or physical materials. This combination of technical skills, cognitive abilities and interpersonal competencies will become more and more essential as the 21st century progresses.

The study found that across all design occupations knowledge of design is key, and there are 13 skills that differentiate design from the rest of the economy based on an assessment of their relative importance to design jobs. This list of skills was extrapolated to identify other occupations elsewhere across the UK economy which also report using the same skills

## Table 1. The most important skills across all design occupations

| Skill | Importance premium | O*NET definition |
|---|---|---|
| Design | 40% | Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings and models. |
| Operations analysis | 23% | Analysing needs and product requirements to create a design. |
| Programming | 22% | Writing computer programs for various purposes. |
| Drafting, laying out and specifying technical devices, parts and equipment | 20% | Providing documentation, detailed instructions, drawings, or specifications to tell others about how devices, parts, equipment, or structures are to be fabricated, constructed, assembled, modified, maintained, or used. |
| Engineering and technology | 18% | Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures and equipment to the design and production of various goods and services. |
| Fine arts | 15% | Knowledge of the theory and techniques required to compose, produce and perform works of music, dance, visual arts, drama and sculpture. |
| Technology design | 10% | Generating or adapting equipment and technology to serve user needs |
| Building and construction | 9% | Knowledge of materials, methods and the tools involved in the construction or repair of houses, buildings, or other structures such as highways and roads. |
| Computers and electronics | 5% | Knowledge of circuit boards, processors, chips, electronic equipment and computer hardware and software, including applications and programming. |
| Geography | 4% | Knowledge of principles and methods for describing the features of land, sea and air masses, including their physical characteristics, locations, interrelationships and distribution of plant, animal and human life. |
| Visualisation | 3% | The ability to imagine how something will look after it is moved around or when its parts are moved or rearranged. |
| Thinking creatively | 2% | Developing, designing, or creating new applications, ideas, relationships, systems, or products, including artistic contributions. |
| Interacting with computers | 1% | Using computers and computer systems (including hardware and software) to program, write software, set up functions, enter data, or process information. |

The design economy contains a diverse mix of skills across occupations, and analysis suggests that of the 13 top skill identified as being of above average importance across all design workers, nine are expected to grow in demand by 2030.

When looking for other occupations with design skills, we found 17 additional occupations outside of the design economy adding significant value across a range of occupations and sectors, from construction to electronics.

There is a strong relationship between the skills required for design and for innovation. Just over one in four of the occupations identified as reporting substantial use of design (high design skills intensity), also have high innovation skills intensity.

## The value of design skills to the UK economy

Our research has identified that design skills are more widely utilised in the UK economy than previously understood. This has caused us to create a new estimate of the value of design to the UK economy which recognises this wider impact. Our research shows that:

Workers with design skills contribute £209bn to the UK economy (GVA).
Between 2011-2015, the value these workers contributed grew at a faster rate than the wider UK economy.

Design skills create value across the economy. A little under half of design skills GVA (47%, £98.8bn in 2015) was generated by designers working in non-design sectors (such as aerospace, banking and retail).

Design is not only highly valuable to the economy, but it also drives high productivity. Our research has found that workers using design skills are 47% more productive than the average UK worker, delivering almost £10 extra per hour in GVA.

These highly valuable and highly productive design skills are embedded across the economy, used by at least 2.5m people in their day-to-day work. This is equivalent to one in 12 workers (8%) and our research has found that demand for workers with these skills has grown at twice the rate of UK employment over the same period (14% vs. 7% since 2012).

The research looked at the link between design skills and innovation. We found that there is a significant presence of design skills in innovation-focused jobs. This means that design skills are central to the process of innovation. Our research has found that:

Workers using design skills are more likely to be in innovation-intensive jobs, with 43% carrying out activities requiring creative thinking and problem solving to develop new ideas for, and answers to, work-related problems, compared with an average for the wider UK workforce of just 6%.

Firms in design industries are more likely to engage in innovation-related activities such as introducing new or significantly improved products, services or processes, or new and significantly improved forms of organisation, business structures or practices and marketing concepts or strategies.

## Skills acquisition and development

This study has also investigated how designers and design firms acquire, develop and maintain the important design skills which add value to the UK economy.

Our research suggests that design firms are more likely to need candidates who are educated to degree level or above, but complain that candidates can lack the required skills and competencies. Key findings include:

When it comes to recruitment, the design economy demands high skills levels. Workers with design skills are more likely to require a degree, post-graduate qualification or professional qualification to enter the design industry.

Recruitment can be a challenge for the design economy, which has a slightly higher level of vacancies to the wider economy. Furthermore, these vacancies are slightly more likely to be classified as 'hard to fill' than compared to the average for UK firms.
A higher proportion of design employers are facing the challenge of skills shortage vacancies than employers in the wider economy.
Where hard to fill vacancies exist, they are more likely to be driven by a lack of skill, experience or qualifications in the applicant base (i.e. a 'skills shortage' in the external labour market) – particularly in the craft, clothing and product/industrial design sectors.
Employers in design skills-intensive industries are more likely than average to report that the staff they recruit from schools, colleges and universities are poorly prepared for work, and that they lack the required skills.
Skills found difficult to obtain in applicants are more likely to be around advanced IT skills and strategic management, and less likely to be around communications skills and literacy skills.

Accompanying these recruitment challenges, our analysis has also identified a declining number of students studying design. In 2017, just under 166,000 GCSE students took Design and Technology subjects, a 61% decrease from the year 2000. This has also been accompanied by a decrease in the number of teachers and teaching hours dedicated to the subject. Between 2011/12 and 2015/16, the number of people leaving Higher Education with undergraduate or postgraduate qualifications in Creative Arts and Design subjects also fell by 7%.

In addition to skills shortages amongst candidates for jobs there are gaps in the skills of those already working in the design economy. These shortages and gaps are preventing design firms – and the UK economy – from reaching their full potential. We estimate that these skills shortages and gaps cost the UK economy £5.9bn per year. Resolving these challenges would mean a more productive, efficient design economy. Our research found that:

One in eight design employers reports that they have staff who are not fully proficient in their current jobs. An estimated 59,000 people working in design skills-intensive industries[1] have skills gaps.

For design industries, drivers of skills gaps include the development of new products and services, the introduction of new working practices and the introduction of new technology.

Skills gaps among the existing workforce in design skills-intensive industries cost the UK up to an estimated £4.3bn in GVA in 2015. Skills shortage vacancies in design skills-intensive industries cost the UK up to an estimated £1.6bn in GVA.

Like most professions, the development of new skills and the updating of existing competencies is crucial to the growth and productivity of the design skills-intensive industries. Our research found that there are a number of barriers preventing further training to address skills gaps. Key findings include:

Designers also require more expensive training, meaning they receive it less often.

[1] 'Design skills-intensive industries' refers to all industries with a high concentration of employment in occupations which use design skills.

As such, designers are less likely to receive the additional training they require after leaving formal education.

When training is acquired, the investment is 66% greater per employee than in non-design industries.

Training costs are more likely to be met by the employees themselves rather than their employers, perhaps reflecting the working arrangements that are often in place between design firms and designers.

Design firms are less likely to establish formal training plans for staff and also to set training than firms in other sectors, so they are less ready to send their staff on relevant training courses.

The most critical barriers to training identified by firms in the design economy are a lack of money available to fund training, training not being considered a priority and a lack of time for management to plan and organise training.

**Conclusions and recommendations**

We hope this study will stimulate further debate about how design skills can be further enhanced to solve economic challenges faced by the UK today and into the future. For the first time, 'Designing a Future Economy' catalogues the skills intricately connected to design and innovation. Design skills are the fusion of creativity with technical ability and interpersonal competencies, and will be essential for any economy seeking to maximise the opportunities of technological advancements.

Yet with these opportunities come significant challenges. This research shows that the UK has skills gaps and shortages in design, accompanied by a narrowing pipeline of young designers who could otherwise fill these roles. Furthermore, firms are not providing the level of additional training required after formal education.

Given the current value of design skills across the economy and their future necessity, we recommend:

- **Education providers and regulators embed design in the curriculum:** the traditional pathways into design careers – such as GCSE Design and Technology – are being eroded. The Department for Education, schools and academies should re-introduce GCSE Design and Technology as a priority subject in post-14 education.
- **Moving from STEM to STEAMD:** Boosting STEM and digital skills alone will not suffice. Policymakers and education providers must consider how they will develop the complex problem-solving, critical and creative thinking abilities that are essential to innovation. Design is central to this. Design methods, tools and approaches should be incorporated to STEM subjects to boost the skills required in the future economy.
- **Greater support and resource for lifelong learning:** A government strategy is needed to address existing skills gaps whist anticipating the future skills needed in the fourth industrial revolution. This requires investment in career long learning with access to resource, training and non-formal education that will equip people with higher value skills required for future work.
- **Recognition and inclusion of design in the implementation of the Industrial Strategy:** The industrial strategy can draw on design and design skills to help create the right conditions for growth. Our research shows how designers use their skills to develop a deeper understanding of people's needs, meaning that an industrial strategy

utilising these skills and principles is more likely to succeed and positively impact upon people's lives.

- **Promoting greater use of design in parts of the economy most in need of a boost:** Government should explore with business leaders and the design industry what wider incentives could be used to encourage greater use of, and upskilling in design across key areas of the economy. In particular incentives should be targeted at the sectors with the lowest levels of productivity and the highest chances of automation, which could benefit from an uplift in productivity while creating more meaningful, creative and higher value jobs in the process.

# Introduction

The pace of development in the digital, biological and technological spheres is bringing significant change and disruption to the way we work and live. From 3D printed buildings to self-driving taxis to vertical farming, there are few parts of the economy that won't be touched by this 'fourth industrial revolution'. While much has been written about the threat of these technological advancements and automation to existing jobs, innovation in the form of new technologies, new industries and new services has historically driven demand for new skills. This trend looks set to continue with the latest phase of developments.

Analysis by Nesta (2017) assessing the impact of automation on employment and the future demand for skills predicts that creative, digital, design and engineering occupations will all experience greater demand for their services by 2030[2]. These occupations are typified by their emphasis on interpersonal skills, such as social perceptiveness and coordination, and cognitive abilities such as visualisation and thinking creatively.

This presents a significant opportunity for the UK, which faces these developments from a unique position among the world's advanced economies. By designing and commercialising new technologies while upskilling the workforce to undertake more meaningful, creative and higher value work, we can become the designers of the future.

## Addressing the UK's 'productivity puzzle' through design

For the past decade the UK has been beset by stagnant productivity levels, meaning the country's workforce is working harder than it was before the 2008 recession to produce less. Not only has this added to pressure on living standards, but as the country negotiates its exit from the European Union, we have fallen significantly behind our international competitors, with German workers being 27% more productive[3].

While there is no one cause of, or simple answer to, the UK's productivity puzzle, there are two key ways typically used to improve productivity: investing in better machinery and equipment, and improving processes that enable workers to increase the quality and quantity of their outputs. Design has a key role to play in implementing both these solutions and helping advanced economies such as the UK to make the most of technological and scientific advancements.

## The role of design in the future economy

Design provides a deeper understanding of people's needs. It puts people at the centre of a service, system or product development, meaning that technological developments utilising design skills and principles are more likely to succeed in the marketplace and positively impact upon people's lives. Design makes sense of things[4], and in doing so makes products, services

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[2] Nesta, (2017), *The future of skills: employment in 2030*, http://www.nesta.org.uk/sites/default/files/the_future_of_skills_employment_in_2030_0.pdf

[3] Office for National Statistics, (2017), *International comparisons of UK productivity (ICP), final estimates: 2015*, https://www.ons.gov.uk/economy/economicoutputandproductivity/productivitymeasures/bulletins/internationalcomparisonsofproductivityfinalestimates/2015

[4] Krippendorff, K., (1989), On the Essential Contexts of Artifacts or on the Proposition That 'Design Is Making Sense (Of Things)', *Design Issues*, 5(2), pp. 9–39.

and systems useful, usable and desirable for those who use them – and effective, efficient, and distinctive for those who supply them[5].

Design also drives innovations that are inherently novel or radical; that change perceptions and habits, rather than accommodating them[6]. In doing so design-led innovations can stimulate previously unknown, latent demand. This helps create new markets and expand the realms of what is possible. The UK has a unique opportunity to mobilise its design expertise and capacity to create the economy of the future, offering more rewarding, creative and interesting work for us all.

Modern design is no longer confined to particular sectors or occupations. The skills, principles and practices of design are now widely used across many parts of the economy, while designers have always drawn on a range of different skills, tools and technologies to deliver new ideas, goods and services. Tomorrow's innovative companies and organisations need people that have had exposure to disciplines outside their individual specialisms, that have experience of working in teams with other disciplines, and that are comfortable deploying their innate creativity and flexibility within teams and projects. Tomorrow's innovative companies need design skills.

## Why we must act now

Understanding and developing the skills and processes that make design so effective could help the UK increase the value they generate and tackle the challenges we face during a period of significant social, economic and technological transformation. Yet the country does not seem prepared.

A 2017 World Economic Forum study[7] of how countries invest in their workforces found that while the UK has access to highly skilled talent (and is ranked 10th in the world on this measure), it is concentrated in specific parts of the economy. When it comes to using the advanced skills and knowledge that are predicted to be required in the economies of the future, the majority of the UK workforce currently does not have exposure to these skills. The UK is instead ranked 54th in the world for the capacity of its workforce to deliver high-value outputs, and 51st in the world for the deployment of these advanced skills and knowledge. As a practice that spans sectors and occupations and will be in high demand in the future economy, building on our pool of design skills is one way to remedy this.

Yet there are concerns across the design economy that the future pipeline of these design skills is narrowing. In 2017, just under 166,000 GCSE students took design and technology subjects[8], a 61% decrease from the year 2000. Added to this, there has been a substantial decline in both the number of teaching hours dedicated to arts and technical subjects such as

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[5] Mager, B. and Gais, M., (2009), *Service Design*, Stuttgart: Utb Gmbh.

[6] Verganti, R. (2009), *Design driven innovation: changing the rules of competition by radically innovating what things mean*, Cambridge, MA: Harvard Business Press.

[7] World Economic Forum, (2017), *These are the 10 best countries for skills and education*, https://www.weforum.org/agenda/2017/09/these-are-the-ten-best-countries-for-skill-and-education/?utm_content=buffer7144b&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer

[8] Joint Council for Qualifications, (2017), *GCSE (Full Course), Outcomes for all grade sets and age breakdowns for UK candidates, Results Summer 2017*, https://www.jcq.org.uk/examination-results/gcses/2017/gcse-full-course-results-summer-2017/gcse-full-course-results-summer-2017

design, as well as in the number of associated teachers. This potentially narrows the pipeline of future designers, who have the skills the economy will require in future.

## Aims and objectives

Design Council has developed a research programme investigating both the supply of, and demand for, design skills which can aid innovation and productivity in the UK. This project forms the second stage in this research programme, following a scoping study undertaken by RF Associates in 2016. The aim of the study is to investigate the skills used within the design economy, the link between these skills and productivity and innovation, and how they align with future demand for skills across the wider UK economy.

In late 2016 Design Council commissioned Ortus Economic Research to undertake this study with four main research objectives:

To understand the skills associated with design occupations

To describe the value of design skills to the UK economy

To investigate the demand and supply of design skills

To describe key labour market characteristics of the design economy

## Methodology

The design economy refers to the totality of designers working in both design sectors (such as advertising) as well as in other sectors of the economy (such as finance). This study is fundamentally about the range of skills utilised by the design economy and the link between those skills and economic value. Unfortunately, we can't measure the economic value of specific skills because the data that would be required to do so is insufficiently detailed. While some surveys in the UK ask detailed skills-related questions, the data is not structured in such a way as to allow in-depth analysis by specific skill. Instead, the study uses occupations (and sectors) as a proxy.

To do so there is a need to understand the relationship between skills and occupations. Again, where UK and European[9] data does exist, it is insufficiently detailed. The preceding scoping study[10] identified the US Department of Labor's O*NET database as a potential source of information on the skills used in design roles and this has been employed extensively in this research study. As the O*NET dataset is a US data source there is an inherent assumption that the skills profile of US occupations is a suitable proxy for the skills profile of UK occupations. This is not the only UK study to take this approach[11].

The analysis used the definition of design conceived and implemented in the *Design Economy* research study of 2015[12]. By mapping UK Standard Occupational Classification (SOC) to US SOC, the *Design Economy* definition of design occupations has been employed to identify the most important skills associated with design occupations. During this process we identified 13

[9] The European Skills, Competences, Qualifications and Occupations (ESCO) dataset may become more important in supporting analysis of skills by occupation in the future.

[10] RF Associates, (2016), *Design Skills for Innovation & Productivity: Scoping Project*, unpublished.

[11] Nesta, (2017), *The future of skills: employment in 2030*, http://www.nesta.org.uk/sites/default/files/the_future_of_skills_employment_in_2030_0.pdf

[12] Design Council (2015), *The Design Economy – The value of design to the UK*, http://www.designcouncil.org.uk/what-we-do/design-economy

skills that are considered to be of above average importance to design occupations. This list of skills was extrapolated to identify other occupations elsewhere across the UK economy which also report using the same skills – which we call '*Design skilled occupations'*.

Using these frameworks, the study then went on to utilise a wide range of economic and labour market datasets, mostly provided by the Office of National Statistics, to investigate the key research questions. These are included throughout the report. This report has been prepared based on extensive analysis of these datasets, while a data pack presenting the results of the analysis is available separately.

## Definitions

### Design occupations and industries

The development of this report has required the establishment of a number of definitions of designers and the industries they work in. The *Design Economy* report of 2015 has been used as a starting point, and we have built upon its definitions through this study.

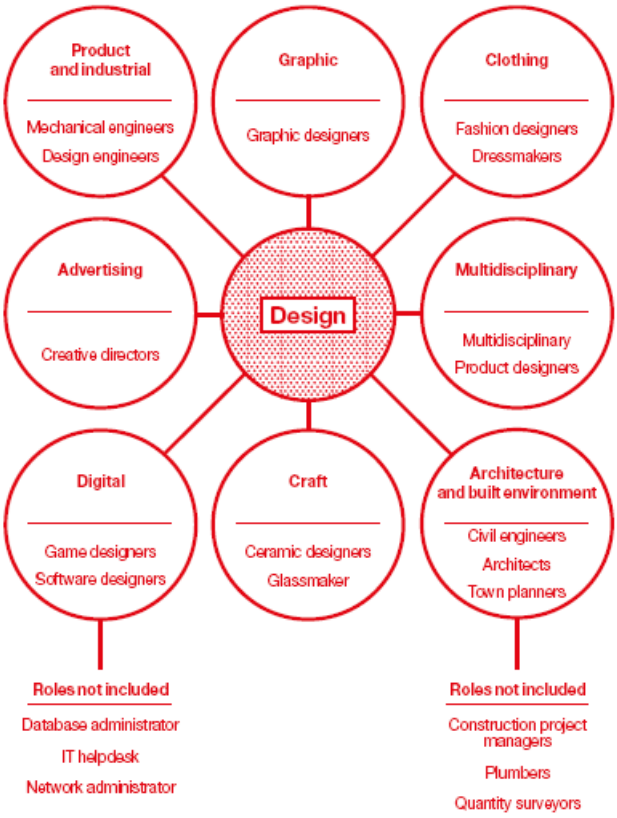
The definitions used in this report include:

#### The design economy

In total there are 23 design occupations in the ***design economy*** (categories A and C in Figure 2, below), defined using best fit Standard Occupational Classification (SOC) codes. These SOC codes identify ***designers***, and are then used to identify the industries which most intensively use design, referred to here as ***design industries*** and identified using individual Standard Industrial Classification (SIC) codes[13].

Figure 1: Examples of design occupations

[13] The design economy definition takes no account of additional 'design-skilled' occupations or 'design-active industries' described below – so in theory, 'other industries' might include design-active industries, and 'non-designers' might include additional design-skilled occupations within design industries; in practice, the analysis shows additional design skilled occupations and design-active industries as separate categories wherever possible.




Any industry where 30% or more of employment is comprised of design occupations is considered to be a design industry. All employment within a design industry is included in analysis of the design economy, on the basis that those employed in non-design roles will be supporting the core design function.

### Table 2: Design industries

| Design Group | SIC 2007 | SIC description | Example design business |
|---|---|---|---|
| Architecture and Built Environment | 71.11 | Architectural activities | Building design and drafting, eco design |
| Multidisciplinary Design | 74.10 | Specialised design activities | Fashion design, sustainable design, industrial design |
| Clothing Design | 14.19 | Manufacture of other wearing apparel and accessories | Accessories |
| Craft Design | 23.41 | Manufacture of ceramic household and ornamental articles | Ceramic tableware |
| | 32.12 | Manufacture of jewellery and related articles | Jewellery or watches, production of precious stones |
| Digital Design | 58.21 | Publishing of computer games | Computer game design and publishing |
| | 58.29 | Other software publishing | Software publishing |

| | | | |
|---|---|---|---|
| | 62.01 | Computer programming activities | Designing structure and content of software, user interface design |
| Product and Industrial Design | 16.29 | Manufacture of other products of wood etc. | Furniture design |
| | 26.40 | Manufacture of consumer electronics | Electronic home entertainment equipment |

The design economy therefore encompasses three key occupational categories which contribute to the value of design:

Figure 2: Occupations in the design economy

| | |
|---|---|
| **A** | **Designers in design industries (e.g. digital design, architecture and built environment)** |
| **B** | **Other roles in design industries (e.g. support functions such as administration, finance, distribution)** |
| **C** | **Designers in other industries across the economy (e.g. aerospace, finance, retail, etc.)** |

## Design-skilled occupations

As part of this study's unique contribution, we have identified occupations which sit outside the original *Design Economy* definition of designers, but for which design skills form an important part of the role. There are 17 additional occupations in this category. To be considered a ***design-skilled occupation***, incumbents must have rated 'knowledge of design' as being of above average importance to their role, as well as any two other skills from the most important 13 skills associated with the design economy (see A Taxonomy of Design Skills, page 18 for a more detailed explanation).

Table 3: Design-skilled occupations

| SOC 2010 | SOC description | Example job titles |
|---|---|---|
| 1122 | Production managers and directors in construction | Building Services manager, Construction manager |
| 1136 | Information technology and telecommunications directors | IT Director, Telecommunications director |
| 2123 | Electrical engineers | Electrical engineer, Power engineer |
| 2124 | Electronics engineers | Avionics engineer, Broadcasting engineer |
| 2127 | Production and process engineers | Chemical engineer, Industrial engineer |
| 2133 | IT specialist managers | Data centre manager, IT manager |
| 2139 | Information technology and telecommunications professionals n.e.c. | IT consultant, Software tester |
| 2434 | Chartered surveyors | Quantity surveyor, Surveyor |

| | | |
|---|---|---|
| 2436 | Construction project managers and related professionals | Project manager (building construction), Transport planner |
| 2461 | Quality control and planning engineers | Planning engineer, Quality assurance engineer |
| 3114 | Building and civil engineering technicians | Civil engineering technician, Survey technician |
| 3116 | Planning, process and production technicians | Process technician, Production controller |
| 5214 | Metal plate workers, and riveters | Boiler maker, Metal plate worker |
| 5315 | Carpenters and joiners | Carpenter, Joiner, Shop fitter |
| 5419 | Textiles, garments and related trades n.e.c. | Embroiderer, Hand sewer |
| 5421 | Pre-press technicians | Compositor, Pre-press technician |
| 5443 | Florists | Floral designer, Florist |

### All design skills-intensive occupations

Throughout this report we present analysis at occupation level, so have developed the category of ***all design skills-intensive occupations*** to refer to all people using design skills. This includes:

1A. Designers in design industries

1C. Designers in other industries

2. Design-skilled occupations

### Design-active industries

Building on these classifications, we are also able to identify other industries – outside the design economy – where 30% or more of employment is in occupations that are considered to have design skills[14]. We consider these industries to be actively using design, and as such have also captured the value by support roles in them. ***Design-active industries*** therefore comprise designers, design-skilled occupations and other roles (e.g. support functions such as administration, finance and distribution).

Table 4: Design-active industries

| SIC 2007 | SIC description | Example sectors |
|---|---|---|
| 16.23 | Manufacture of other builders' carpentry and joinery | Manufacture of wooden goods for the construction industry |
| 18.11 | Printing of newspapers | Printing of newspapers and periodicals appearing at least four times a week |
| 23.49 | Manufacture of other ceramic products | Manufacture of ceramic pots, jars and similar |

[14] While this is an experimental methodology, we have adopted the 30% threshold developed by Nesta and used by the Department of Culture, Media and Sports in the Creative Industries Economic Estimates.

| | | |
|---|---|---|
| | | articles |
| 25.73 | Manufacture of tools | Manufacture of knives and cutting blades for machines, Manufacture of hand tools, Manufacture of saws and saw blades |
| 27.52 | Manufacture of non-electric domestic appliances | Manufacture of non-electric space heaters, cooking ranges, grates, stoves, water heaters, cooking appliances |
| 31.02 | Manufacture of kitchen furniture | Manufacture of kitchen furniture |
| 32.13 | Manufacture of imitation jewellery and related articles | Manufacture of jewellery made from base metals plated with precious metals, Manufacture of jewellery containing imitation stones |
| 32.20 | Manufacture of musical instruments | Manufacture of stringed instruments, wind instruments, percussion musical instruments, electronic musical instruments |
| 42.99 | Construction of other civil engineering projects n.e.c. | Construction of refineries and chemical plants, Construction of outdoor sports facilities |
| 43.32 | Joinery installation | Installation of doors and windows, installation of fitted kitchens, built-in cupboards, staircases |
| 46.64 | Wholesale of machinery for the textile industry and of sewing and knitting machines | Wholesale of manual and computer-controlled sewing and knitting machines |
| 62.02 | Computer consultancy activities | Planning and designing of computer systems which integrate computer hardware, software and communication technologies, and related user training |
| 62.03 | Computer facilities management activities | On-site management and operation of clients' computer systems or data processing facilities, and related support services |
| 62.09 | Other information technology and computer service activities | Computer disaster recovery services, installation (setting-up) of personal computers, Software installation services |
| 71.12 | Engineering activities and related technical consultancy | Engineering design for industrial process and production, geophysical, geologic and seismic surveying, architectural engineering services, drafting services |
| 81.30 | Landscape service activities | Planting, care and maintenance of parks and gardens |
| 90.03 | Artistic creation | Sculptors, painters, cartoonists, engravers, etchers etc., writers |
| 95.24 | Repair of furniture and home furnishings | Reupholstering, refinishing, repairing and |

| | | |
|---|---|---|
| | | restoring of furniture and home furnishings including office furniture |

### All design skills-intensive industries

We also present analysis at industry level throughout this report, so have developed the category of ***all design skills-intensive industries*** to refer to all industries with a high concentration of employment in occupations which use design skills. This includes both design industries and other design-active industries.

### The Design skills ecosystem

Taken collectively, all this activity contributes to an ecosystem of design skills. This includes sectors where design is used intensively and purposefully (such as Advertising or Graphic Design), as well as industries outside the design economy, where design skills are actively used, consciously or otherwise.

The ***design skills ecosystem*** is therefore comprised of:

The design economy

Design-skilled occupations

Other roles in design-active industries

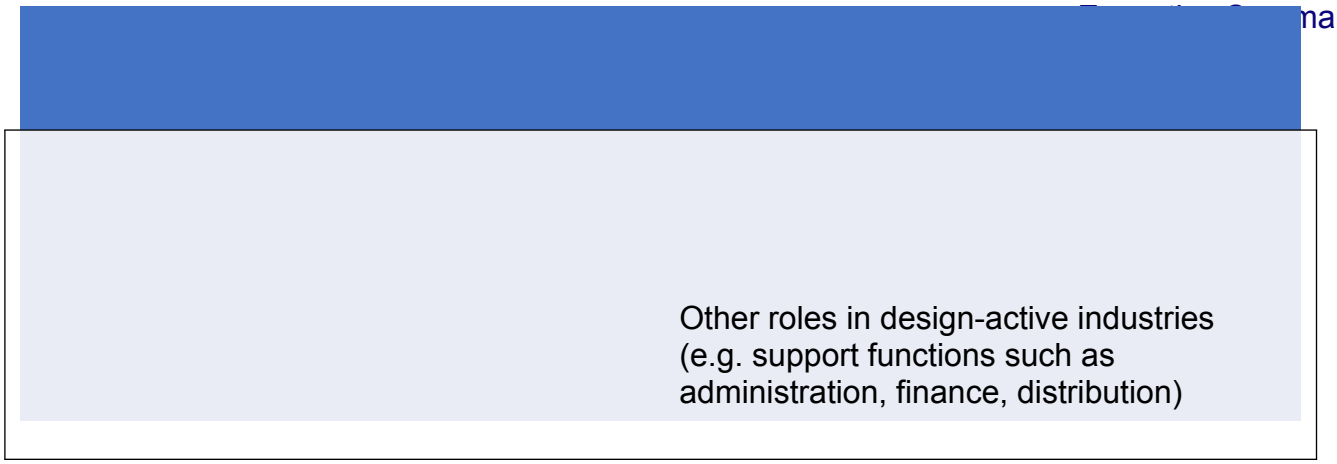
Figure 3: The Design skills ecosystem

**The Design skills ecosystem**

| **The design economy** | |
|---|---|
| Designers in design industries (e.g. digital design, architecture and built environment) | Other roles in design industries (e.g. support functions such as administration, finance, distribution) |
| Designers in other sectors across the economy (e.g. aerospace, finance, retail, etc). | |

| **Design-skilled occupations** | |
|---|---|
| Occupations outside the *Design Economy* definition but which use three of the most important design skills, including knowledge of design. | |

| **All design-skilled occupations** | **Design-active industries** |
|---|---|
| Analysis by occupation includes all people in design skills-intensive jobs, regardless whether they work in a design skills- | Those sectors outside the *Design Economy* definition of design intensive industries and where >30% of |




## Non-design occupations and industries

Throughout this report we compare designers and design-skilled occupations with other occupations falling outside these definitions. These are occupations in which design skills do not form such an important part of the role, and we refer to them as ***non-design occupations***.

Similarly, we compare design industries and design-active industries with other industries which do not exhibit such a strong concentration of design skills. These are industries where less than 30% of employment is comprised of designers and other design-skilled occupations. We refer to them as ***non-design industries***.

Finally, our analysis also includes comparisons with the whole of the UK economy, described as ***all occupations*** and ***all industries*** or, where appropriate, ***total UK*** or the ***UK average***.

### Innovation-intensive occupations and industries

In addition to mapping occupations and industries with a high use of design skills, we have also explored the links between design and innovation by examining which occupations report 'innovation'[15] to be an important skill. This enables us to explore the relationship between design skills and innovation skills. We refer to occupations with a high intensity of both design skills and innovation skills as ***innovation-intensive occupations***. Any industry where 30% or more of employment is comprised of innovation-intensive occupations is considered to be an ***innovation-intensive industry***. These are industries with high concentrations of innovation-intensive jobs (see 'The link between design and innovation', page 25 for a more detailed explanation).

We also refer to ***'innovation active' firms***. These are firms recorded as 'innovation active' in the UK Innovation Survey because they have introduced a new or significantly improved product (good or service) or process, engaged in uncompleted innovation projects, and/or introduced new and significantly improved forms of organisation, business structures or practices, or marketing concepts or strategies. This measure of innovation is based on business activity, rather than on skills, but allows us to compare innovation activity in design industries and non-design industries (see 'Design and innovation', page 34).

[15] Innovation is defined in the O*NET database as creativity and alternative thinking to develop new ideas for and answers to work-related problems.

# A taxonomy of design skills

This section addresses the following research questions:

What skills are currently associated with design occupations?

From understanding this, what skills are associated with design and innovation?

Innovation in the form of new technologies, new industries and new services, drives demand for new skills. While it is essential that the UK anticipates demand, it can also lead the way in developing a workforce with the right mix of skills to drive innovation. Tomorrow's innovative companies and organisations need individuals that have had exposure to disciplines outside their individual specialisms, that have experience of working in teams with other disciplines, and that are comfortable deploying their innate creativity and flexibility within teams and projects. This chapter outlines the skills most commonly associated with design occupations, and in doing so demonstrates that these skills are also present in other high-value parts of the economy as well as being strongly associated with innovation.

## Key findings

Design covers a broad spectrum of activities – from human-centred design to the technical design of artefacts, components and systems. As such, those employed in the design economy use a wide range of skills in their work – from the ability to visualise future possibilities, to the technical ability to create detailed drawings which instruct others how devices and components should be built, maintained or used.

The emphasis on specific skills changes from one design discipline to another. So, while in architecture and built environment, knowledge of 'building and construction' is the most important skill, in graphic design the most important skill is knowledge of 'fine arts', and the theory and techniques required to compose and produce graphic designs.

The design economy contains a diverse mix of skills across occupations, and our analysis suggests that of the 13 top skills we identified as being of above average importance across all design workers, nine are expected to grow in demand by 2030[16].

When looking for other occupations with design skills, we found 17 additional occupations outside the design economy that use at least three of these design skills, with all rating knowledge of design as being of above average importance to their role.

There is a strong relationship between the skills required for design and for innovation. Just over one in four of the occupations identified with high design skills intensity also have a high innovation skills intensity.

## Developing a taxonomy

There has long been an internationally agreed standard for defining occupations, the International Standard Classification of Occupations, on which individual governments' Standard Occupational Classifications (SOC) are based. A similar agreed framework for skills is lacking, but some codifications of skills and other attributes of occupations are available.

[16] Nesta, (2017), *The future of skills: employment in 2030*, http://www.nesta.org.uk/sites/default/files/the_future_of_skills_employment_in_2030_0.pdf

Through the delivery of a scoping study[17], Design Council identified the US Labour Department's O*NET database[18] as a useful framework to develop a taxonomy of skills associated with design occupations. The O*NET surveys ask workers from different occupations to identify various characteristics of their jobs, including:

The **tasks** and **work activities** they undertake.

The **tools** and **technology** their job requires them to use.

The **skills** and **knowledge** that are important for their role.

The **abilities** that influence their performance.

The **work styles** that affect how well they do their job.

These 'domains' each cover a wide range of elements related to the content of jobs and occupations[19]. These elements, or 'skills' as we term them in this report, allow us to understand what job holders consider as important for each individual occupation. Using this dataset, we can therefore compare and contrast occupations and understand more of the content of groups of occupations, such as those related to design.

Of the O*NET domains listed above, it is the domains of knowledge, skills, abilities, work activities and work styles that have the most to offer this study into design skills. Hereafter in this report, the term 'skills' is used to mean the range of skills, knowledge, abilities, work activities and work styles that differentiate design workers from others.

The primary objective of the taxonomy analysis is to create a framework for classifying design skills and in doing so to understand more about what differentiates design skills from those utilised in other occupations and other parts of the economy.

Note that throughout this section we use a measure called the ***importance premium*** to assess the relative concentration of skills in the design economy relative to the wider economy. O*NET asks workers to rate how important particular skills are for their roles. We have used this to calculate a premium, dividing the O*NET importance score for the design occupation (or group of occupations) by the average for the whole economy (i.e. all occupations), expressed as a percentage.

## The skills used for design

Analysis of the O*NET database identifies 13 core skills which differentiate the design economy from the wider economy, in terms of being rated as above average importance for design occupations compared with other UK occupations (i.e. have an importance premium above 0%). These are shown in Table 5, alongside the definitions of these skills used in the O*NET database:

### Table 5: 13 skills that differentiate design

| Skill | O*NET 'domain' | Importance premium | O*NET definition |
|---|---|---|---|
| Design | Knowledge | 40% | Knowledge of design techniques, tools, and principles |

[17] RF Associates, (2016), *Design Skills for Innovation & Productivity: Scoping Project*, unpublished.

[18] For detailed information on the O*NET database, see https://www.onetcenter.org/online.html

[19] The content and structure of the O*NET database is described at https://www.onetcenter.org/content.html

| | | | |
|---|---|---|---|
| | | | involved in production of precision technical plans, blueprints, drawings, and models. |
| Operations analysis | Skills | 23% | Analysing needs and product requirements to create a design. |
| Programming | Skills | 22% | Writing computer programs for various purposes. |
| Drafting, laying out and specifying technical devices, parts and equipment | Work Activities | 20% | Providing documentation, detailed instructions, drawings, or specifications to tell others about how devices, parts, equipment, or structures are to be fabricated, constructed, assembled, modified, maintained, or used. |
| Engineering and technology | Knowledge | 18% | Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures and equipment to the design and production of various goods and services. |
| Fine arts | Knowledge | 15% | Knowledge of the theory and techniques required to compose, produce and perform works of music, dance, visual arts, drama and sculpture. |
| Technology design | Skills | 10% | Generating or adapting equipment and technology to serve user needs |
| Building and construction | Knowledge | 9% | Knowledge of materials, methods and the tools involved in the construction or repair of houses, buildings, or other structures such as highways and roads. |
| Computers and electronics | Knowledge | 5% | Knowledge of circuit boards, processors, chips, electronic equipment and computer hardware and software, including applications and programming. |
| Geography | Knowledge | 4% | Knowledge of principles and methods for describing the features of land, sea and air masses, including their physical characteristics, locations, interrelationships and distribution of plant, animal and human life. |
| Visualisation | Abilities | 3% | The ability to imagine how something will look after it is moved around or when its parts are moved or rearranged. |
| Thinking creatively | Work Activities | 2% | Developing, designing, or creating new applications, ideas, relationships, systems, or products, including artistic contributions. |
| Interacting with computers | Work Activities | 1% | Using computers and computer systems (including hardware and software) to program, write software, set up functions, enter data, or process information. |

Source: Ortus Economic Research analysis of the O*NET database

The investigation into design skills also generates the following observations.

Almost half (six out of thirteen) of the skills which differentiate design from the wider economy fall under the ‘knowledge’ domain.

The elements from the 'skills' domain are all technical skills, while the O*NET database identifies a range of other skills which do not appear to be specific to design; i.e. they are common across the rest of the economy (e.g. basic skills, social skills, resource management skills, systems skills and complex problem-solving skills).

The single element from the 'abilities' domain which differentiates design (visualisation) is drawn from the category of cognitive abilities within the O*NET database. None of the abilities within the other O*NET categories (psychomotor, physical or sensory) are distinctive to design.

Two of the work activities that are important to design – thinking creatively, and interacting with computers – are related to mental processes, defined by O*Net as the 'processes, planning, problem-solving and innovating activities that are performed with job-relevant information'. The third work activity (drafting, laying out, etc) is related to work output.

These findings are based on examination of the occupations which sit within the definition of design developed and utilised in the *Design Economy* report[20]. That report made a number of key advances in presenting evidence of the economic value of design, including the development of a more complete definition of the design economy and the occupations and industries that it covers. Later in this chapter (see page 23) we investigate whether there are occupations outside of the pre-existing *Design Economy* definition which also show a high level of design skills intensity.

There is also evidence to suggest that the skills associated with design are likely to grow in demand in future. Analysis using the O*NET database by both Nesta[21] and the World Economic Forum[22] suggests that as advanced economies such as the UK develop and become more focused on knowledge-intensive activities, demand will grow for specific types of knowledge, cognitive abilities and social skills. Table 6 below shows that the top nine skills rated as most important among designers are all expected to grow in demand by 2030, and are all within the top 100 most in-demand skills. [23]

Table 6: Future demand for design skills

| Skill | Importance to Design Economy occupations (Importance Premium) | Predicted future demand (rank by Pearson correlation of the importance of O*NET variables to future demand for UK occupations (Source: Nesta 2017)) |
|---|---|---|
| Operations analysis | 23% | 22 |
| Fine arts | 15% | 51 |
| Programming | 22% | 58 |

[20] The Design Economy – The value of design to the UK (2015), Design Council

[21] Nesta, (2017), *The future of skills: employment in 2030*, http://www.nesta.org.uk/sites/default/files/the_future_of_skills_employment_in_2030_0.pdf

[22] World Economic Forum, (2016), *The 10 skills you need to thrive in the Fourth Industrial Revolution*, https://www.weforum.org/agenda/2016/01/the-10-skills-you-need-to-thrive-in-the-fourth-industrial-revolution/

[23] The Nesta analysis does not include the O*Net domain of 'Work Activities', meaning it is not possible to forecast demand for 'Drafting, laying out and specifying technical devices, parts and equipment', 'Thinking creatively' or 'Interacting with computers'.

| | | |
|---|---|---|
| Computers and electronics | 5% | 60 |
| Geography | 4% | 61 |
| Visualisation | 3% | 64 |
| Design | 40% | 68 |
| Engineering and technology | 18% | 76 |
| Building and construction | 9% | 82 |

Sources: Ortus Economic Research analysis of the O*NET database / Nesta, (2017) *The future of skills: employment in 2030*.

## Design skills across different disciplines

The design economy covers 23 design occupations, clustered into eight design groups. The skills associated with each of these groups are likely to be different in comparison with other groups as well as different from the aggregate view. Indeed, we found that across the eight design groups the skills emphasis changes. Furthermore, in some cases, skills which are not deemed important for the design workforce as a whole (using our methodology) emerge as being crucial to certain design disciplines (e.g. reaction time in craft design).

This finding acknowledges that there are 'outlier' skills which influence our overall assessment of design skills. It also acknowledges that design skills are richer than the 13 that are promoted as being distinctive in our analysis, as their influence is watered down by the relative strength of other skills which are either rated as more comparatively important or more commonly present across the design economy occupations.

Breaking the design workforce down into disciplines[24], the top three skills in terms of importance by design group are shown in Table 7.

### Table 7. Top skills by design group

| Design Group | Top skill (and Importance Premium) | Second top skill (and Importance Premium) | Third top skill (and Importance Premium) |
|---|---|---|---|
| Architecture and Built Environment | Building and construction (71%) | Design (70%) | Geography (65%) |
| Advertising Design | Fine arts (88%), | *Sales and marketing (81%)*<br>*Knowledge of principles and methods for showing, promoting, and selling products or services. This includes marketing strategy and tactics, product demonstration, sales techniques, and sales control system* | *Communications and media (59%)*<br>*Knowledge of media production, communication, and dissemination techniques and methods. This includes alternative ways to inform and entertain via written, oral, and visual media* |
| Clothing Design | *Manual dexterity (39%)* | *Rate control (37%)* | Fine arts (37%) |

[24] Note that in the bullet-point list, skills which are important for design groups but do not occur in our list of 13 key design skills are highlighted in italicised text.

| | | | |
|---|---|---|---|
| | *The ability to quickly move your hand, your hand together with your arm, or your two hands to grasp, manipulate, or assemble objects* | *The ability to time your movements or the movement of a piece of equipment in anticipation of changes in the speed and/or direction of a moving object or scene* | |
| Craft Design | *Rate control (48%)* | *Production and processing (47%)*<br>*Knowledge of raw materials, production processes, quality control, costs, and other techniques for maximising the effective manufacture and distribution of goods* | *Reaction time* (47%)<br>*The ability to quickly respond (with the hand, finger, or foot) to a signal (sound, light, picture) when it appears* |
| Digital Design | Programming (112%) | Computers and electronics (57%) | Operations analysis (55%) |
| Graphic Design | Fine arts (211%) | Design (93%) | *Communications and media (54%)* |
| Multidisciplinary Design | Fine arts (137%) | Drafting, laying out, etc. (116%) | Design (107%) |
| Product and Industrial Design | *Physics (104%)*<br>*Knowledge and prediction of physical principles, laws, their interrelationships, and applications to understanding fluid, material, and atmospheric dynamics, and mechanical, electrical, atomic and sub-atomic structures and processes* | Engineering and technology (99%) | Design (84%) |

Source: Ortus Economic Research analysis of the O*NET database

These findings tell us that some types of skills are relatively more important for certain design groups than others, but they also point to at least two groups of skills which are important for design but lie outside of the 13 skills which differentiate design. For example, *communications and media* is an extremely important skill for designers working in advertising and graphic design, whilst *rate control*[25] (a psychomotor ability within the O*NET taxonomy) is relatively important for design groups which produce a physical product (clothing and craft).

## A taxonomy of design skills

Having identified the skills that differentiate the design workforce from the wider workforce, we focus on the development of a taxonomy of design skills. The objective here is to put forward a classification framework which is a first attempt to create a resource for future use. The application of this tool is beyond the scope of the current study, but the proposal below could provide a platform for further analysis of the relationship between design skills and economic

[25] The O*NET definition of Rate Control is 'the ability to time your movements or the movement of a piece of equipment in anticipation of changes in the speed and/or direction of a moving object or scene'.

outcomes in the future. The approach followed here could equally be used to create taxonomies at the design group and individual occupational level.

Combining the thirteen elements presented across four domains as set out above enables the creation of a design skills taxonomy. This ranks each of the individual elements by their importance premium for the design workforce. The taxonomy works on the tenet that the higher the importance premium, the more integral that element is to people who work in design occupations. This taxonomy is presented in Table 8 below.

Table 8: Design Skills taxonomy

| Category | Importance Premia range | Element | Domain | Importance Premium |
|---|---|---|---|---|
| **Integral to design** | 20% and above | Design | Knowledge | 40% |
| | 20% and above | Operations analysis | Skills | 23% |
| | 20% and above | Programming | Skills | 22% |
| | 20% and above | Drafting, laying out, and specifying technical devices, parts, and equipment | Work Activities | 20% |
| **Very important to design** | 10% to 19% | Engineering and technology | Knowledge | 18% |
| | 10% to 19% | Fine arts | Knowledge | 15% |
| | 10% to 19% | Technology design | Skills | 10% |
| **Important to design** | 5% to 9% | Building and construction | Knowledge | 9% |
| | 5% to 9% | Computers and electronics | Knowledge | 5% |
| **Relevant to design** | 0% to 5% | Geography | Knowledge | 4% |
| | 0% to 5% | Visualisation | Abilities | 3% |
| | 0% to 5% | Thinking creatively | Work Activities | 2% |
| | 0% to 5% | Interacting with computers | Work Activities | 1% |

Source: Ortus Economic Research analysis of the O*NET database

## Widening understanding of how design skills are utilised in the UK economy

The taxonomy also allows us to identify occupations which are not in the core design economy definition of the design workforce but that demonstrate high levels of design skills intensity (i.e. apply design skills more intensively to their work). For the purposes of this report we describe these as design-skilled occupations.

The basic approach involved using the 13 design skills elements identified earlier as a template to identify all design skills-intensive occupations, and to remove those already in our

definition of designers in order to identify other design-skilled occupations. To be classed as a design-skilled occupation, an occupation must have an importance premium of above 0% in the design element (i.e. design must be more important than for the average occupation) *and* an importance premium of above 50% in at least 2 of the other 12 design skills (i.e. two other design skills must be at least 50% more important than for the average)[26].

The process above identified 17 additional design-intensive occupations which show a high level of design skills intensity, as presented in Table 9 below. It also highlights through shading the elements where each occupation meets the criteria described.

Table 9: Additional design-skilled occupations[27]

| SOC 2010 | SOC description | Operations analysis | Technology design | Programming | Computers and electronics | Engineering and technology | Design | Building and construction | Geography | Fine arts | Visualisation | Thinking creatively | Interacting with computers | Drafting, laying out, etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1122 | Production managers and directors in construction | 61% | 10% | -5% | 7% | 73% | 75% | 163% | 11% | -13% | 26% | 3% | 20% | 38% |
| 1136 | Information technology & telecommunications directors | 49% | 47% | 73% | 63% | 50% | 19% | -32% | 22% | 6% | 8% | 8% | 40% | -4% |
| 2123 | Electrical engineers | 55% | 32% | 26% | 47% | 99% | 83% | 10% | -5% | -21% | 13% | 12% | 30% | 83% |
| 2124 | Electronics engineers | 43% | 52% | 60% | 64% | 106% | 89% | -3% | -12% | -10% | 11% | 26% | 36% | 84% |
| 2127 | Production and process engineers | 44% | 50% | 24% | 14% | 90% | 63% | 10% | -16% | -14% | 19% | 26% | 23% | 55% |
| 2133 | IT specialist managers | 49% | 47% | 73% | 63% | 50% | 19% | -32% | 22% | 6% | 8% | 8% | 40% | -4% |
| 2139 | Information technology and telecommunications professionals n.e.c. | 31% | 39% | 86% | 46% | 29% | 35% | -26% | 18% | 6% | 3% | 21% | 37% | 6% |
| 2434 | Chartered surveyors | -7% | 10% | 29% | 32% | 55% | 59% | 32% | 123% | -11% | 14% | 1% | 35% | 54% |
| 2436 | Construction project managers and related professionals | 61% | 10% | -5% | 7% | 73% | 75% | 163% | 11% | -13% | 26% | 3% | 20% | 38% |
| 2461 | Quality control and planning engineers | 47% | 55% | 41% | 31% | 96% | 82% | 35% | -6% | -17% | 18% | 18% | 24% | 77% |
| 3114 | Building and civil engineering technicians | 23% | 2% | 10% | 24% | 51% | 52% | 61% | 91% | -19% | 16% | -4% | 29% | 69% |
| 3116 | Planning, process and production technicians | 43% | 40% | 160% | 40% | 61% | 71% | 3% | -19% | 11% | 22% | 15% | 28% | 92% |

[26] In the case of two elements – thinking creatively and interacting with computers – the threshold was lowered to 30% as there were no occupations with an Importance Premium of at least 50%. For a more detailed explanation of our approach, see Appendix 3: Methodology (page 55).

[27] Note that definitions for each of these occupations are provided in Appendix 3 (, page 62).

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5214 | Metal plate workers, and riveters | 13% | -9% | -32% | -33% | 19% | 69% | 101% | -26% | -24% | 22% | -3% | -37% | 68% |
| 5315 | Carpenters and joiners | 12% | 8% | -23% | -18% | 34% | 76% | 90% | -19% | -1% | 24% | 7% | -31% | 75% |
| 5419 | Textiles, garments and related trades n.e.c. | 16% | 10% | -5% | -22% | 2% | 73% | -32% | -35% | 66% | 31% | 22% | -18% | 40% |
| 5421 | Pre-press technicians | -5% | 3% | 10% | 37% | -10% | 60% | -35% | -33% | 54% | 17% | 20% | 31% | 29% |
| 5443 | Florists | 43% | -12% | -13% | -30% | -34% | 56% | -36% | -25% | 57% | 40% | 16% | -14% | -37% |

Source: Ortus Economic Research analysis of the O*NET database

## The link between design and innovation

The study also has the objective of developing a proposed skills taxonomy for innovation as well as for design. Again, this is to put forward a framework that might be built upon and used in future analysis. For example, this may be to further explore the relationship between design skills, innovation skills, economic outcomes and innovation outcomes. It also informs us of the skills overlap between innovation and design.

Our approach was similar to that used to identify design-skilled occupations. We calculated the importance premium for the innovation[28] element in the O*NET database and identified 157 occupations in which innovation is more important than average. Those occupations with an innovation importance premium of at least 10% and a design importance premium of at least 10% are classed as innovation-intensive occupations[29]. Applying this definition identifies 30 innovation-intensive occupations, as shown in Table 10.

### Table 10: Innovation-intensive occupations

| SOC 2010 | SOC description | Design group | Innovation Importance Premium | Design Importance Premium |
|---|---|---|---|---|
| 3422 | Product, clothing and related designers | Multidisciplinary Design | 33% | 107% |
| 3411 | Artists | Graphic Design | 25% | 84% |
| 2318 | Education advisers and school inspectors | | 22% | 24% |
| 2119 | Biological scientists and biochemists | | 20% | 21% |
| 2137 | Web design and development professionals | Digital Design | 19% | 68% |
| 2473 | Advertising accounts managers and creative directors | Advertising Design | 18% | 24% |
| 2124 | Electronics engineers | | 18% | 89% |

[28] Innovation is defined in the O*NET database as creativity and alternative thinking to develop new ideas for and answers to work-related problems.

[29] See Appendix 3: Methodology (page 68) for more information on our approach.

| | | | | |
|---|---|---|---|---|
| 2314 | Secondary education teaching professionals | | 18% | 15% |
| 1132 | Marketing and sales directors | | 17% | 14% |
| 2431 | Architects | Architecture and Built Environment | 16% | 116% |
| 3421 | Graphic designers | Graphic Design | 16% | 101% |
| 1115 | Chief executives and senior officials | | 16% | 24% |
| 7125 | Merchandisers and window dressers | | 16% | 30% |
| 2127 | Production and process engineers | | 16% | 63% |
| 2461 | Quality control and planning engineers | | 15% | 82% |
| 5419 | Textiles, garments and related trades n.e.c. | | 15% | 73% |
| 2122 | Mechanical engineers | Product and Industrial Design | 15% | 94% |
| 2136 | Programmers and software development professionals | Digital Design | 15% | 49% |
| 2435 | Chartered architectural technologists | Architecture and Built Environment | 14% | 114% |
| 1121 | Production managers and directors in manufacturing | | 13% | 30% |
| 1211 | Managers and proprietors in agriculture and horticulture | | 13% | 22% |
| 1213 | Managers and proprietors in forestry, fishing and related services | | 13% | 22% |
| 2432 | Town planning officers | Architecture and Built Environment | 12% | 42% |
| 2135 | IT business analysts, architects and systems designers | Digital Design | 12% | 39% |
| 2129 | Engineering professionals n.e.c. | Product and Industrial Design | 12% | 76% |
| 2134 | IT project and programme managers | | 12% | 35% |
| 2111 | Chemical scientists | | 11% | 17% |
| 2139 | Information technology and telecommunications professionals n.e.c. | | 11% | 35% |
| 5449 | Other skilled trades n.e.c. | Craft Design | 10% | 51% |

| | | | | |
|---|---|---|---|---|
| 2113 | Physical scientists | | 10% | 13% |

Source: Ortus Economic Research analysis of the O*NET database

Table 10 also presents the innovation importance premium and design importance premium, as well as the design group for any occupation which is within the design economy definition. There is a reasonable degree of overlap with design economy occupations; of the 30 occupations identified as innovation-intensive, 13 are from the 30 which are already within the design economy definition.

The occupations listed in Table 10 represent a largely intuitive definition of innovation-intensive occupations. Product designers have long been feted for their innovations, for instance. However, there are a small number of occupations which appear somewhat anomalous. These include, for example, education advisers and school inspectors, secondary education teaching professionals, marketing and sales directors, physical scientists and chemical scientists – all of which have relatively low design importance premia. However, to maintain a relatively simple definition and to avoid additional arbitrary criteria, it was decided to resist the temptation to moderate the definition from that stated above.

# The value of design skills to the UK economy

This section addresses the following research questions:

- What are the links between 'design skills' and economic outcomes?
- Do firms and industries with a higher prevalence of design skills enjoy better economic outcomes?

Design skills are an integral part of the UK economy, and as the economy changes, demand for these skills is growing. Recent research – including from the World Economic Forum[30] and Nesta[31] – suggests that demand for skills such as operations analysis[32], visualisation and thinking creatively is likely to grow in the near future. Not only are such skills highly associated with design, but as this chapter demonstrates, they are a valuable part of the UK economy, contributing to higher levels of productivity and innovation. Embracing and further developing these skills could help the UK make a success of future economic and technological developments.

## Key findings

Design skills add significant value to the UK economy, contributing an estimated £209.3bn in gross value added (GVA) to the UK economy in 2015. This represents 12% of total UK GVA, broadly equivalent to the annual output of the Wholesale and Retail or Real Estate sectors (11% and 13% respectively).

Design skills create value across the economy. A little under half of design skills GVA (47%, £98.8bn in 2015) was generated by designers and others in design-skilled occupations working in non-design sectors such as finance and retail.

Design skills are embedded across the economy, used by at least 2.5m people in their day-to-day work. This is equivalent to one in 12 workers (8%).

Demand for workers with design skills has grown at twice the rate of UK employment over the same period (14% vs. 7% since 2012).

Workers using design skills are more likely to be in innovation-intensive jobs, with 43% carrying out activities requiring creativity and alternative thinking to develop new ideas for, and answers to, work-related problems, compared with the UK average of 6%.

Firms in design industries are more likely to engage in innovation-related activities such as introducing new or significantly improved products, services or processes, or new and significantly improved forms of organisation, business structures or practices and marketing concepts or strategies.

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[30] World Economic Forum (2016) *The 10 skills you need to thrive in the Fourth Industrial Revolution*, https://www.weforum.org/agenda/2016/01/the-10-skills-you-need-to-thrive-in-the-fourth-industrial-revolution

[31] Nesta (2017) *The future of skills: employment in 2030*, http://www.nesta.org.uk/sites/default/files/the_future_of_skills_employment_in_2030_0.pdf

[32] Defined in the O*NET database as 'analysing needs and product requirements to create a design'.

## The value of design

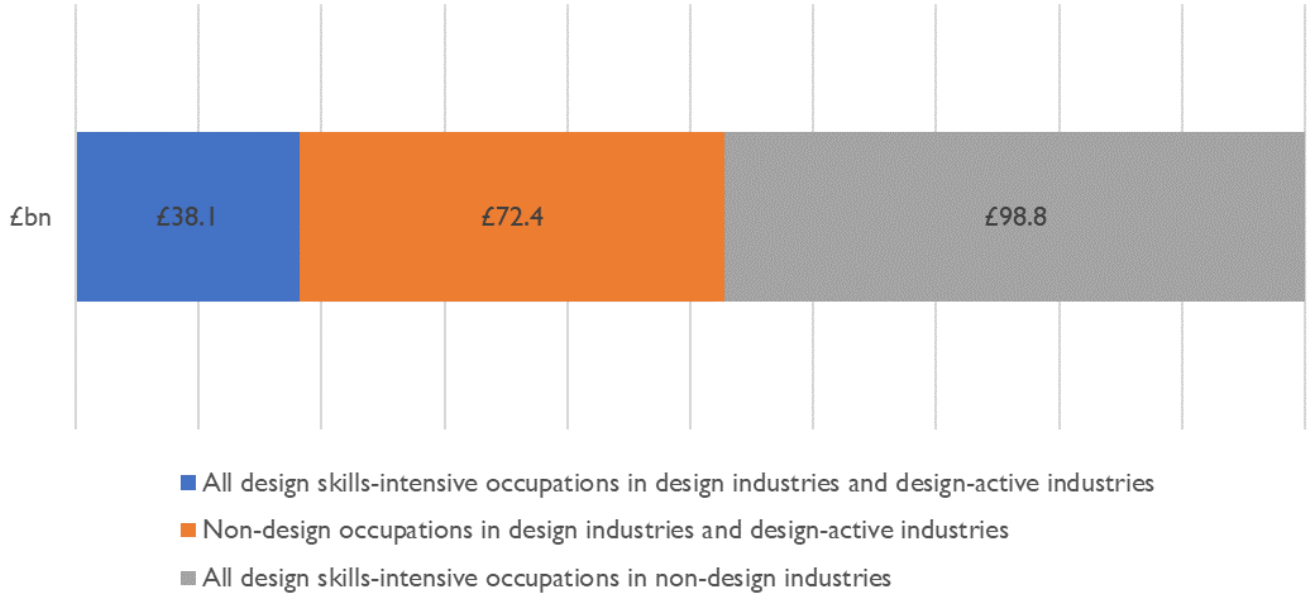
Design skills contributed an estimated £209.3bn in gross value added (GVA)[33] to the UK economy in 2015[34]. This represents 12% of total UK GVA, broadly equivalent to the annual output of the Wholesale and Retail or Real Estate sectors (11% and 13% respectively)[35].

Design's contribution to the economy has grown at a faster rate than the UK average. Over the period 2011–2015 design skills GVA rose by 36%, compared with 25% across the UK as a whole[36]. This means design skills created an additional £55.9bn in output in 2015 compared with 2011. Each design group has contributed to this growth.

Design skills create value across the economy. A little under half of design skills GVA (47%, £98.8bn in 2015) was generated by designers and others in design-skilled occupations working in non-design sectors (such as aerospace, banking and retail).

Design industries and design-active industries generated £110.5bn of GVA, with around a third of this (34%, £38.1bn) attributable to designers and those in other design-skilled roles, and the rest (66%, £72.4bn) attributable to non-design roles.

Figure 4: Design skills GVA, 2015




Source: Derived from ONS (2017) *Annual Business Survey, UK non-financial business economy: 2015 revised results* / ONS (2017) *Annual Survey of Hours and Earnings, 1997–2016* / ONS (2017) *Annual Population Survey, 2004–2016*

[33] The measure of gross value added used in this report is approximate gross value added, available via the Annual Business Survey. Approximate gross value added is the measure recommended by the Office for National Statistics when analysis at detailed industrial levels is required. More information is provided in Appendix 3: Methodology.

[34] Derived from ONS (2017) *Annual Business Survey, UK non-financial business economy: 2015 revised results* / ONS (2017) *Annual Survey of Hours and Earnings, 1997–2016* / ONS (2017) *Annual Population Survey, 2004–2016.*

[35] ONS (2017) *Annual Business Survey, UK non-financial business economy: 2015 revised results.*

[36] ONS (2017) *Annual Business Survey, UK non-financial business economy: 2015 revised results.*

Our GVA estimates[37] suggest that the design economy contributed £70.1bn to the UK in 2015, equivalent to 6% of total UK GVA. This is an increase of 42% since 2011.

Roughly two thirds of design economy GVA (65%, £45.4bn in 2015) was generated by designers working outside design industries. Some £24.7bn GVA was generated by design industries, fairly evenly split between designers (53%) and those working in other roles supporting the design function (47%)[38].

Digital Design, where design skills such as programming, computing and operational analysis are particularly important, makes the most significant contribution to design economy GVA (47% in 2015). The Architecture and Built Environment design group, drawing on skills such as building and construction, design and geography, and the Product and Industrial Design sector, needing skills such as physics, engineering and technology and design, are also key contributors (around 16.5% each).

Table 11: Design skills GVA by industry, 2011–2015 (£m)

| Industry | 2011 | 2012 | 2013 | 2014 | 2015 | Change 2011–2015 |
|---|---|---|---|---|---|---|
| Architecture & Built Environment | £7,811 | £8,713 | £9,395 | £10,083 | £11,500 | 47.2% |
| Multidisciplinary Design | £3,536 | £3,748 | £4,416 | £4,865 | £5,741 | 62.4% |
| Advertising Design | £1,232 | £1,528 | £1,691 | £2,201 | £2,220 | 80.1% |
| Clothing Design | £395 | £484 | £491 | £556 | £558 | 41.2% |
| Craft Design | £2,823 | £2,884 | £2,827 | £3,262 | £3,430 | 21.5% |
| Digital Design | £23,248 | £23,615 | £26,131 | £30,331 | £32,958 | 41.8% |
| Graphic Design | £1,604 | £1,633 | £1,888 | £2,099 | £2,237 | 39.5% |
| Product and Industrial Design | £8,694 | £9,088 | £9,636 | £11,033 | £11,419 | 31.3% |
| *Design economy total* | *£49,344* | *£51,694* | *£56,475* | *£64,430* | *£70,063* | *42.0%* |
| Other design-active industries | £104,032 | £112,429 | £122,784 | £130,595 | £139,201 | 33.8% |
| **All design skills-intensive** | **£153,376** | **£164,122** | **£179,259** | **£195,026** | **£209,264** | **36.4%** |

[37] GVA estimates in this report are calculated following a similar method to that used in *The Design Economy 2015*. However, the earnings data used in the calculations in this report have been taken from the Annual Survey of Hours & Earnings (ASHE); previously, earnings data from the Annual Population Survey was used. ASHE is considered the more robust source, due to its larger sample and the fact that that earnings data is provided by employers, rather than the employees themselves.

[38] Derived from ONS (2017) *Annual Business Survey, UK non-financial business economy: 2015 revised results* / ONS (2017) *Annual Survey of Hours and Earnings, 1997–2016* / ONS (2017) *Annual Population Survey, 2004–2016.*

| | | | | | | |
|---|---|---|---|---|---|---|
| **industries** | | | | | | |
| All Industries | £915,655 | £937,039 | £1,004,978 | £1,089,861 | £1,147,218 | 25.3% |

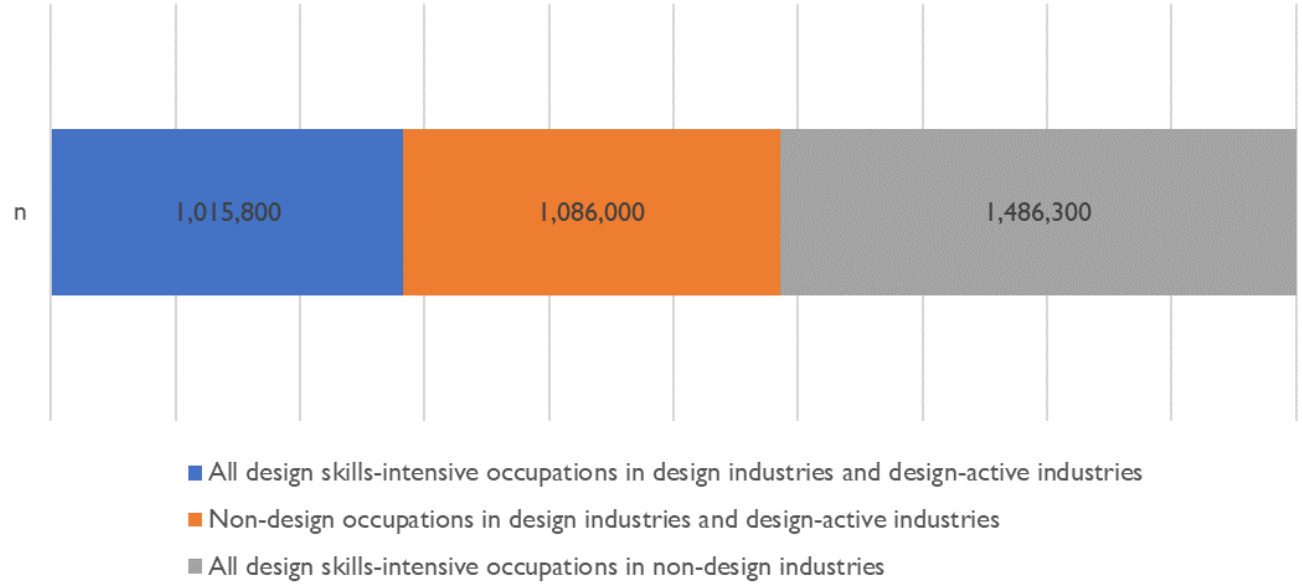
Source: Derived from ONS (2017) *Annual Business Survey, UK non-financial business economy: 2015 revised results* / ONS (2017) *Annual Survey of Hours and Earnings, 1997–2016* / ONS (2017) *Annual Population Survey, 2004–2016*

## Employment

An estimated 2.5m people worked in design skills-intensive occupations in 2016. This is equivalent to 8% of the total UK workforce, a similar proportion to employment in Construction (7%), Transport and Communications and Manufacturing (both 9%).

The number of people working in design skills-intensive occupations has risen faster than the UK average. All design skills-intensive employment increased by 14% in the period 2012–2016, compared with total employment growth of 7% in the UK[39].

Figure 5: Employment in design skills-intensive occupations and industries, 2016




Source: ONS (2017) *Annual Population Survey, 2004–2016*

The design economy employed more than 1.7m people in 2016 (equivalent to 5% of the total UK workforce), including 1.4m people working as designers. One in 2 designers (51%, more than 716,000 people in 2016) worked outside both the traditional design industries and additional design-intensive industries. Design industries employed a further 55,000 people in other design-skilled roles, and almost 250,000 people in non-design roles.

More than 1m people were employed in design-skilled occupations outside the design economy in 2016, including almost 280,000 people working in design-active industries. Most people in design-skilled occupations (73%, more than 770,000 people) worked in non-design sectors. Design-active industries employed a further 837,000 people in non-design roles.

[39] ONS (2017) *Annual Population Survey, 2004–2016*.

Table 12: Design skills employment by occupation, 2012–2016

| Occupation | 2012 | 2013 | 2014 | 2015 | 2016 | Change 2012–2016 |
|---|---|---|---|---|---|---|
| Architecture & Built Environment | 298,900 | 333,700 | 341,700 | 316,000 | 341,300 | 14.2% |
| Multidisciplinary Design | 54,800 | 65,700 | 76,300 | 75,400 | 86,200 | 57.3% |
| Advertising Design | 22,600 | 29,600 | 30,000 | 33,000 | 35,800 | 58.4% |
| Clothing Design | 12,100 | 12,600 | 12,200 | 13,400 | 13,900 | 14.9% |
| Craft Design | 105,400 | 100,300 | 100,700 | 103,000 | 106,100 | 0.7% |
| Digital Design | 416,900 | 411,300 | 444,900 | 464,600 | 487,300 | 16.9% |
| Graphic Design | 118,800 | 114,900 | 124,000 | 126,900 | 136,400 | 14.8% |
| Product and Industrial Design | 178,500 | 183,600 | 184,100 | 192,000 | 191,900 | 7.5% |
| *Design economy total* | *1,208,000* | *1,251,700* | *1,313,900* | *1,324,300* | *1,398,900* | *15.8%* |
| Other design-active occupations | 984,700 | 1,025,100 | 1,083,300 | 1,109,800 | 1,103,100 | 12.0% |
| **All design skills-intensive occupations** | **2,192,700** | **2,276,800** | **2,397,200** | **2,434,100** | **2,502,000** | **14.1%** |
| All occupations | 29,462,700 | 29,882,700 | 30,453,900 | 31,071,000 | 31,483,900 | 6.9% |

Source: ONS (2017) *Annual Population Survey, 2004–2016*

Digital Design and Architecture and Built Environment occupations account for the largest shares of design economy employment (35% and 24% respectively in 2016). Clothing Design occupations account for the smallest share (1%). Most occupations show a higher rate of growth than the UK average over the period 2012–2016. Employment in Advertising Design and Multidisciplinary Design occupations has risen most significantly (58% and 57% respectively[40]), suggesting there has been strong demand for skills such as fine arts, drafting and laying out, sales and marketing and communication and media over the last few years.

Employment in Craft Design occupations, where skills such as processes and production and control precision are important, has remained relatively unchanged over the period 2012–2016

[40] A fall in employment in Advertising Design between 2010 and 2012 (and subsequent growth) means that employment growth is much more significant than that reported over the period 2010–2014 in *The Design Economy 2015*.

(less than 1% change), though some growth is apparent between 2015 and 2016. Employment in Product and Industrial Design occupations, which draw on skills such as physics, engineering and technology and design, has also grown more slowly than in other design economy sectors (8% over the period 2012–2016).

### Spatial distribution of design employment

Design skills are unevenly distributed across the country. Table 13 provides location quotients[41] expressing the degree of specialisation of regional employment towards all design skills-intensive industries. The data shows that design employment is concentrated in London and the South East, which have the highest location quotients. London has a 73% higher than average share of design skills-intensive employment and the South East has a 36% higher share relative to all employment in those regions.

Table 13: Regional location quotients for employment in all design skills-intensive industries, 2015

| Region | LQ for Employment in Design Skills |
|---|---|
| London | 1.73 |
| South East | 1.36 |
| England (total) | 1.07 |
| West Midlands | 0.92 |
| East of England | 0.86 |
| North East | 0.83 |
| East Midlands | 0.82 |
| South West | 0.80 |
| North West | 0.70 |
| Yorkshire and The Humber | 0.64 |
| Scotland | 0.61 |
| Wales | 0.39 |
| **Great Britain** | **1.00** |

[41] A location quotient (LQ) is a way of showing how concentrated a particularly industry or occupation is within a geographic area, compared to the rest of the country. A high LQ indicates a specific area of strength. For instance, an LQ of 1.0 indicates that the concentration of firms within an area matches the national average. An LQ of 1.5 means that there is 50% more of a particular activity in the area than one might expect to find based on the national average. Conversely, an LQ of 0.5 means that there is 50% less of an activity in the area than one might expect.

Source: ONS (2016) *Business Register & Employment Survey 2015*

## Productivity

Based on GVA per hour worked, people working in design skills-intensive industries are 47% more productive than the UK average. Each delivered an average £29.31 GVA per hour worked in 2015, compared with the average of £19.97. Yet GVA per hour worked has also risen more slowly in design skills-intensive industries than in the UK as a whole – an increase of 14% between 2011 and 2015, compared with the average of 18%[42]. This suggests that while design enjoys above average productivity, it is not immune from the stagnation seen elsewhere in the economy.

People working in design industries delivered an average £22.82 GVA per hour worked in 2015, 14% more than the UK average. GVA per hour worked in design industries rose by 16% between 2011 and 2015. People working in other design-active industries, meanwhile, delivered an average £31.92 GVA per hour worked in 2015, 60% more than the UK average (and 40% more than people working in design industries). GVA per hour worked in design-active industries rose by 14% between 2011 and 2015.

### Table 14: GVA per hour worked, 2011–2015

| Sector | 2011 | 2012 | 2013 | 2014 | 2015 | Change 2011–2015 |
|---|---|---|---|---|---|---|
| Architecture & Built Environment | £18.33 | £20.60 | £21.23 | £22.63 | £28.62 | 56.2% |
| Multidisciplinary Design | £13.10 | £11.59 | £12.28 | £12.24 | £15.00 | 14.6% |
| Clothing Design | £12.84 | £10.47 | £10.13 | £16.38 | £9.30 | -27.6% |
| Craft Design | £14.63 | £13.74 | £11.10 | £15.42 | £18.55 | 26.8% |
| Digital Design | £24.39 | £22.03 | £22.93 | £23.80 | £25.66 | 5.2% |
| Product and Industrial Design | £13.17 | £11.27 | £12.78 | £14.31 | £12.73 | -3.3% |
| All design industries | £19.75 | £18.58 | £19.20 | £20.26 | £22.82 | 15.6% |
| Other design-active industries | £27.94 | £29.10 | £30.61 | £30.79 | £31.92 | 14.2% |
| All design skills-intensive industries | £25.72 | £26.15 | £27.40 | £27.68 | £29.31 | 14.0% |
| Non-design industries | £16.41 | £16.62 | £17.57 | £18.81 | £19.33 | 17.8% |
| All industries | £16.97 | £17.20 | £18.18 | £19.35 | £19.97 | 17.7% |

[42] Derived from ONS (2017) *Annual Business Survey, UK non-financial business economy: 2015 revised results* / ONS (2017) *Annual Survey of Hours and Earnings, 1997–2016* / ONS (2017) *Annual Population Survey, 2004–2016*. The above average performance of design is also supported when calculating productivity based on GVA per head. This approach finds that people working in design skills-intensive industries are 49% more productive than the UK average in 2015, each delivering an estimated £55,000 in output compared with the average of £36,900.

Source: Derived from ONS (2017) *Annual Business Survey, UK non-financial business economy: 2015 revised results* / ONS (2017) *Annual Survey of Hours and Earnings, 1997–2016* / ONS (2017) *Annual Population Survey, 2004–2016* . Estimates for the Advertising Design and Graphic Design sectors are not available.

Architecture and Built Environment is the most productive design group when measured using GVA per hour worked, reflecting the inherently high value of the industry's outputs. Each worker delivered an estimated £28.62 per hour in 2015 (43% more than the UK average). GVA per hour worked rose by 56% in the period 2011–2015, the largest increase of any design sector. GVA per hour worked is also relatively high in Digital Design industries, where each worker delivered an estimated £25.66 in 2015 (29% higher than the UK average). Productivity in Digital Design rose 5% between 2011 and 2015.

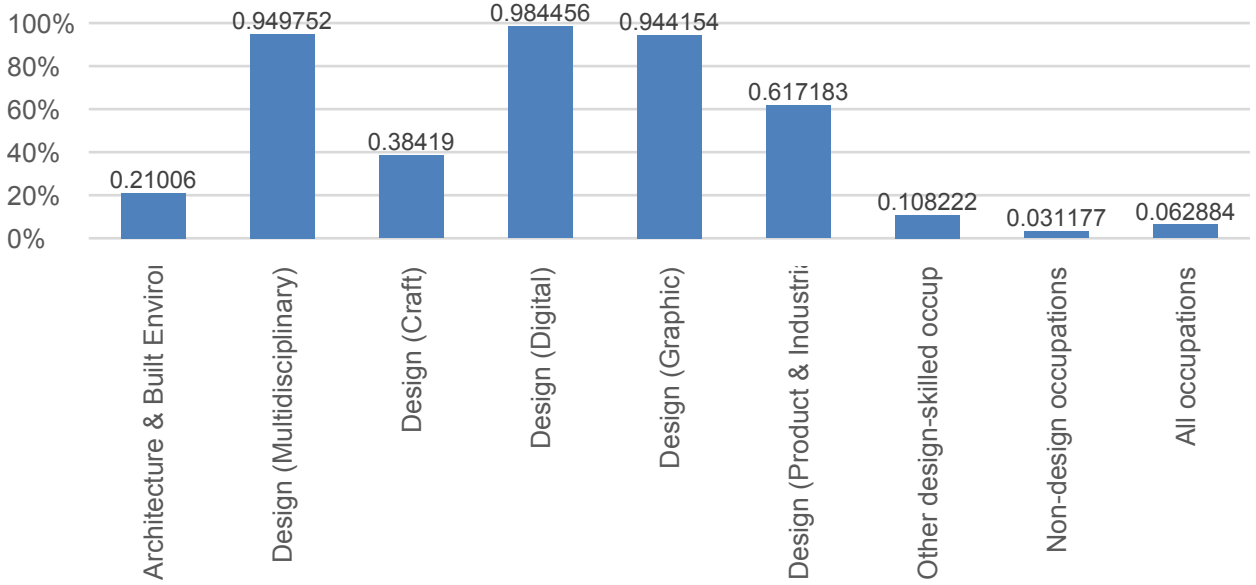
Among design groups, productivity is lowest in Clothing Design industries, where each worker delivered an estimated £9.30 GVA per hour in 2015 (47% of the UK average). 70% of employees in Clothing Design industries are in non-design roles (e.g. marketing, administration), the highest proportion of any design group. GVA per hour worked in Clothing Design industries fell by 28% in the period 2011–2015. GVA per hour worked was also relatively low in the Product and Industrial Design group (where 63% of employees are in non-design roles, the second highest proportion), with each worker delivering an estimated £12.73 GVA per hour (64% of the UK average). GVA per hour worked in Product and Industrial Design industries fell by 3% in the period 2011–2015.

## Design and innovation

Overall, 43% of people working in design skills-intensive occupations also work in jobs which our analysis shows are innovation-intensive, compared with the UK average of 6%[43]. Alongside design skills, these are jobs which require creativity and alternative thinking to develop new ideas for, and answers to, work-related problems (see Table 10). The proportion of designers who have innovation-intensive jobs (66%) is significantly higher than the proportion in other design-active occupations (11%).

Figure 6: Proportion of employment in innovation-intensive jobs by design occupation, 2016

[43] ONS (2017) *Annual Population Survey, 2004–2016*.




Source: ONS (2017) *Annual Population Survey, 2004–2016* . * Data is not available for Design Advertising and Design Clothing occupations due to small sample sizes.

More than 90% of people working in Multidisciplinary Design, Digital Design and Graphic Design occupations have jobs that are also innovation-intensive. Smaller proportions of people working in Product and Industrial Design (62%), Craft Design (38%) and Architecture and Built Environment occupations (21%) have jobs that are innovation-intensive.

According to the UK Innovation Survey, firms in design industries are historically more likely than average to be 'innovation active', and significantly more so in 2015 (74% compared with the UK average of 53%)[44]. Firms which are 'innovation active' are those which have introduced a new or significantly improved product (good or service) or process, engaged in innovation projects not yet complete or abandoned, and/or introduced new and significantly improved forms of organisation, business structures or practices and marketing concepts or strategies.

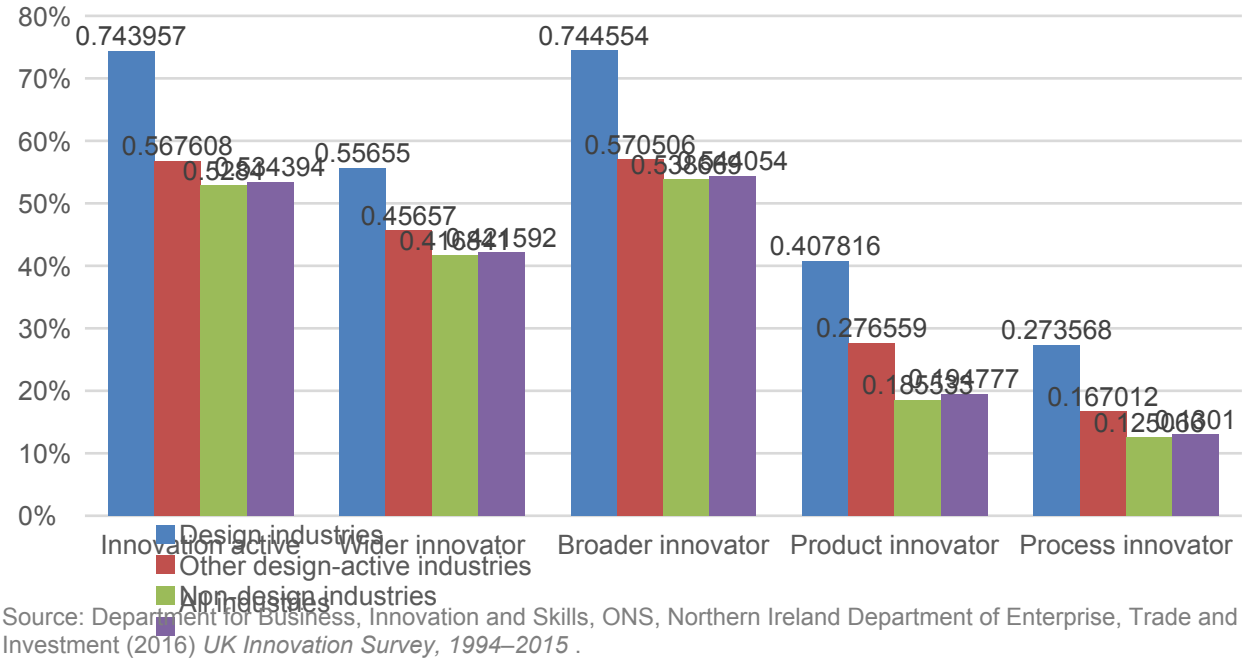
Similarly, firms in design industries are more likely than average to be 'broader innovators' (75% in 2015, compared with the UK average of 54%). Firms which are 'broader innovators' are those which are 'innovation active' and/or which have invested in areas such as internal research and development, training, acquisition of external knowledge or machinery and equipment linked to innovation activities. Firms in design industries are also more likely than average to be 'wider innovators' (56% in 2015, compared with the UK average of 42%). Firms which are 'wider innovators' are those which have introduced new and significantly improved forms of organisation, business structures or practices and marketing concepts or strategies.

Firms in design industries are more likely than average to be product innovators (41% in 2015, compared with the UK average of 20%), introducing new or significantly improved goods or services. They are also more likely to be process innovators (27% in 2015, compared with the UK average of 13%), introducing new or significantly improved processes.

Firms in design-active industries are also more likely than average to engage in innovation-related activities (on all UK Innovation Survey measures), though they are much less likely to innovate than firms in design industries.

[44] Department for Business, Innovation and Skills, ONS, Northern Ireland Department of Enterprise, Trade and Investment (2016) *UK Innovation Survey, 1994–2015*.

## Figure 7: Innovation active firms by design industry, 2015




Source: Department for Business, Innovation and Skills, ONS, Northern Ireland Department of Enterprise, Trade and Investment (2016) *UK Innovation Survey, 1994–2015* .

Reflecting levels of innovation, firms in design industries are more likely to invest in 'all forms of design' (29% in 2015, compared with the UK average of 10%). Investment in 'all forms of design' includes engagement in all design activities, including strategic activities, for the development or implementation of new or improved goods, services and processes. Firms in design industries invest a similar proportion of their innovation expenditure in 'all forms of design' to the UK average (7% in 2015). Firms in other design-active industries are also more likely to invest in 'all forms of design' (16% in 2015), but invest a much smaller proportion of their innovation expenditure (1%)[45].

### Regional variation in 'innovation active' firms

The proportion of firms in design skills-intensive industries that are 'innovation active' is highest in the West Midlands (71%) and the East Midlands (69%) while it is lowest in the South East (53%). We have not investigated this variation, but it is likely that it reflects differences in the relative concentrations of design groups (and even individual design sectors) in each region[46].

## Table 15: Proportion of firms that are 'innovation active' by region, 2015

| Region | Design skills-intensive industries | All industries |
|---|---|---|
| West Midlands | 70.9% | 55.7% |
| East Midlands | 68.5% | 56.9% |
| North West | 65.9% | 52.2% |

[45] Department for Business, Innovation and Skills, ONS, Northern Ireland Department of Enterprise, Trade and Investment (2016) *UK Innovation Survey, 1994–2015*. No breakdown of investment in 'all forms of design' is available.

[46] The *Design Economy* examined clusters of design industries at local level.

| | | |
|---|---|---|
| Northern Ireland | 64.7% | 45.1% |
| Yorkshire and The Humber | 62.4% | 65.2% |
| North East | 61.5% | 52.6% |
| Scotland | 61.0% | 50.8% |
| South West | 60.8% | 42.9% |
| Wales | 60.1% | 50.8% |
| London | 57.8% | 49.5% |
| South East | 53.4% | 58.1% |
| East of England | 50.3% | 56.3% |

Source: Department for Business, Innovation and Skills, ONS, Northern Ireland Department of Enterprise, Trade and Investment (2016) *UK Innovation Survey, 1994–2015*.

# The design skills gap

This section addresses the following research questions:

- Where do design-intensive firms recruit from for design-related roles?
- What formal qualifications do design workers have?
- How satisfied are design-intensive firms with the standard of their recruits?
- Where are there skills shortages within the Design Economy (by SOC and SIC)?
- What is the likely impact of skills gaps for The Design Economy (and the wider UK economy)?

Skills have long been identified as one of the key reasons for the UK's 'productivity gap' with other major economies. As a high value part of the economy, understanding the difficulties employers can have finding the design skills they need is key to building on their value and further embedding them across the economy. Our research suggests that design firms are more likely to need candidates who are educated to degree level or above, but complain that candidates can lack the required skills and competencies. One in eight design firms, meanwhile, reports that they have staff who lack the skills to perform their jobs effectively. The lost value to the UK of not addressing gaps and vacancies related to design skills is significant. The financial loss to the UK economy may be billions of pounds, while the country also loses out from the innovative and creative thinking required to navigate through a time of tremendous change.

## Key findings

The design economy demands high skills levels. Firms in design industries are significantly more likely to recruit university leavers than average, and less likely to recruit school leavers or young people from Further Education (FE). Workers are much more likely to need a degree, post-graduate qualification or professional qualification to enter design than the average job.

Employers in design industries are more likely to find it hard to fill vacancies than average, and more likely to report that this is because of a shortage of people with the right skills, experience or qualifications.

Employers in design skills-intensive industries are more likely than average to report that the staff they recruit from schools, colleges and universities are poorly prepared for work and that they lack the required skills.

One in eight employers in design-skills intensive industries, meanwhile, reports that they have staff who are not fully proficient in their current jobs. An estimated 59,000 people working in design skills-intensive industries have skills gaps.

Design industries are more likely than average to report the development of new products and services, the introduction of new working practices and the introduction of new technology as causes of skills gaps.

Skills gaps among the existing workforce in design skills-intensive industries cost the UK up to an estimated £4.3bn in GVA in 2015. Skills shortage vacancies in design skills-intensive industries cost the UK up to an estimated £1.6bn in GVA.

## Recruitment demand and skills shortages

Firms in design skills-intensive industries were slightly less likely than average to have vacancies in 2015, but those vacancies represented a slightly higher proportion of their current employment. 17% of firms in design industries and 18% of firms in other design-active sectors had vacancies in 2015, compared with the UK average of 19%. Vacancies represented 4% of current employment in both design industries and other design-active sectors in 2015, compared with the UK average of 3%. Recruitment demand was highest in the Digital Design and Architecture and Built Environment industries[47].

### Table 16: Incidence and density of vacancies, hard to fill vacancies and skills shortage vacancies, 2015

| Industry | Percentage of employers with vacancies | Vacancies as percentage of employment | Hard to fill vacancies as percentage of all vacancies | Skills shortage vacancies as percentage of hard to fill vacancies | Skills shortage vacancies as percentage of all vacancies |
|---|---|---|---|---|---|
| Architecture and Built Environment | 22.0% | 4.9% | 47.9% | 89.7% | 43.0% |
| Multidisciplinary Design | 12.0% | 3.5% | 30.2% | 85.4% | 25.8% |
| Craft / Clothing Design | 12.0% | 1.8% | 13.0% | 100.0% | 13.0% |
| Digital Design | 27.4% | 6.6% | 53.5% | 99.0% | 53.0% |
| Product & Industrial Design | 16.1% | 1.1% | 46.3% | 66.8% | 30.9% |
| All design industries | 17.3% | 4.3% | 44.8% | 91.2% | 40.8% |
| Other design-active industries | 17.8% | 4.0% | 49.9% | 78.8% | 39.3% |
| All design skills-intensive industries | 17.6% | 4.0% | 48.8% | 81.0% | 39.6% |
| Non-design industries | 19.5% | 3.3% | 31.4% | 67.5% | 21.2% |
| All industries | 19.3% | 3.3% | 32.7% | 69.1% | 22.6% |

Source: UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2015* . Due to sample sizes, data is aggregated for the Clothing Design and Craft Design sectors.

Vacancies in design skills-intensive industries are more likely to be ‘hard to fill’ than average. 45% of vacancies in design industries and 50% of vacancies in other design-active industries in 2015 were hard to fill, compared with the UK average of 33%. Hard to fill vacancies have a range of impacts on firms in design-intensive industries, including the loss of business of competitors, difficulties meeting customer service objectives and increased production costs

[47] UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2015*. Due to sample sizes, data is aggregated for the Clothing Design and Craft Design sectors.

through the need to outsource work. Most significantly (reported by 90% of design industry firms with hard to fill vacancies), they increase the workload of other staff, placing greater demands on their skills.

Hard to fill vacancies in design skills-intensive industries are more likely to be driven by a lack of the required skills, experience or qualifications among applicants (i.e. 'skills shortages' in the external labour market). 41% of vacancies in design industries (around 5,500 vacancies) and 40% in other design-active industries in 2015 (over 18,000 vacancies) were hard to fill because of skills shortages, compared with the UK average of 23%. Skills shortages were particularly evident in the Digital Design group, where 53% of vacancies in 2015 were caused by a lack of the required skills, experience of qualifications among applicants.

## Weaknesses in the design skills pipeline

Firms in design skills-intensive industries recruit from all levels of formal education, but they are significantly more likely to recruit university leavers than average, and less likely to recruit school leavers or young people from Further Education (FE). The pipeline of design skills supplied by formal education, however, appears to be threatened by a decline in the numbers of young people studying Design and Technology at GCSE level, as well as in the number of teachers and teaching hours dedicated to the subject. In 2017, just under 166,000 GCSE students took Design and Technology subjects[48], a 61% decrease from the year 2000. Between 2011/12 and 2015/16, the number of people leaving Higher Education with undergraduate or postgraduate qualifications in Creative Arts and Design subjects fell by 7%[49].

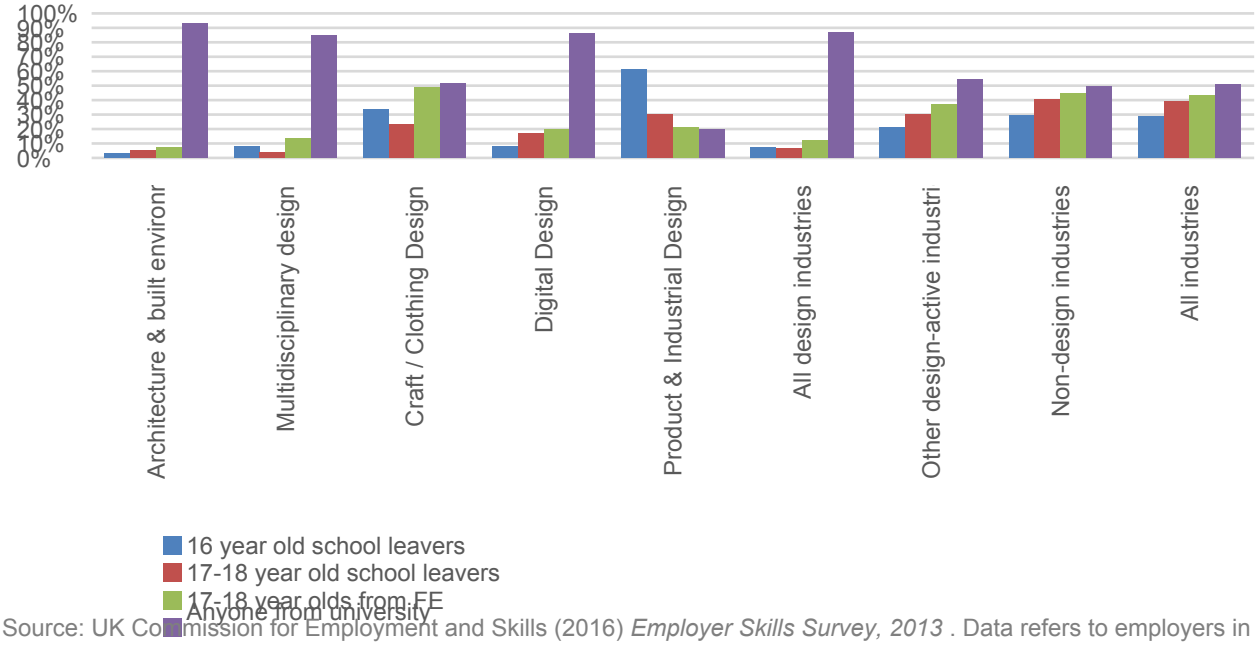
Recruitment from education varies by design group. Demand in the Architecture and Built Environment, Multidisciplinary Design and Digital Design industries is focused on university leavers. The Clothing Design and Craft Design industries are slightly more likely than average to recruit university leavers, but also slightly more likely than average to recruit 17–18 year olds from FE and 16 year olds from school. The Product and Industrial Design industry, meanwhile, is less likely than average to recruit from university and significantly more likely than average to recruit 16 year olds from school[50].

Figure 8: Recruitment from education by design industry, 2013

[48] Joint Council for Qualifications, (2017), *GCSE (Full Course), Outcomes for all grade sets and age breakdowns for UK candidates, Results Summer 2017*, https://www.jcq.org.uk/examination-results/gcses/2017/gcse-full-course-results-summer-2017/gcse-full-course-results-summer-2017

[49] Higher Education Statistics Agency (2017) HE qualifications obtained by sex, subject area and level of qualification obtained 2011/12 to 2015/16, https://www.hesa.ac.uk/data-and-analysis/students/overviews

[50] UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2013*. Data refers to employers in England, Wales and Northern Ireland only. Due to sample sizes, data is aggregated for the Clothing Design and Craft Design sectors.




Source: UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2013* . Data refers to employers in England, Wales and Northern Ireland only. Due to sample sizes, data is aggregated for the Clothing Design and Craft Design sectors.

Those employers in design skills-intensive industries who recruit school leavers are more likely than average to report that they are poorly or very poorly prepared for work, primarily because of a lack of experience or maturity. Employers in design industries are also more likely than average to report that older school leavers (17–18 year olds[51]) lack common sense, have a poor attitude or lack motivation. Employers in other design-active industries are more likely than average to report that older school leavers lack the required skills or competencies[52].

Similarly, employers in design skills-intensive industries are more likely than average to report that the young people they recruit from FE are poorly or very poorly prepared for work, with the main reasons being a lack of experience or maturity and a lack of the required skills or competencies. Employers in design industries are also more likely than average to report that young people recruited from FE lack the required literacy and numeracy skills.

Employers in design skills-intensive industries are slightly more likely than average to report that university leavers are poorly or very poorly prepared for work. They are more likely than average to report that university leavers lack the required skills and competencies, as well as being more likely than average to suggest that university leavers have had a poor education.

## Design skills shortages

Employers in design skills-intensive industries – like employers in other industries – are most likely to report that technical, practical or job-specific skills are difficult to obtain from applicants for skills shortage vacancies. Employers in design industries are also more likely than average to report that advanced IT or software skills, planning and organisation skills, problem solving skills, numeracy skills, customer handling skills and strategic management skills are difficult to obtain. Alongside technical, practical or job-specific skills, employers in other design-active

[51] Although the data is not explicit in this regard, these are most likely young people entering the workforce directly from sixth form provision (having undertaken A-level or equivalent qualifications) without pursuing further or higher education.

[52] UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2013*.

sectors are more likely than average to report that advanced IT or software skills, problem solving skills and team working skills are difficult to obtain.

Table 17: Skills found difficult to obtain in applicants, 2015

| Skill | % of employers with skills shortage vacancies | | | | |
|---|---|---|---|---|---|
| | Design industries | Design-active industries | All design skills-intensive industries | Non-design industries | All industries |
| Technical, practical or job specific skills | 65.7% | 83.4% | 80.1% | 64.8% | 66.8% |
| Problem solving skills | 42.9% | 44.2% | 44.0% | 35.3% | 36.4% |
| Planning and organisation skills | 53.2% | 40.0% | 42.5% | 40.0% | 40.3% |
| Customer handling skills | 43.8% | 37.3% | 38.5% | 37.8% | 37.9% |
| Oral communication skills | 39.4% | 35.1% | 35.9% | 37.3% | 37.1% |
| Advanced IT or software skills | 35.3% | 34.6% | 34.8% | 18.4% | 20.6% |
| Team working skills | 22.2% | 37.7% | 34.8% | 32.3% | 32.6% |
| Written communication skills | 34.0% | 29.7% | 30.5% | 33.5% | 33.1% |
| Literacy skills | 30.4% | 28.2% | 28.6% | 27.9% | 28.0% |
| Strategic management skills | 32.6% | 25.8% | 27.0% | 27.5% | 27.5% |
| Numeracy skills | 30.1% | 23.9% | 25.0% | 23.6% | 23.8% |
| Basic computer literacy / using IT | * | * | 24.1% | 18.5% | 19.3% |
| Foreign language skills | 11.7% | 13.0% | 12.8% | 15.0% | 14.7% |
| Personal attributes | 0.0% | 3.1% | 2.5% | 5.5% | 5.1% |
| Experience/lack of product knowledge | * | * | 1.7% | 1.8% | 1.8% |

Source: UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2015*.

Employers in design industries report that the technical, practical and job-specific skills found difficult to obtain from applicants in 2015 include specialist skills or knowledge needed to perform the role (48% of employers with skills shortage vacancies, compared with the UK average of 66%), advanced or specialist IT skills (32%, compared with the average of 22%), knowledge of products and services offered by the organisation (30%, compared with the average of 43%), skills in solving complex problems requiring a solution specific to the situation (28%, compared with the average of 41%) and reading and understanding instructions, guidelines, manuals or reports (20%, compared with the average of 30%). Smaller

proportions report recruitment difficulties relating to knowledge of how the organisation works (18%, compared with the average of 36%), complex numerical or statistical skills and understanding (15%, compared with the average of 29%), computer literacy or basic IT skills (14%, compared with the average of 22%) and writing instructions, guidelines, manuals or reports (12%, compared with the average of 27%)[53].

Employers in design-active industries report that a similar range of technical, practical and job-specific skills were difficult to obtain from applicants in 2015. Adapting to new equipment or materials (25% of employers with skills shortage vacancies, compared with the UK average of 22%) and manual dexterity (24%, compared with the average of 19%) were also issues.

## Design skills in the current workforce

As well as recruiting new entrants to the labour market from education, firms recruit from the existing workforce – whether promoting someone from among their own staff, for example, or recruiting someone from another organisation – and skills shortages in design skills-intensive industries therefore reflect to some extent the skills of the current workforce as well as weaknesses in the design skills pipeline. Around one in eight firms in design skills-intensive industries (12.3%) report that they have staff who are not fully proficient in their current jobs, and who therefore cannot fully effectively perform their job role.

Firms in design skills-intensive industries are generally less likely than average to report that they have staff who lack full proficiency, though the incidence of skills gaps is higher than average in the Digital Design and Product and Industrial Design groups. Where they exist, however, skills gaps can have a significant impact. Firms in design industries are more likely than average to report that a lack of proficiency among their staff affects business performance, including increased operating costs, difficulties in introducing new working practices and delays in developing new products and services. The most significant impact is to increase the workload of other staff, placing greater demands on their skills[54].

An estimated 59,000 people working in design skills-intensive industries (3.9%) are not fully proficient in their current jobs. As illustrated in Table 12, the proportion of staff in design skills-intensive industries who lack proficiency is smaller than average, again with the exception of Product and Industrial Design (where it is close to average) and Digital Design (where it is slightly higher than average)[55].

### Table 18: Incidence and density of skills gaps, 2015

| Sector | Firms with skills gaps | Employees with skills gaps |
|---|---|---|
| Architecture and Built Environment | 11.0% | 2.4% |
| Multidisciplinary Design | 7.9% | 2.2% |
| Craft / Clothing Design | 12.2% | 3.1% |
| Digital Design | 15.7% | 5.5% |
| Product and Industrial Design | 17.2% | 4.8% |

[53] UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2015*.

[54] UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2015*.

[55] UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2015*.

| | | |
|---|---|---|
| All design industries | 10.2% | 3.1% |
| Other design-skilled industries | 13.0% | 4.1% |
| All design skills-intensive industries | 12.3% | 3.9% |
| Non-design industries | 14.1% | 5.0% |
| All industries | 13.9% | 5.0% |

Source: UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2015* . Due to sample sizes, data is aggregated for the Clothing Design and Craft Design sectors.

The most common reasons reported for skills gaps among design skills-intensive industries are that staff are new to the role and that training is not yet fully completed. One implication is that firms are reducing their entry requirements and recruiting staff who are not fully proficient in order to develop their skills once they are in post, possibly as a response to recruitment difficulties caused by skills shortages. Indeed, firms in design skills-intensive industries are more likely than average to report that they have skills gaps because they have been unable to recruit staff with the right skills (27% in 2015, compared with the UK average of 24%). Employers in design industries are also more likely than average to report that the development of new products and services (26% of employers with skills gaps in 2015, compared with the average of 17%), the introduction of new working practices (30%, compared with the average of 25%) and the introduction of new technology (21%, compared with the average of 19%) contribute to skills gaps.

## Design skills gaps

Employers in all industries are most likely to report that staff lack technical, practical or job-specific skills, but employers in design skills-intensive industries are more likely to do so than average. In 2015, 80% of employers in design industries and 66% of employers in other design-active industries who had skills gaps, reported that their existing staff lacked technical, practical or job-specific skills, compared with the UK average of 60%. Employers in design industries are also more likely than average to report that staff lack proficiency in advanced IT or software skills, strategic management skills, planning and organisation skills, written communication skills and problem-solving skills. Employers in other design-active industries are more likely than average to report that staff lack proficiency in advanced IT or software skills.

### Table 19: Skills gaps, 2015

| Skill | % of employers with skills gaps | | | | |
|---|---|---|---|---|---|
| | Design industries | Design-active industries | All design skills-intensive industries | Non-design industries | All industries |
| Technical, practical or job specific skills | 80.3% | 66.2% | 69.1% | 60.1% | 60.8% |
| Planning and organisation skills | 62.1% | 48.5% | 51.3% | 52.5% | 52.4% |

| | | | | | |
|---|---|---|---|---|---|
| Problem solving skills | 52.5% | 43.3% | 45.2% | 43.9% | 44.0% |
| Advanced IT or software skills | 56.9% | 31.8% | 36.9% | 23.2% | 24.2% |
| Customer handling skills | 41.6% | 31.0% | 33.2% | 44.2% | 43.4% |
| Team working skills | 28.7% | 31.2% | 30.7% | 40.0% | 39.3% |
| Oral communication skills | 38.9% | 24.9% | 27.8% | 35.8% | 35.2% |
| Strategic management skills | 41.3% | 22.1% | 26.0% | 25.3% | 25.3% |
| Written communication skills | 36.7% | 22.8% | 25.7% | 28.0% | 27.8% |
| Basic computer literacy / using IT | 18.7% | 17.5% | 17.7% | 22.8% | 22.4% |
| Literacy skills | 17.0% | 12.7% | 13.6% | 19.1% | 18.7% |
| Numeracy skills | 22.0% | 10.5% | 12.8% | 17.4% | 17.0% |
| Foreign language skills | 5.7% | 4.9% | 5.1% | 9.4% | 9.1% |
| Personal attributes | * | * | 1.5% | 2.9% | 2.8% |
| Experience/lack of product knowledge | * | * | 0.5% | 1.2% | 1.1% |

Source: UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2015* . Note that skills are self-defined by respondents, and are likely to be interpreted in diverse ways according to the different contexts of their organisation.

Employers in design industries report that the technical, practical and job-specific skills lacking among their existing staff include specialist skills or knowledge needed to perform the role (57% of employers with skills gaps in 2015, compared with the UK average of 53%), skills in solving complex problems requiring a solution specific to the situation (49%, compared with the average of 43%), advanced or specialist IT skills (48%, compared with the average of 24%), knowledge of the organisation's products and services (42%, compared with the average of 47%), computer literacy or basic IT skills (39%, compared with the average of 28%), and knowledge of how your organisation works (39%, compared with the average of 37%). Smaller proportions report that staff lack complex numerical or statistical skills and understanding (28%, compared with the average of 24%), reading and understanding instructions, guidelines, manuals or reports (26%, compared with the average of 30%), adapting to new equipment or materials (19%, compared with the average of 30%), basic numerical skills and understanding (18%, compared with the average of 20%) and writing instructions, guidelines, manuals or reports (15%, compared with the average of 24%).

Employers in other design-active industries report that similar technical, practical and job-specific skills are lacking among their staff. However, they are less likely than employers in design industries to report that staff lack advanced or specialist IT skills (36%), and more likely to report that staff lack proficiency in adapting to new equipment or materials (29%) and writing instructions, guidelines, manuals or reports (28%).

Employers in design industries are more likely than average to report that staff lack proficiency in sales skills (57% of employers with skills gaps in 2015, compared with the UK average of

34%), persuading or influencing others (48%, compared with the average of 36%), making speeches or presentations (30%, compared with the average of 19%) and customer handling skills (56%, compared with the average of 48%).

## The design skills productivity gap

Skills shortage vacancies – difficulties recruiting people with the right skills, qualifications or experience from outside the organisation – in design skills-intensive industries cost the UK up to an estimated £1.6bn in GVA in 2015[56].

Skills shortage vacancies in design industries cost up to an estimated £271m in GVA in 2015. Some 54% of this (£148m) was attributable to vacancies in design skills-intensive occupations, while 46% (£124m) was attributable to vacancies in non-design occupations. Skills shortage vacancies in other design-active industries, meanwhile, cost up to an estimated £1.3bn in GVA in 2015. Some 30% of this (399m) was attributable to vacancies in design skills-intensive occupations, and 70% (£913m) attributable to vacancies for non-designers.

Table 20: Estimated GVA cost of design skills shortages and skills gaps, 2015 (£m)

| Industry | Occupation | Estimated GVA cost of skills shortage vacancies | Estimated GVA cost of skills gaps |
|---|---|---|---|
| Design industries | All design skills-intensive occupations | £147.5 | £204.5 |
| | Non-design occupations | £123.8 | £228.1 |
| | *All occupations* | *£271.3* | £432.7 |
| Design-active industries | All design skills-intensive occupations | £399.0 | £666.1 |
| | Non-design occupations | £913.3 | £3,181.0 |
| | *All occupations* | *£1,312.3* | £3,847.1 |
| All design skills-intensive industries | | £1,583.6 | £4,279.8 |

Source: Derived from ONS (2017) *Annual Business Survey, UK non-financial business economy: 2015 revised results* / ONS (2017) *Annual Survey of Hours and Earnings, 1997–2016* / ONS (2017) *Annual Population Survey, 2004–2016* / UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2015* .

Meanwhile, skills gaps among the existing workforce in design skills-intensive industries – where staff aren't fully proficient in their jobs, which means they are unable to perform their job role effectively – cost the UK up to an estimated £4.3bn in GVA in 2015. A lack of proficiency in design industries cost up to an estimated £433m in GVA. Almost half (47%) of this (£205m) was attributable to skills gaps among people working in design skills-intensive occupations,

[56] Derived from ONS (2017) *Annual Business Survey, UK non-financial business economy: 2015 revised results* / ONS (2017) *Annual Survey of Hours and Earnings, 1997–2016* / ONS (2017) *Annual Population Survey, 2004–2016* / UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2015*.

while 53% (£228m) was attributable to a lack of proficiency among staff in non-design occupations. Skills gaps in other design-active sectors cost up to an estimated £3.8bn in 2015, with 17% of this (£666m) attributable to a lack of proficiency among people working in design skills-intensive occupations and 83% (£3.2bn) attributable to skills gaps among employees in non-design occupations.

These estimates represent the maximum possible cost of skills shortages and skills gaps in design skills-intensive industries in terms of lost GVA. In reality, costs are likely to be lower as firms adapt to skills shortages and skills gaps, for example by reorganising work.

Most employers (86% of design industry employers and 84% of employers in other design-active sectors, compared to the UK average of 85%) take steps to improve the proficiency of staff with skills gaps, though a small proportion take no action. Like all employers, those in design skills-intensive industries are most likely to increase training activity or expenditure, increase or expand training programmes, and/or increase supervision of staff in response to skills gaps.

# Developing the skills of designers

This section addresses the following research questions:

- What formal qualifications do design workers have?
- How do businesses currently incorporate (through training) design skills in their workforce?
- What relevant training do design-intensive firms currently offer their staff?

The case for design is compelling. Businesses and industries that use design skills are a high value part of the economy, contributing £209bn to the UK in gross value added. And designers are highly educated and highly skilled people – a higher proportion of designers hold degrees than is generally found in the UK workforce. But like most professions, the development of new skills and the updating of existing competencies is crucial to the growth and productivity of the design skills-intensive industries. Yet the supply of these skills is at risk, and as this research has shown, not addressing current skills gaps already costs the UK up to £4bn in lost value. This scenario could be further exacerbated by technological and economic disruption, and this chapter finds that design firms could do more to prepare for these changes by maintaining and further developing design skills among their employees through training.

## Key findings

Designers are more likely to have a degree as their highest qualification (57% in 2016) than average (34%).

Designers require more expensive training, meaning they receive it less often. Firms in design industries invested an average £2,623 per employee on training (including both direct and indirect costs) in 2015, while firms in other design-active industries invested an average £2,516, compared with the UK average of £1,637 per employee.

This means that on average, design industries invest 66% more per employee on training (including both direct and indirect costs) than non-design industries.

Designers are less likely to receive the additional training they require after leaving formal education. The proportion of both designers and those in other design-skilled occupations undertaking training is lower than average. Design firms provide training to a lower proportion of all their employees than average.

When training does happen, the costs are more likely to be met by the employees themselves rather than their employers. In 2012 training costs were slightly less likely than average to have been met by their employer, and more likely to have been funded by themselves or a family member or relative.

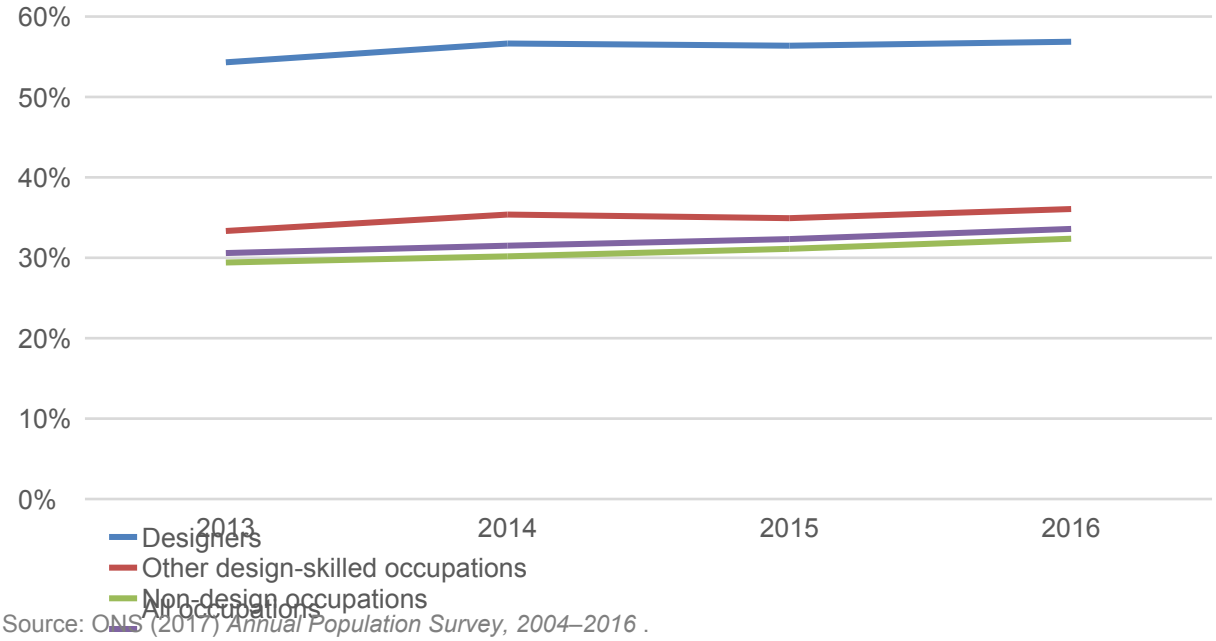
## The qualifications held by designers

Reflecting the overall pattern of recruitment from education in design industry firms, designers are more likely to require a first degree or post-graduate qualification (or a vocational qualification at an equivalent level) to enter their jobs than average. In 2012, 25% of designers said they would need a first degree if applying for their current job, compared with the UK average of 14%. 12% said they would need a Masters degree or PhD, compared with the UK average of 5%. Those working in other design-skilled occupations are also more likely than average to require a first degree (20%), but slightly less likely than average to need a post-

graduate qualification (4%). In general, those working in design skills-intensive industries are less likely than average to be able to enter their jobs with qualifications below university level[57].

Designers are therefore more likely to be qualified to degree level or higher than the average worker in the UK economy: 57% of people working in design economy occupations in 2016 were qualified to this level compared with the UK average of 34%. In contrast, those working in other design-active occupations were only slightly more likely than average to be qualified to degree level or higher (36%)[58].

Figure 9: Proportion of workers holding a degree, 2013–2016




Source: ONS (2017) *Annual Population Survey, 2004–2016* .

The extent to which designers have acquired degree-level qualifications is not uniform across design disciplines. Designers in Advertising are most likely to be educated to degree level (79%), whilst designers in Clothing (20%) and Craft (18%) are least likely to hold a degree qualification. By contrast, the proportion of people with A-levels as their highest qualification is higher in Craft (31%) than on average across the UK workforce (23%)[59]. Firms in the Clothing Design and Craft Design industries are more likely to recruit 16 year olds from school and 17–18 year olds from FE than most other design industries[60]., as seen in Weaknesses in the Design Skills Pipeline (page 40).

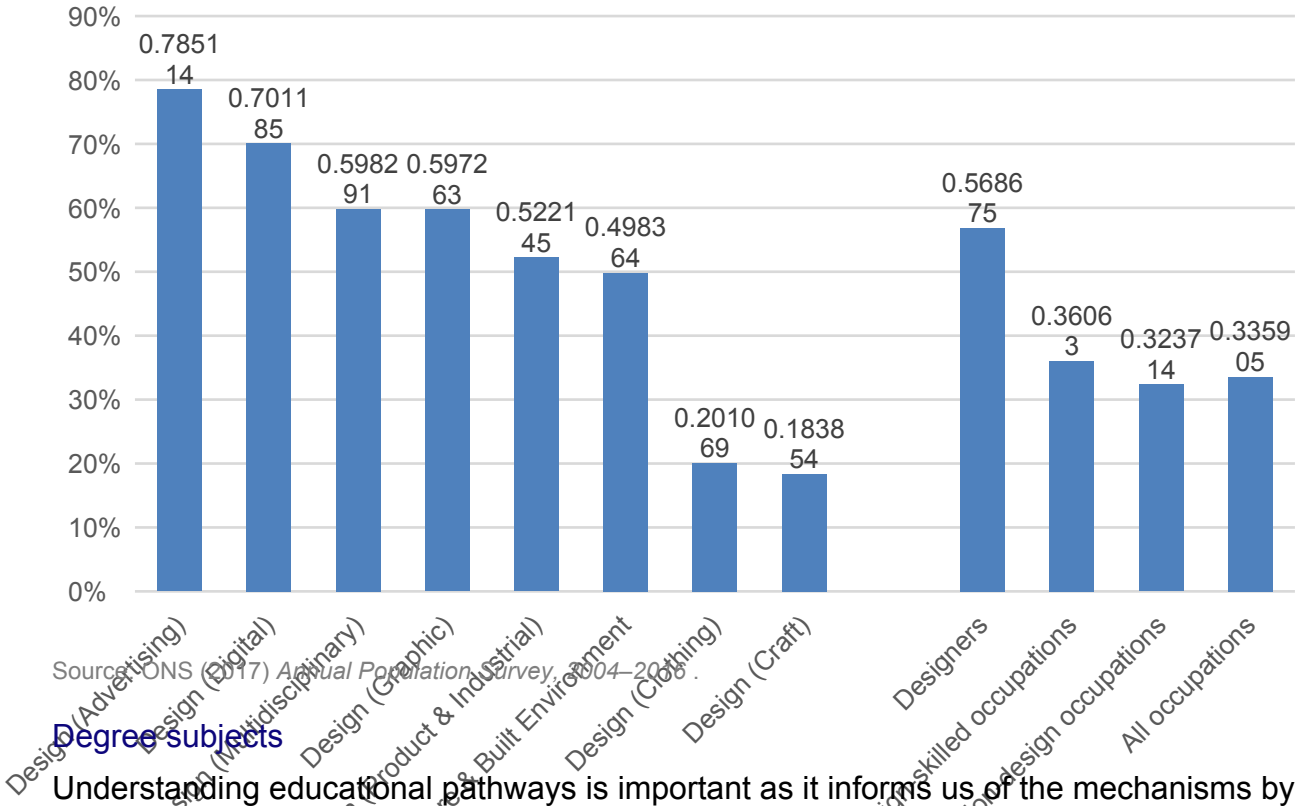
Figure 10: Proportion of workers holding a degree by design occupation, 2016

[57] Felstead, A, Gallie, D, Green, F, Inanc, H (2014) *Skills and Employment Surveys Series Dataset, 1986, 1992, 1997, 2001, 2006 and 2012*.

[58] ONS (2017) *Annual Population Survey, 2004–2016*.

[59] ONS (2017) *Annual Population Survey, 2004–2016*.

[60] UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2013*. Data refers to employers in England, Wales and Northern Ireland only. Due to sample sizes, data is aggregated for the Clothing Design and Craft Design sectors.




Source: ONS (2017) *Annual Population Survey, 2004–2016*.

## Degree subjects

Understanding educational pathways is important as it informs us of the mechanisms by which designers acquire many of the skills they go on to use in their jobs. Given how important degree level qualifications are for the design economy, our analysis examined the range of degree subjects that were taken by people working in the sector. As we have seen, employers in design skills-intensive industries are more likely to complain that the people they recruit from Higher Education lack the required skills and competencies (see page 40), and there appears to be scope to improve the relevance of university qualifications.

The top ten undergraduate degree subjects among people working in design economy in 2016[61], ranked by the relevance of the subject to design, are:

Urban and rural planning (81% of people with a degree in 'urban and rural planning' work in a design occupation)

Architecture, building and planning (73%)

Interactive and electronic design (72%)

Architecture design theory (70%)

Automotive engineering (69%)

Human-computer interaction (65%)

Interior architecture (63%)

Planning (urban, rural and regional) (62%)

Programming (61%)

Architecture not elsewhere classified (59%)

[61] ONS (2017) *Annual Population Survey, 2004–2016*.

While the proportion of designers that hold first (bachelor's) degrees is high, this is not necessarily the highest level of qualification held. Some designers hold higher degrees (such as Masters degrees) and an analysis of the subjects taken by designers at this level indicates that such qualifications tend to be technical in nature, with a focus on technology or engineering. The top ten higher degree subjects among people working in design economy in 2016 are:

Turbine technology (100%)

Automotive engineering (91%)

Information modelling (90%)

Architecture not elsewhere classified (85%)

Architecture (78%)

Architectural design theory (78%)

Computer architectures and operating systems (78%)

Air passenger transport engineering (77%)

Offshore engineering (67%)

Multimedia design (65%)

## Training

### Cost and funding of training

Firms in design industries invested an average of £2,623 per employee on training in 2015 (including both direct and indirect costs). This underlines that training for designers is more expensive than for the average worker in the UK economy (£1,637 per employee). Firms in other design-active industries also face higher than average training costs per employee (£2,516)[62].

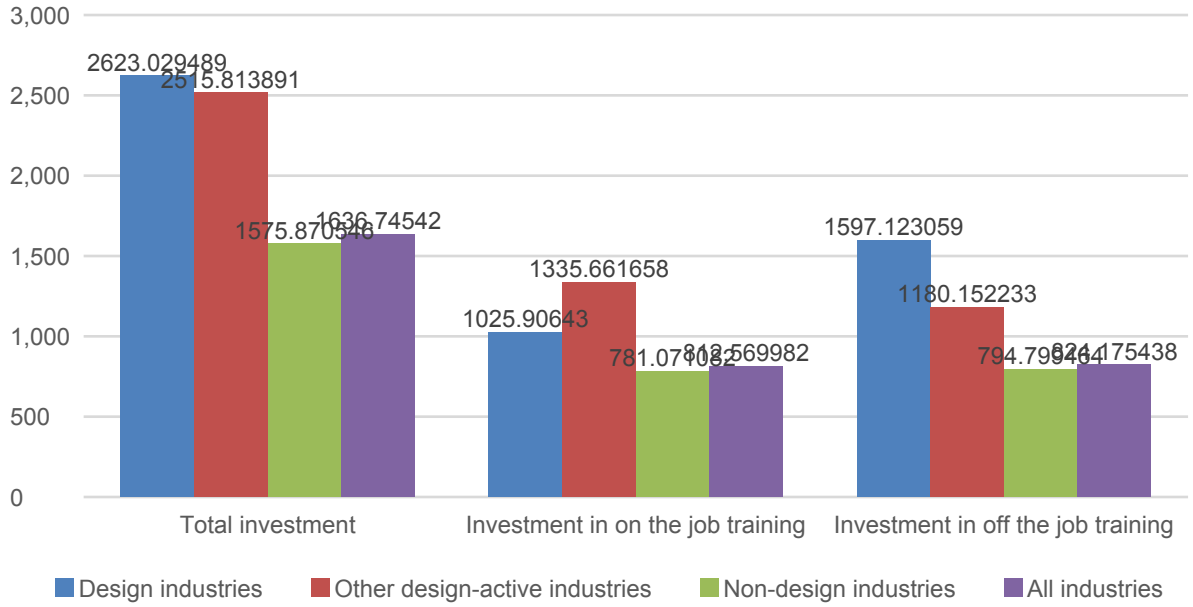
Typically, costs of training rise when training is delivered away from the usual place of work (off-the-job training, such as an external classroom-based course) compared to training undertaken during the course of normal work duties (on-the-job training, such as coaching). However, the cost increase of off-the-job training for design firms is more acute than for other sectors. Design firms invest 56% more in off-the-job training per employee than on-the-job training, whereas the average across all UK firms is only 2%. This implies that the nature of training relevant to designers is more expensive at least in part because of the nature of the delivery of that training (which itself will be influenced by the content of that training). The type of training designers need is therefore more expensive than for other industries.

Designers (31% in 2012) and those working in other design-skilled occupations (45%) are also more likely than average (24%) to have had recent training which involved costs. However, as well as training being more expensive, the associated costs are more likely to fall to the designer rather than their employer. Half of the designers undertaking training in 2012 had it funded by their employer compared with 59% across the whole economy. Training is more likely to be funded by the designers themselves or their family or a relative (47%, compared with the UK average of 36%)[63]. These findings may well be influenced by the high proportion of

[62] UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2015*.

freelancers within the design workforce.

### Figure 11: Investment in training, 2015




Source: UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2015* .

## Training plans and budgets

While training is often agreed and undertaken in an ad hoc manner, it is widely understood that progressive development of skills is best managed through formal training planning. Such planning ensures that training is targeted at key skills development that are relevant to the needs of both the individual and employer. Design firms, however, are less likely to have both training plans (24% of employers in 2015, compared with the UK average of 43%) and formal training budgets (24% compared with 33%)[64]. This lack of planning and budget assignment will potentially decrease both the likelihood of training and the effectiveness of that training.

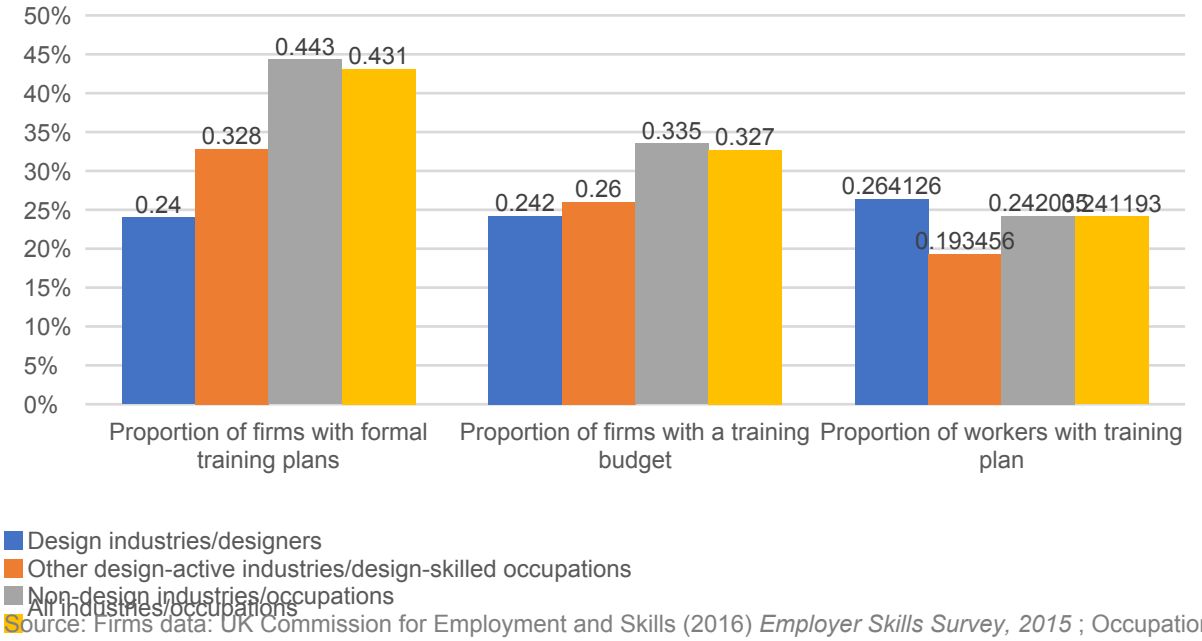
By contrast, employees in design occupations appear slightly more likely to have a formal career or training plan in place (26% in 2006) than the average worker (24%)[65]. Taking these findings together, it can be concluded that within design firms, design occupations are given more attention in terms of formalised training and development than non-design occupations, which itself may evidence a recognition of the importance of those roles within design industries.

### Figure 12: Training plans and budgets

[63] Felstead, A, Gallie, D, Green, F, Inanc, H (2014) *Skills and Employment Surveys Series Dataset, 1986, 1992, 1997, 2001, 2006 and 2012*.

[64] UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2015*.

[65] Felstead, A, Gallie, D, Green, F, Inanc, H (2014) *Skills and Employment Surveys Series Dataset, 1986, 1992, 1997, 2001, 2006 and 2012*.




Source: Firms data: UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2015* ; Occupation data: Felstead, A, Gallie, D, Green, F, Inanc, H (2014) *Skills and Employment Surveys Series Dataset, 1986, 1992, 1997, 2001, 2006 and 2012* .

## Incidence of training

In this section we examine data related to training in design firms in design industries, before then considering training for designers (i.e. across all industries).

Data is available for training received in design firms for the prior three and 12 months (before the point of data capture) and is set out in Figure 13. The analysis of both measures shows that the proportion of employees in design industries that have received training is lower than average. In 2016, 52% of staff in design industries had received training in the preceding 12 months, compared with the UK average of 66%[66]. Similarly, the proportion of staff receiving job-related training in the preceding three months is also lower in design firms (16% in 2016) than the UK average (25%)[67].

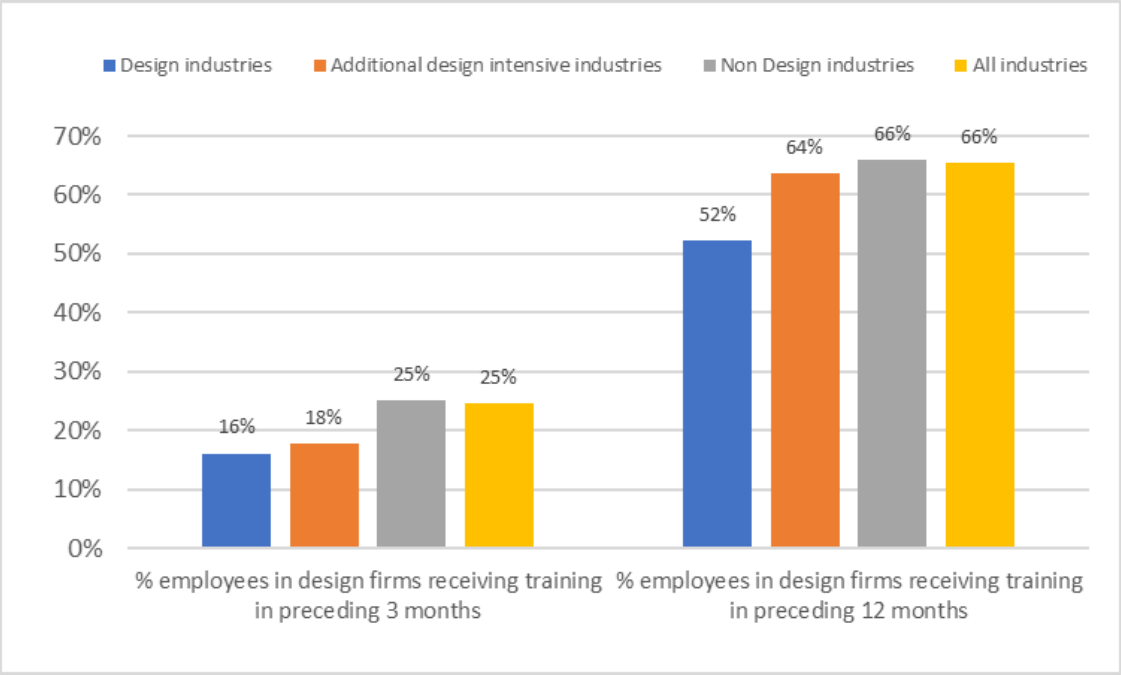
When the incidence of training in design firms is reviewed at the level of design group, we find there is considerable variance. Firms in Architecture and Built Environment have provided training to a much higher proportion of staff in the last three months (27%) than either the average for design as a whole (16%) or the UK economy as a whole (25%). Firms in Digital Design are also more likely than design overall to have provided training (17%). However, firms in Multidisciplinary Design (11%) and Product and Industrial Design (12%) are less likely to have trained staff in that period.

What we have also found is that the proportion of employees in design firms who have undertaken training for their current work since leaving education is marginally higher for design firms (61% in 2012) than the UK average (59%).

Figure 13: Incidence of training in design industries

[66] UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2015*.

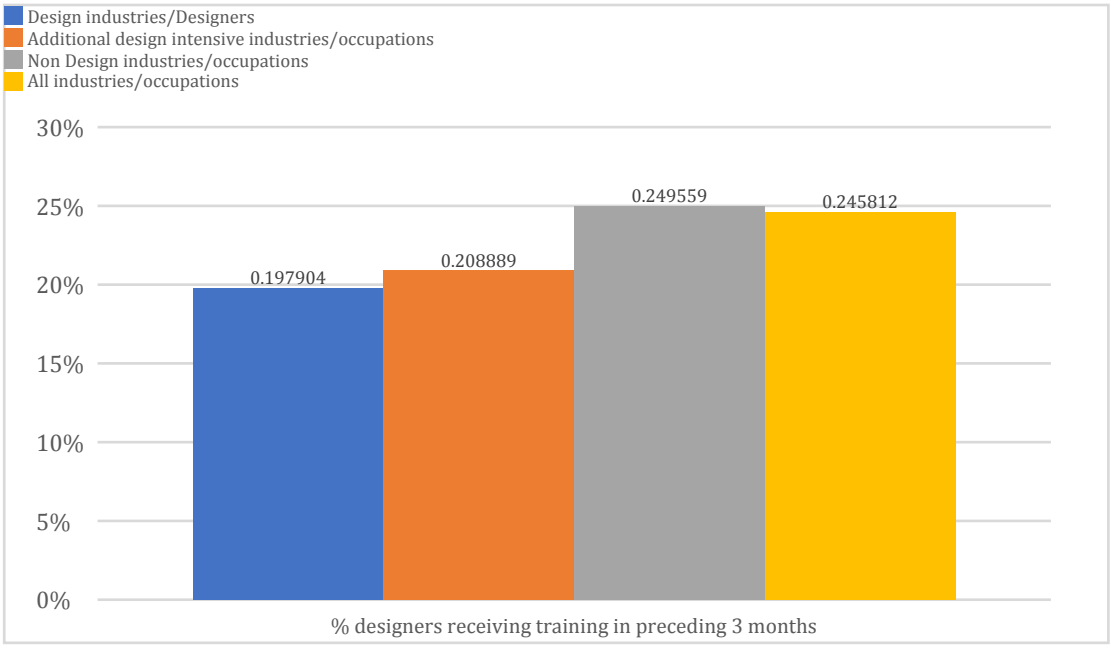
[67] ONS (2017) *Annual Population Survey, 2004–2016*.




Source: ONS (2017) Annual Population Survey, 2004–2016

Figure 14 sets out analysis of training incidence for designers. When compared with Figure 13 it shows that designers are more likely to be trained than the average for all employees in design firms (20% against 16% for design firms). However, the analysis also shows that designers are less likely to receive training than the average UK worker (20% of designers having received training in the preceding three months compared to 25% across the UK economy).

## Figure 14: Incidence of training in design occupations




Source: ONS (2017) Annual Population Survey, 2004–2016

Designers are marginally more likely to have received training in the prior three months in Product & industrial Design (25%), Digital Design (22%) and Architecture and Built Environment (21%) compared to the average across all design occupations (20%). Designers in Craft (15%), Multidisciplinary Design (14%) and Graphic Design (12%) are less likely to have received training than on average.

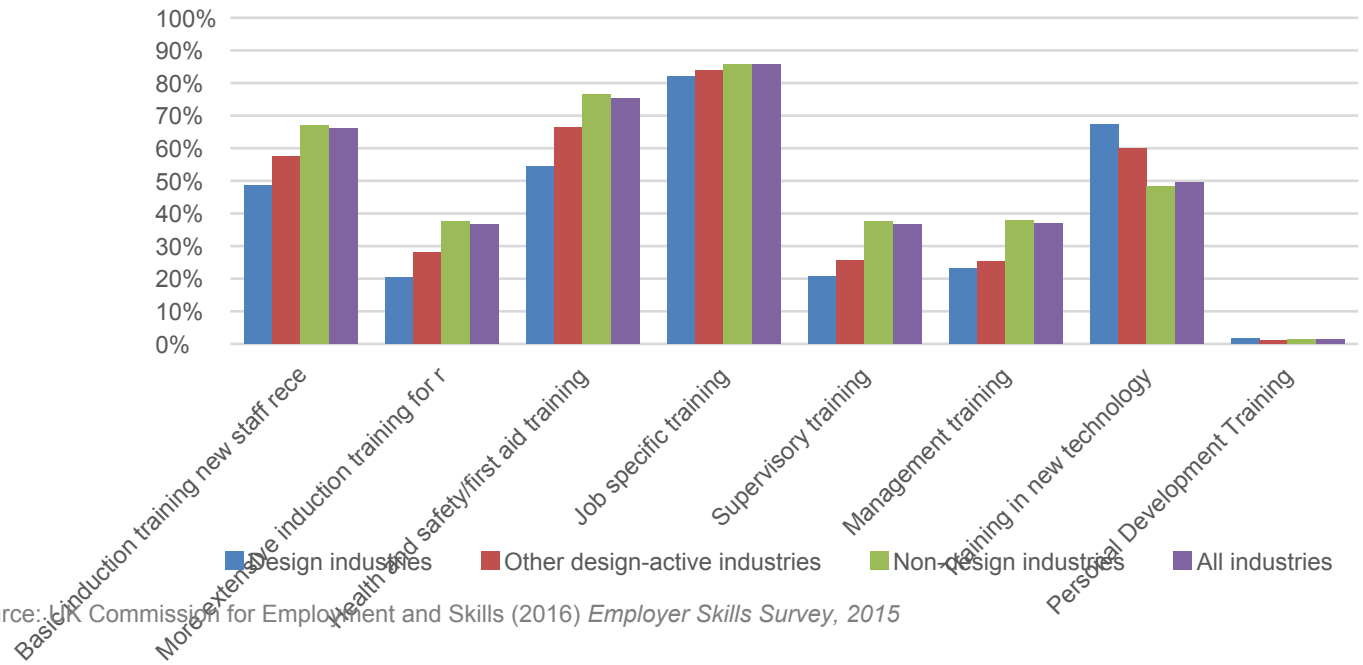
The proportion of designers that have undertaken work-related training since leaving education is lower (56%) than on average (59%)[68].

The evidence shows that the incidence of training both within design firms and for designers is below average. It also begs further questions (such as whether training in design firms is more likely to be targeted at designers) for future research.

### Types of training received

The types of training these staff receive is also different from other sectors; it is more likely to be focused on technical skills (e.g. computing skills) or leadership skills. And generally speaking, across design firms, training tends to be more focused on new technology and less likely to be in management/supervisory and health and safety. Training in design firms is less likely to be towards nationally recognised qualifications. The exception to this last finding is Architecture and Built Environment, where the need for professional accreditation is likely to influence training towards recognised qualifications.

### Figure 15: Types of training undertaken, 2015



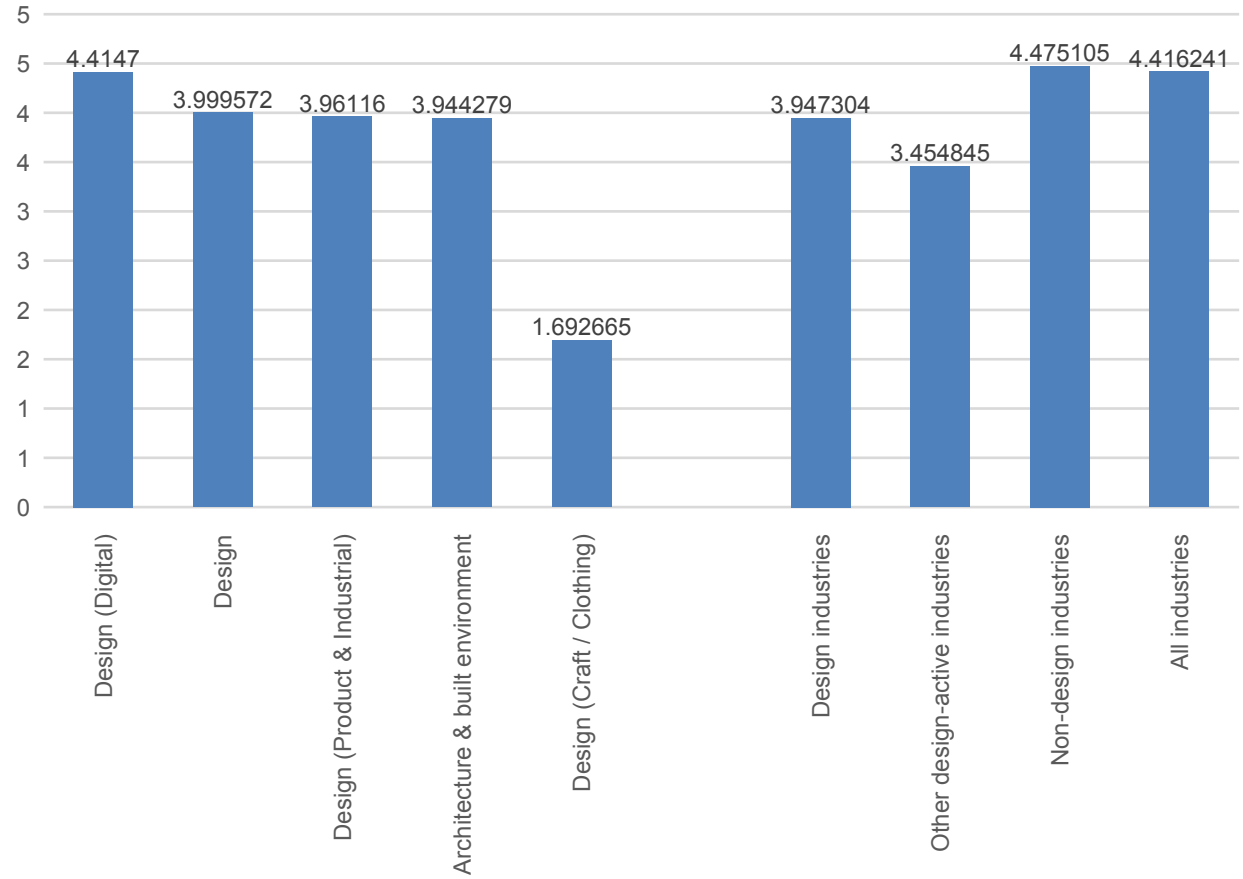

Source: UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2015*

### Other training characteristics

As well as being less likely to receive training, staff in design industries also receive less training in a year than employees in other sectors. As shown in Figure 16, on average staff in design industries receive 3.9 days' training per year compared with 4.4 days across the whole UK economy. However, staff in firms operating in the Digital Design industry receive a comparable volume of training (4.4 days). Those in Craft/Clothing Design receive the least training among design industries (data is only available for five groups), at 1.7 days per year[69].

[68] Felstead, A, Gallie, D, Green, F, Inanc, H (2014) *Skills and Employment Surveys Series Dataset, 1986, 1992, 1997, 2001, 2006 and 2012*.

Figure 16: Average number of days training received in the last 12 months, 2015




Source: UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2015*

The volume of training undertaken since leaving full time education is also relatively low for staff in design occupations: 29% of designers in 2012 said they had undertaken less than one month of training since leaving full time education, compared with 24% across all industries[70]. On the other hand, the proportion of designers that had undertaken two years or more of training since leaving education (39%) is very close to the national average (40%). These finding requires further investigation as this is a key characteristic of the training received by designers but the factors that lie behind it cannot be discerned from the data analysed here.

Satisfaction with training is lower among people in design occupations. Some 25% of designers who received training in 2012 were either completely or very satisfied with that training compared with the UK average of 35%. Designers are less likely to state that training improved skills: 33% indicated that skills were improved 'a lot' by training, compared to the UK average of 42%[71]. Designers are also slightly less likely to be very satisfied with the training opportunities on offer to them (13% of designers in 2011, compared with the UK average of 14%[72]). It is difficult to tell what underpins this lower level of satisfaction and effectiveness, but

[69] UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2015*.

[70] Felstead, A, Gallie, D, Green, F, Inanc, H (2014) *Skills and Employment Surveys Series Dataset, 1986, 1992, 1997, 2001, 2006 and 2012*.

[71] Felstead, A, Gallie, D, Green, F, Inanc, H (2014) *Skills and Employment Surveys Series Dataset, 1986, 1992, 1997, 2001, 2006 and 2012*.

this is perhaps something that could be explored further in the future.

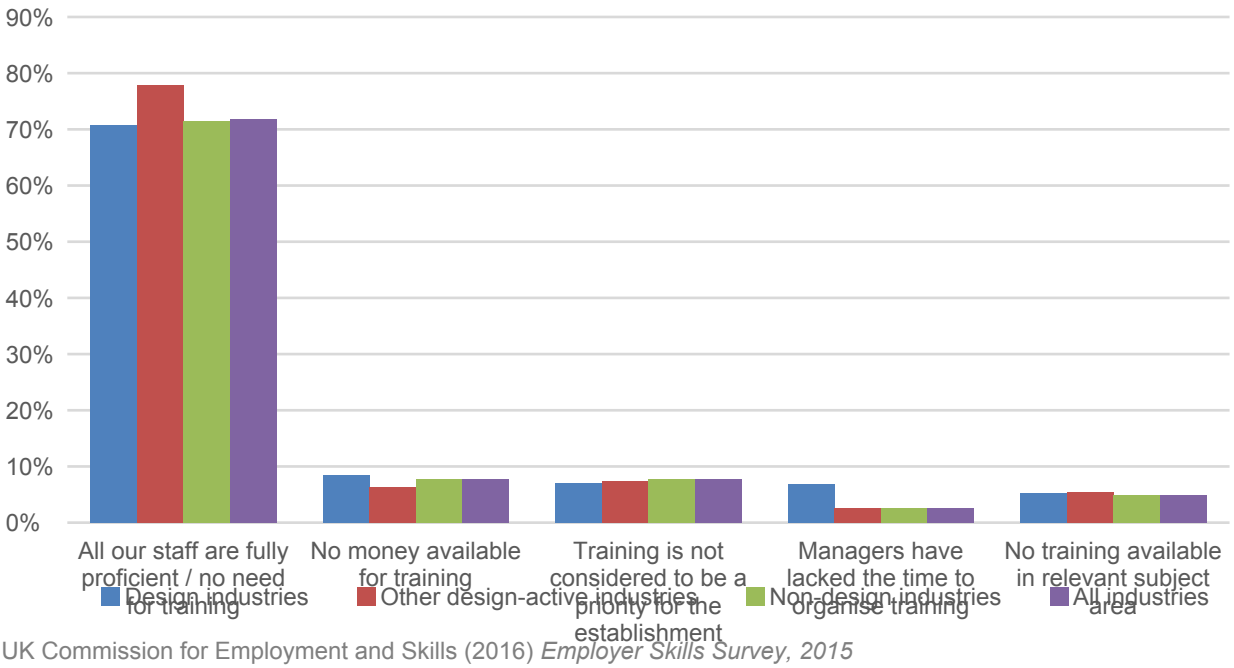
## Barriers to training

Some employers are prevented from providing training by a range of barriers, while others provide some training but would prefer to offer more. Other employers feel no need to provide training at all.

The key reason for not providing training is that the employer believes their staff are fully proficient (71% of design industry firms which did not provide training, which is comparable to the UK average of 72%). Other responses are also comparable with the views of other employers, but the one response which differentiates design industries from others is that managers lack the time to organise training (7% of design firms, compared to the UK average of 3%). This resonates with the earlier finding that staff in design firms are less likely to have training plans. Design industry employers are also more likely than other employers to report that training is not needed due to size of firm and that employees are too busy to undertake training[73].

These results together suggest that there are capacity constraints within design firms which impinge on the planning, organisation and delivery of training.

Figure 17: Reasons for not providing any training in the previous 12 months – top five responses, 2015




Source: UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2015*

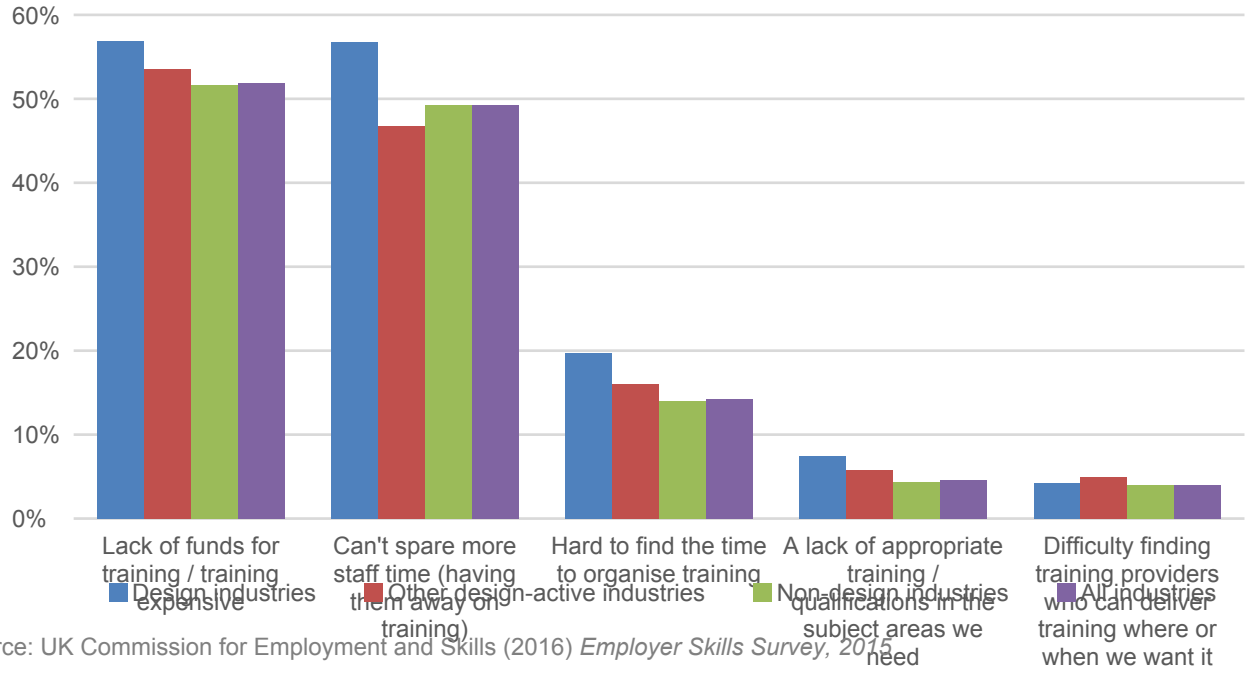
When asked whether they would have provided more training if possible, 46% of employers in design industries who provided some training stated that they would. This is slightly below the UK average of 48%. Figure 18 provides an insight into the barriers preventing more training being delivered. It shows that a lack of funds is the most significant barrier, and also a barrier for a higher proportion of employers in design industries than average (57% of design

[72] Department for Business, Innovation and Skills, Advisory, Conciliation and Arbitration Service, National Institute of Economic and Social Research (2015) *Workplace Employee Relations Survey, 2011*.

[73] UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2015*.

employers compared with the UK average of 52%). Design industry employers also face barriers associated with the time spent away from work that training staff would require (57% compared with the UK average of 49%) and that they find it hard to find the time to organise training (20% compared with the UK average of 14%). These results emphasise the capacity constraints that firms in design industries face or perceive, which restrict both the opportunities for staff to take time away from their normal activities for training and also restrict firms' ability to plan and organise training for staff.

Figure 18: Barriers to providing more training – top five responses, 2015




Source: UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2015*

## Conclusions

The pace of economic change is fast and quickening. As the pace accelerates, the skills and approach of design workers could help the UK make a success of future economic and technological developments.

Our research suggests that designers possess and exploit a set of highly valuable skills covering a broad spectrum of activities – from human-centred design to the technical design of artefacts, components and systems. As such those employed in the design economy use a wide range of skills in their work – from the ability to visualise future possibilities to the technical ability to create detailed drawings which instruct others how devices and components should be built, maintained or used.

Design skills are not confined to recognised design industries however, and this research has shown they are diffused throughout the wider economy, with a total of 2.5m people employed in roles that show high levels of design skills. The demand for these skills is growing and at a faster rate than jobs generally; there has been an increase of 14% in four years, compared to 6.9% growth in the overall UK employment rate.

These skills are already in high demand . Combining our findings with that of other recent research[74] studies allows us to conclude that the skills deemed most important across current design occupations are expected to grow in demand by 2030. This growth in demand will not only affect the design economy, it will mean that design skills further permeate the workforce in the future.

Further developing these skills across the economy will help the UK better prepare for the future, though there is much more we can do now. These skills already contribute significant value (£209bn) to the UK economy, which until now has been difficult to measure, meaning they have not been given due attention in debates about skills.

For a country about to enter its second decade of stagnant productivity, there is potentially much we can learn from workers who are 47% more productive than the average UK worker.

Design also plays a crucial role in the innovation process. We found that 42% of design workers carry out innovation-related activities such as R&D or improving products and services, compared to a 6% UK average.

Yet the future pipeline for designers is narrowing. Our analysis shows that employers require the current design workforce to be highly qualified. For some sectors – such as Architecture and Digital Design – the rewards of this are obvious in terms of higher levels of GVA and productivity. For other sectors – such as Clothing and Craft – the costs of not acting are also evident in that productivity and output challenges will deepen.

In 2017, there are a decreasing number of students studying design and technology subjects at school (a 61% decrease from the year 2000) and Creative Arts and Design subjects at university (a 7% decrease since 2011). Added to this, there has been a substantial decline in both the number of teaching hours dedicated to arts and technical subjects such as design, as well as in the number of associated teachers. This has to be a huge concern for our economy when considered in the light of the results presented here.

While the government has a key role to play in securing design skills for the future, our evidence suggests employers could also do more to take responsibility for developing and

[74] Nesta, (2017), *The future of skills: employment in 2030*, http://www.nesta.org.uk/sites/default/files/the_future_of_skills_employment_in_2030_0.pdf

maintaining the skills they require. Designers are less likely to receive the additional training they require after leaving formal education, and when they do they are more likely to meet the costs than their employers. This trend is no doubt partly influenced by the high proportion of freelancers working in design, though it also highlights a gap in the ability of design firms to meet shortfalls in skills themselves.

If not addressed, skills gaps among the existing workforce in design skills industries (i.e. all roles using design skills) will cost the UK up to an estimated £4.3bn in GVA and a further £1.6bn lost through skills shortages in candidates seeking employment in the design economy.

**Recommendations**

We hope this study will stimulate further debate about how design skills can be further enhanced to solve economic challenges faced by the UK today and into the future. Unlocking further innovation and improving productivity appear to be two important and prescient opportunities in this respect. Given the current value of design skills across the economy and their future necessity, Design Council recommends:

- **Education providers and regulators embed design in the curriculum:** the traditional pathways into design careers – such as GCSE Design and Technology – are being eroded. The Department for Education, schools and academies should re-introduce GCSE Design and Technology as a priority subject in post-14 education.
- **Moving from STEM to STEAMD:** Boosting STEM and digital skills alone will not suffice. Policymakers and education providers must consider how they will develop the complex problem-solving, critical and creative thinking abilities that are essential to innovation. Design is central to this. Design methods, tools and approaches should be incorporated to STEM subjects to boost the skills required in the future economy.
- **Greater support and resource for lifelong learning:** A government strategy is needed to address existing skills gaps whist anticipating the future skills needed in the fourth industrial revolution. This requires investment in career long learning with access to resource, training and non-formal education that will equip people with higher value skills required for future work.
- **Recognition and inclusion of design in the implementation of the Industrial Strategy:** The industrial strategy can draw on design and design skills to help create the right conditions for growth. Our research shows how designers use their skills to develop a deeper understanding of people's needs, meaning that an industrial strategy utilising these skills and principles is more likely to succeed and positively impact upon people's lives.
- **Promoting greater use of design in parts of the economy most in need of a boost:** Government should explore with business leaders and the design industry what wider incentives could be used to encourage greater use of, and upskilling in design across key areas of the economy. In particular incentives should be targeted at the sectors with the lowest levels of productivity and the highest chances of automation, which could benefit from an uplift in productivity while creating more meaningful, creative and higher value jobs in the process.

We also hope to see a continued development of the research and evidence base around this subject. As well as generating a considerable evidence base around design skills, this study has also highlighted gaps in the evidence base as well as opportunities to develop the findings further. The following areas for future research are suggested:

The design skills taxonomy could be further developed, at a number of levels for the design industries (i.e. at design group and individual occupational level) to create a tool for more detailed analysis of the concentration of design skills in the UK economy.

As new data emerges, the US data which underpins the analysis of skills that differentiate design from other industries (O*Net) could be complemented (and perhaps ultimately replaced) by insight which reflects the working practices of the UK design economy. In the first instance, such data could be used to test the hypothesis that there are differences in the skills rated as important by designers in the UK, Europe and the USA.

Regression analysis on microdata could be undertaken to explore the causal relationships between design skills and economic outcomes.

Whilst recognising that understanding future skills demand is a significant challenge, this remains a key area for future research to inform education and training planning.

# Appendix 1: Skills integration

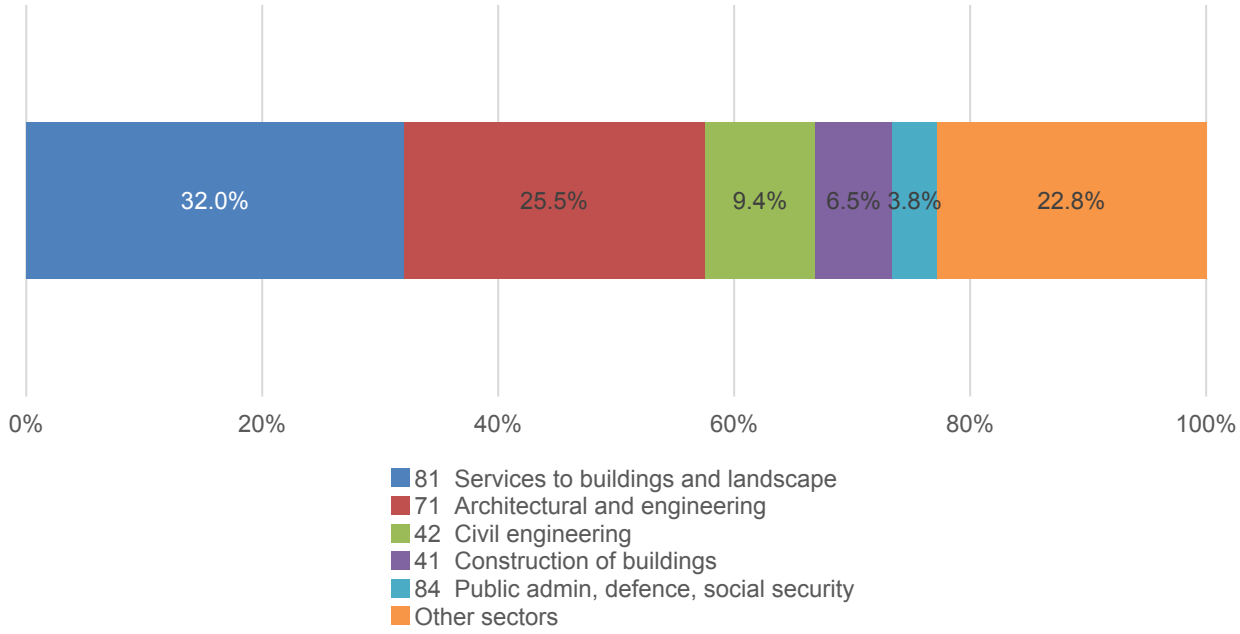
This section addresses the following research questions:

- How do businesses currently incorporate design skills in their workforce?
- How are design skills distributed across the UK economy (in terms of sectors)?
- How concentrated are design skills in the design industries?

This section investigates how design skills are integrated into the UK economy. It does this by reviewing the concentration of design skills across the UK economy and identifies which industries contain the highest concentrations of design skills-intensive occupations. As acknowledged previously, design skills are not homogenous across design industries; each of our eight design groups demonstrates its own specific set of skills which are most intensive. For this reason, the analysis below is presented by design group at the two digit SIC code level.

## Architecture and Built Environment

### Figure 19: Industry concentration of Architecture and Built Environment occupations




Source: ONS (2017) Annual Population Survey, 2004–2016

The Architecture and Built Environment design group[75] has particular strengths in skills such as building and construction (71% higher importance than the average for across all jobs), design (70%), geography (65%), drafting, etc. (65%) and engineering and technology (44%). We found the highest concentration of design skills to be in the following industries:

The Services to Building and Landscape sector – 32% of Architecture and Built Environment jobs are concentrated in this sector.

[75] Details of the occupations in each design group can be found in Table 21 (page 65).

The Architectural and Engineering sector, where 26% of design jobs are concentrated.

The Civil Engineering sector (9%).

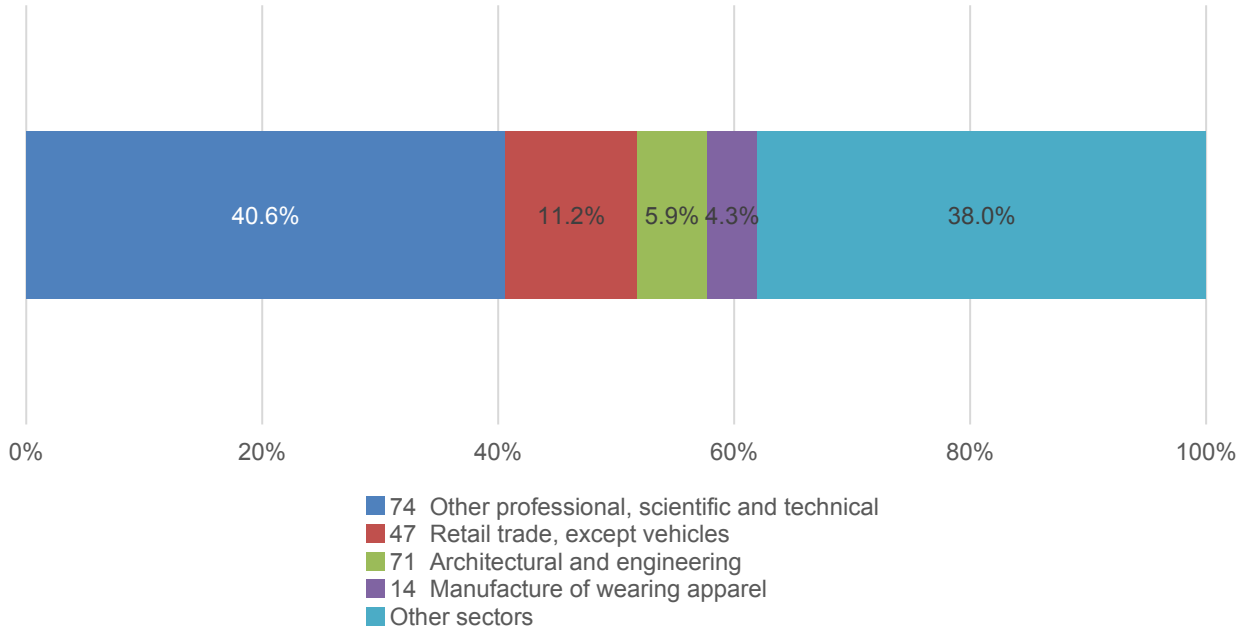
The Construction of Buildings sector (7%).

The analysis above looks at the distribution of occupations across all industries. Alternatively, we can examine *design industries* and understand the extent to which *Architecture and Built Environment design occupations* fall within them.

If we take this perspective, we find that 82% of people using these architecture and built environment design skills work outside the design economy definition of design industries. This breaks down as follows: 52% work in design-active industries and a further 31% work in non-design industries, indicating that the skills these people bring are in relatively high demand across the UK economy.

## Multidisciplinary Design

### Figure 20: Industry concentration of Multidisciplinary Design occupations



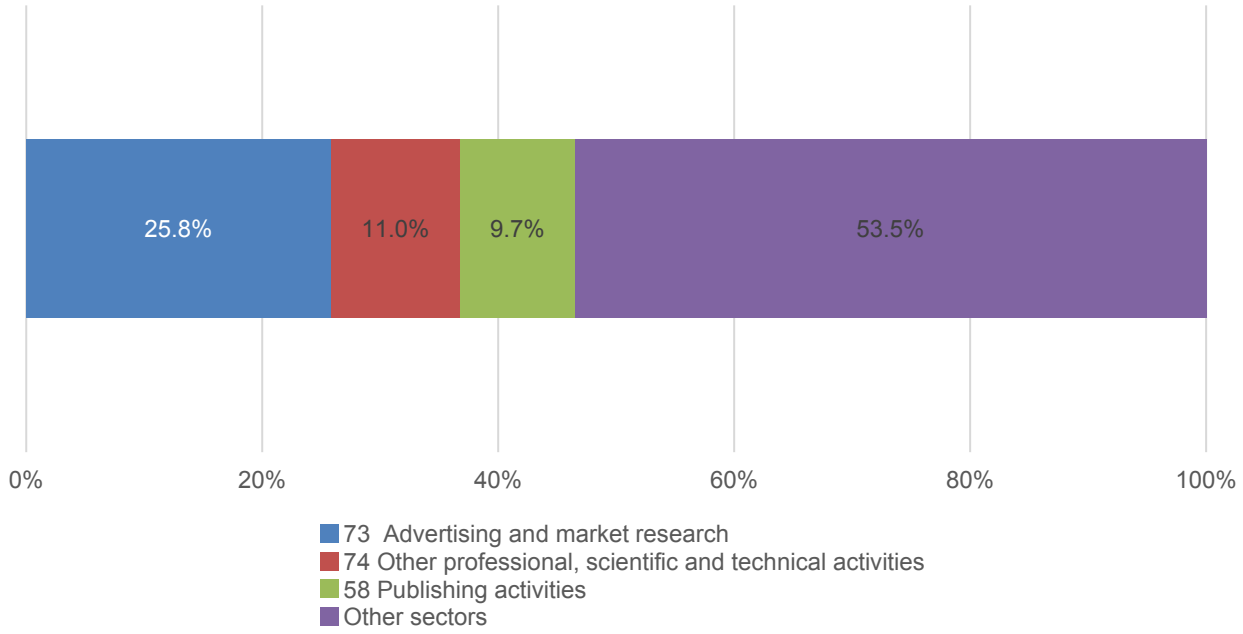

Source: ONS (2017) Annual Population Survey, 2004–2016

The Multidisciplinary Design group is founded on a definition which uses a single occupational code; SOC 3422 – Product, clothing and related designers. It is worth noting that this occupation is itself concentrated in the industry classification for specialised design activities (SIC 7410). This SIC falls within the Other Professional, Scientific and Technical sector, so it is no surprise to see that this sector employs 41% of people in this design group. The Retail Sector is also important as an employing industry (11%), followed by the Architectural and Engineering (6%) and the Manufacturing of Wearing Apparel sectors (4%).

If we examine *design industries* and look at the extent to which *Multidisciplinary Design occupations* fall within them, we find that 58% of people using these multidisciplinary design skills work outside the design economy definition of design industries. This breaks down as follows: 12% work in design-active industries outside the design economy definition, whilst a further 46% work in non-design industries across the rest of the economy.

## Advertising Design

### Figure 21: Industry concentration of Advertising Design occupations




Source: ONS (2017) Annual Population Survey, 2004–2016

Key skills for the Advertising Design group include fine arts (88% more important that for the economy as a whole), sales and marketing (81% more important) and communications and media (59% more important). These skills are most in demand in the sectors in which these occupations are concentrated, and these include:

Advertising and market research (where 26% of the jobs in the Advertising occupations are employed)

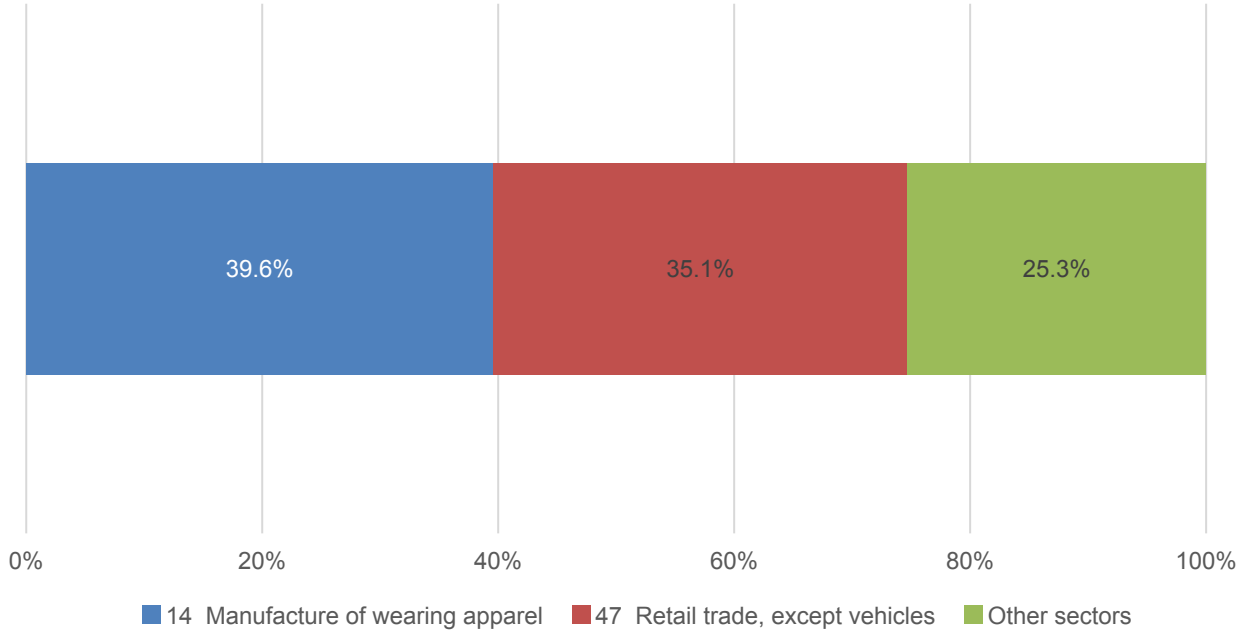
Social work without accommodation (11%)

Publishing activities (10%)

If we examine *design industries* and look at the extent to which *Advertising Design occupations* fall within them, we find that 94% of people using these advertising design skills do so in industries outside of the design economy definition of design industries. This proportion is high relative to comparable statistics for other groups, largely because there is no distinct advertising design industry in the design economy definition (as no single 4-digit SIC has more than 30% of employment in a design occupation).

## Clothing Design

### Figure 22: Industry concentration of Clothing Design occupations



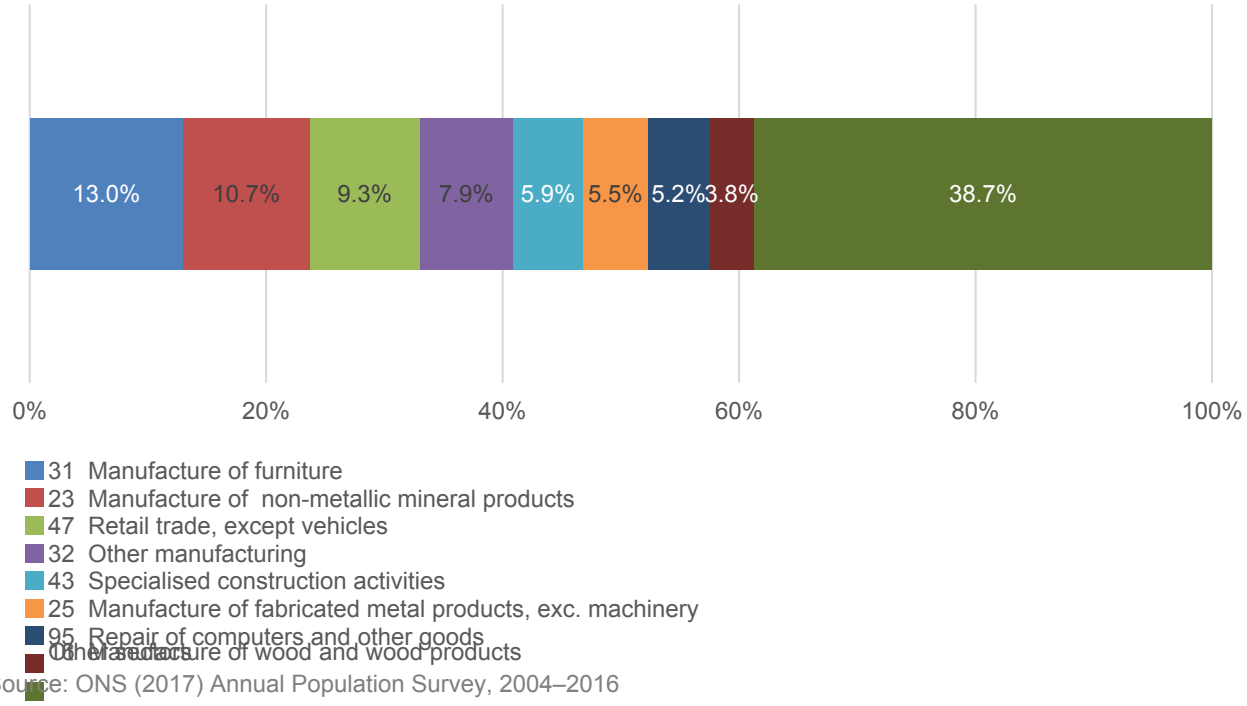

Source: ONS (2017) Annual Population Survey, 2004–2016

Important skills in the Clothing Design group include manual dexterity (39% more important than the average for all occupations), rate control (37%) and fine arts (37%). Like Craft Design, the influence of industrial working environments and business models is apparent. These skills are in significant demand in the Manufacturing of Wearing Apparel sector which employs 40% of those in this design group, and non-vehicle Retail Trade (35%).

If we can examine *design industries* and look at the extent to which *Clothing Design occupations* fall within them, we find that 89% of people using these clothing design skills work outside the design economy definition of design industries.

## Craft Design

### Figure 23: Industry concentration of Craft Design occupations




Source: ONS (2017) Annual Population Survey, 2004–2016

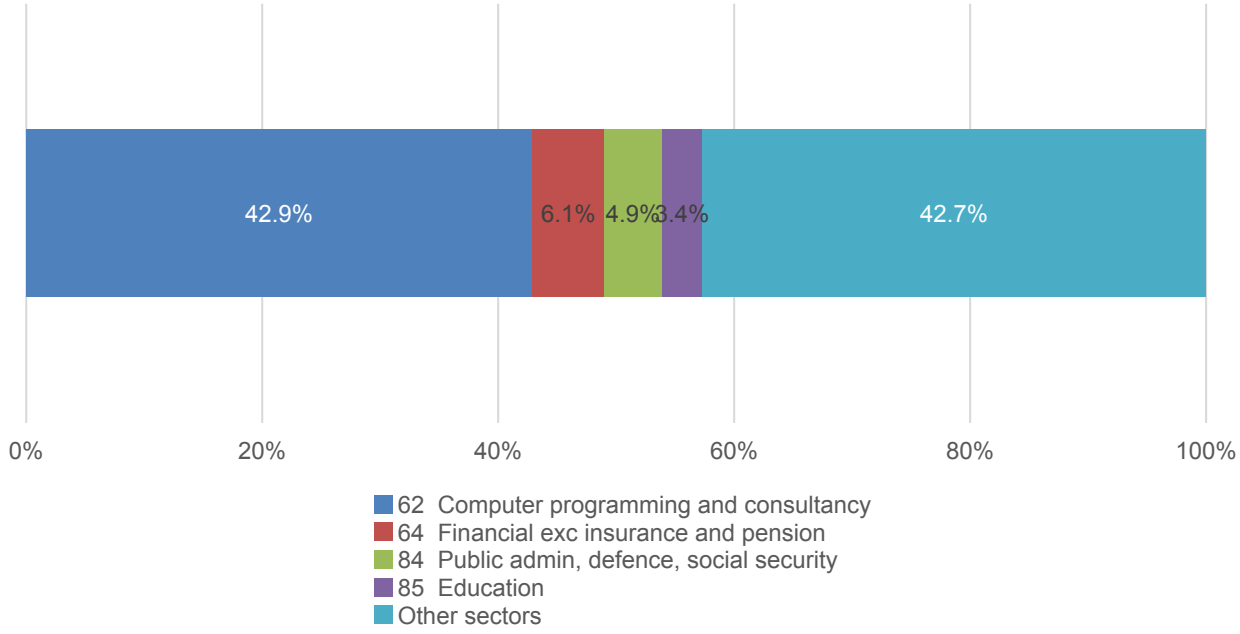
The key skills for the Craft Design group relate to process and production (rate control, production and processing, reaction time) indicating that this group is potentially influenced by craftspeople working within an industrialised environment.

The highest concentration of people working in Craft Design occupations is in the Manufacture of Furniture sector (13%), with slightly smaller proportions in Manufacture of Non-Metallic Mineral Products (11%), Retail (9%) and Manufacture of Wood and Wood Products (8%). Smaller proportions work in a range of other sectors.

If we examine *design industries* and look at the extent to which *Craft Design occupations* fall within them, we find that 88% of people using these craft design skills work outside the design economy definition of design industries. This breaks down as follows: 19% work in design-active industries, while 69% in Craft Design occupations work in non-design industries.

## Digital Design

### Figure 24: Industry concentration of Digital Design occupations




Source: ONS (2017) Annual Population Survey, 2004–2016

The most important skills for those working in the Digital Design group include programming (112% more important than the average across the economy), computers and electronics (57%) and operations analysis (55%). These skills are concentrated in the Computer Programming and Consultancy sector, which employs 43% of those working in Digital Design occupations. Others in this occupation are spread across a wide range of other sectors but in comparatively small numbers, including:

Financial services excluding insurance and pensions (6%)

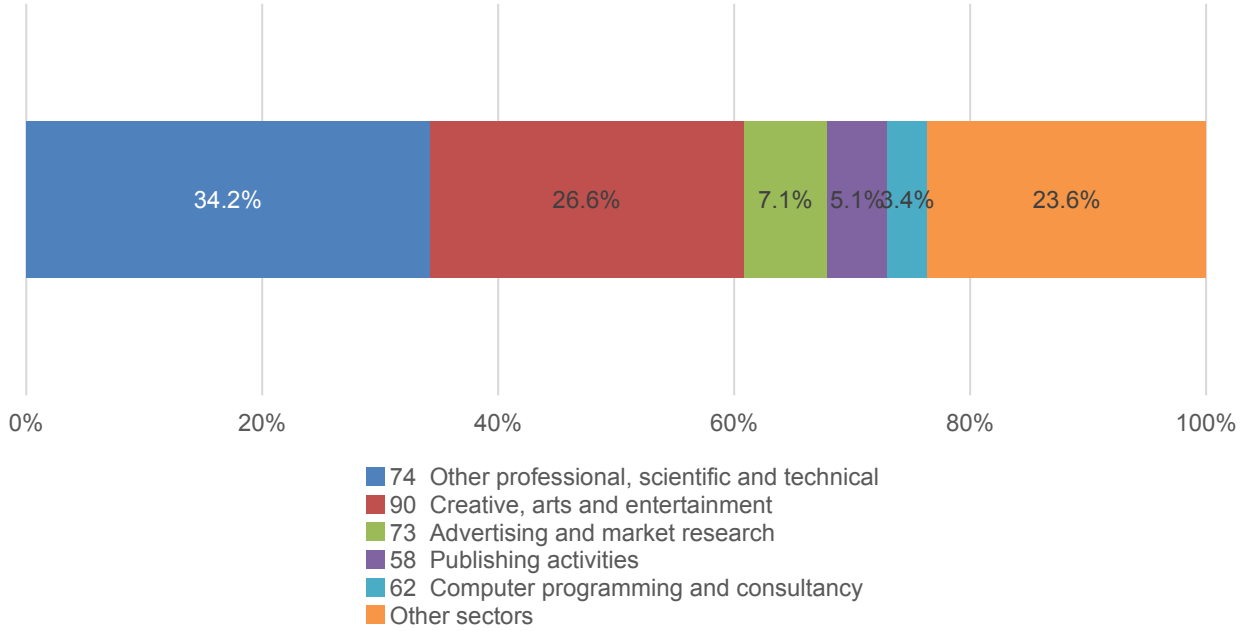
Public administration (5%)

Education (3%)

If we examine *design industries* and look at the extent to which *Digital Design occupations* fall within them, we find that 82% of people using these digital design skills work outside the design economy definition design industries. This breaks down as follows: 30% work in design-active industries and a further 51% of people in Digital Design occupations work in non-design industries.

## Graphic Design

### Figure 25: Industry concentration of Graphic Design occupations



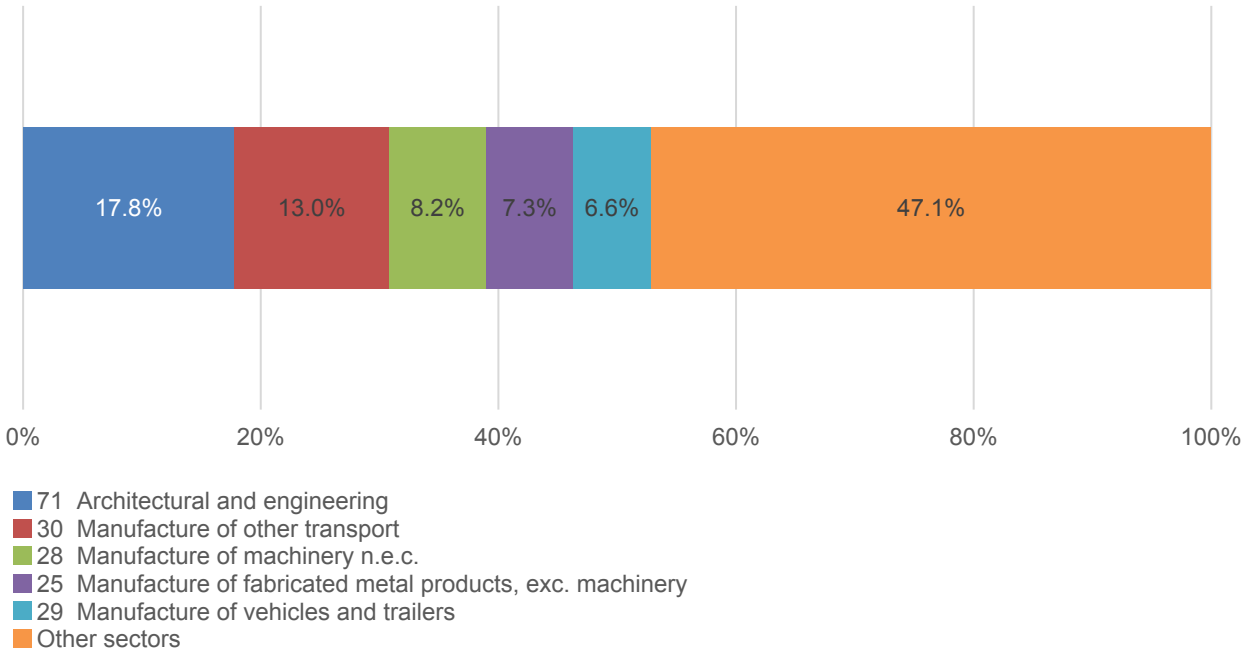

Source: ONS (2017) Annual Population Survey, 2004–2016

Graphic designers state that their most important skills are fine arts (211% more important than the average occupation), design (93%) and communications and media (54%). These skills are most concentrated in the Other Professional, Scientific and Technical sector (29% of those working in this occupation and which includes SIC 7410, specialised design activities), the Creative Arts and Entertainment sector (27%) and Advertising and Market Research (7%).

If we can examine *design industries* and look at the extent to which *Graphic Design occupations* fall within them, we find that 64% of people using these graphic design skills work outside of the design economy definition design industries. This breaks down as follows: 29% work in design-active industries, while 35% of people in Graphic Design occupations work in non-design industries.

## Product and Industrial Design

### Figure 26: Industry concentration of Product and Industrial Design occupations




Source: ONS (2017) Annual Population Survey, 2004–2016

Product and Industrial designers view physics skills (104% more important than average), engineering and technology (99%) and design skills (84%) as most important for their jobs. These skills are in demand across the economy, but are concentrated in the Architectural and Engineering sector (20% of those employed in design occupations) and Manufacturing of Other Transport sector (11%).

If we examine *design industries* and look at the extent to which *Product and Industrial Design occupations* fall within them, we find that 99% of people using these product and industrial design skills work outside the design economy definition of design industries. This breaks down as follows: 23% work in design-active industries and 76% of people in Product and Industrial Design occupations work in non-design industries.

## Conclusions

These findings provide important evidence of both:

how concentrated design occupations (and therefore skills) are within design and other industries, and

the extent to which design occupations (and skills) are concentrated in design industries.

The key points to take from the analysis are as follows:

There is a significant amount of variation between design skills when it comes to their concentration in design industries and the wider economy. Design skills tend to fall into three categories:

> Those where skills are highly concentrated in one industry and where a relatively high proportion of those skills are also diffused across the rest of the economy. In this category are Digital Design and Multidisciplinary Design.
>
> Those where skills are concentrated in a small number of industries and a smaller proportion are diffused across the rest of the economy. This category includes Architecture and Built Environment, Clothing Design and Graphic Design.

Those where design skills are employed widely across the economy. This category includes Craft Design, Product and Industrial Design and Advertising Design.

Another key conclusion from this analysis is that the design industries, as defined in the *Design Economy* study and in the current research, cover a relatively small proportion of design skills. Again, there is considerable variation across design groups. Design skills are therefore highly distributed across the UK economy, and this evidence should form part of the base that informs future decisions on how to define the design economy.

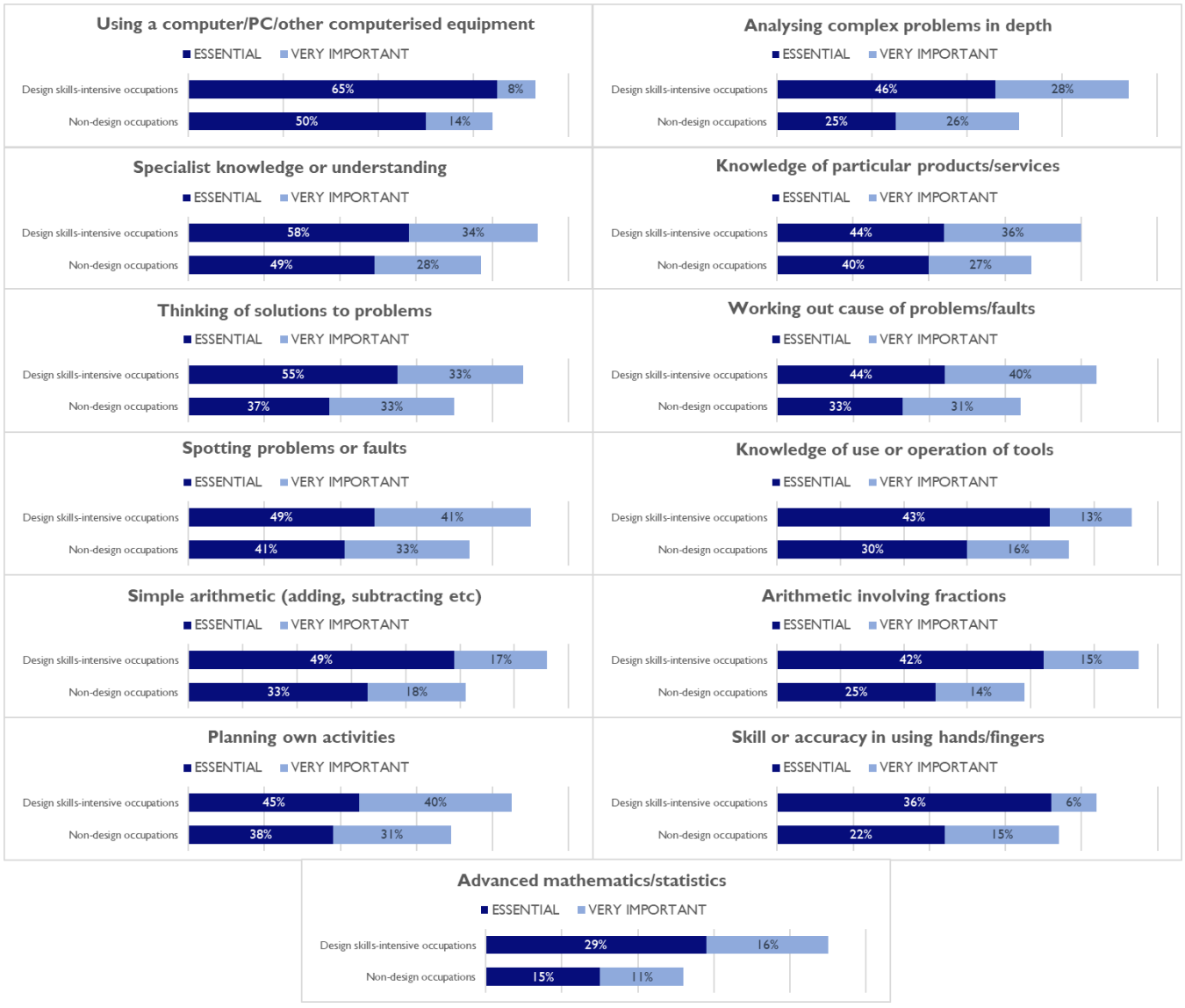
# Appendix 2: UK insight on important skills for design

The Taxonomy chapter examined the skills that designers say they have through a comparative analysis of the importance rating attributed to a wide range of skills. The underlying data is from the USA. However, a UK data source does exist which provides complementary insight into how UK workers rate the importance of different aspects of their jobs, albeit that the level of detail is significant below that provided by the O*NET dataset.

The analysis presented below is drawn from the Skills and Employment Survey 2012, run by Cardiff Business School. The underlying survey ask workers to rate the importance of parts of their job on a five-point Likert scale, between 'Not at all important/does not apply' and 'Essential'. The charts below, which cover the 13 job elements which are more important for Design than the whole economy, identify the proportion of respondents who rate each part as either Essential or Very Important.

The analysis confirms that the following skills and competencies are important for design: use of certain tools (e.g. computers); problem identification and solving; mathematics; knowledge of products, services and operations; manual dexterity; planning.

## Figure 27:




Source: Ortus Economic Research analysis of the Skills and Employment Survey (2012), Cardiff University

The dataset also identifies the following skills as being less important for design that the economy as a whole:

Dealing with people

Teaching individuals or groups

Counselling, advising or caring for customers/clients

Listening carefully to colleagues

Planning the activities of others

Cooperating with colleagues

# Appendix 3: Methodology

All analysis in this report is based on the most recent data available at the time of writing. The methodology for this research is designed to reflect and build on that used in the *Design Economy* research[76]. This appendix outlines the processes used for the analysis reported in this report.

## Defining designers

Designers are defined using the Standard Occupational Classification 2010, as set out in the *Design Economy* report.

### Table 21: Designers: Standard Occupational Classification 2010

| Design group | SOC 2010 | SOC description | Example job titles |
|---|---|---|---|
| Architecture and Built Environment | 2121 | Civil engineers | Building engineer, structural engineer |
| | 2431 | Architects | Architect, architectural consultant, landscape architect |
| | 2432 | Town planning officers | Planning officer, town planner |
| | 2435 | Chartered architectural technologists | Architectural technologist |
| | 3121 | Architectural and town planning technicians | Architectural assistant, construction planner |
| | 3122 | Draughtspersons | CAD operator, cartographer |
| | 5113* | Gardeners and landscape gardeners | Garden designer, gardener, landscape gardener |
| Multidisciplinary Design | 3422 | Product, clothing and related designers | Fashion designer, product designer, interaction designer |
| Advertising Design | 2473 | Advertising accounts managers and creative directors | Advertising manager, campaign manager, brand identity manager |
| Clothing Design | 5414 | Tailors and dressmakers | Fabric cutter, tailor |
| Craft Design | 5211 | Smiths and forge workers | Blacksmith, farrier |
| | 5411 | Weavers and knitters | Carpet weaver, knitwear manufacturer |
| | 5441 | Glass and ceramics makers, decorators and finishers | Glass blower, potter |

[76] Design Council (2015), *The Design Economy – The value of design to the UK*, http://www.designcouncil.org.uk/what-we-do/design-economy

| | | | |
|---|---|---|---|
| | 5442 | Furniture makers and other craft woodworkers | Cabinet maker, antiques restorer |
| | 5449 | Other skilled trades n.e.c. | Engraver, goldsmith |
| Digital Design | 2135 | IT business analysts, architects and systems designers | Business analyst, systems analyst, technical architect |
| | 2136 | Programmers and software development professionals | Database developer, games programmer, software engineer |
| | 2137 | Web design and development professionals | Internet developer, web designer, user interface designer |
| Graphic Design | 3411* | Artists | Illustrator, portrait painter, sculptor |
| | 3421 | Graphic designers | Graphic artist, graphic designer |
| Product and Industrial Design | 2122 | Mechanical engineers | Aerospace engineer, automotive engineer |
| | 2126 | Design and development engineers | Design engineer, research and development engineer |
| | 2129* | Engineering professionals not elsewhere classified | Metallurgist, project engineer |

Subject to the following exclusions: Employment/value in SOC 5113 is only included only where this occurs within SIC 71.11 and 81.30. Employment/value in SOC 3411 is only where people are working outside of SIC 90.03 and excludes those working in an educational setting. Employment/value in SOC 2129 is only included for those working in product and industrial manufacturing industries (SIC 13-32), other creative industries (as per the DCMS definition) or those identified as design industries).

Source: Design Council (2015) *The Design Economy 2015*

## Identifying the 13 skills used for design

The following five domains were examined in detail in the development of the taxonomy:

Skills

Knowledge

Abilities

Work activities, and

Work styles

These domains were selected because they provide data that can be used to develop the taxonomy and they align best to the aims and objectives of the study. For example, the Tasks domain was examined but excluded on the basis that the range of tasks applicable to different occupations was so diverse and variable that it did not support comparative analysis of one occupation against another.

Within the O*Net system, each domain is disaggregated into a number of 'elements'. For example, in the Skills domain, there are six sub-domains (e.g. basic skills, social skills, etc.) and these in turn are broken down into 35 elements (e.g. within basic skills, these include active learning, active listening, critical thinking and so on). We are therefore interested, in this analysis, in identifying the elements which are deemed most important by the design workforce in comparison with the workforce overall.

Note that whilst the O*Net system provides ratings for both **level** and **importance** for each element and by occupation, it was decided during the course of the analysis to focus solely on the **importance** scores. This was because the study is primarily interested in the skills which differentiate the design workforce from others, and that including level would complicate the analysis and potentially influence results such that they become difficult to interpret. In other words, the study is about what the design workforce does, not the level at which it does it. Additionally, some elements (e.g. 'innovation) are scored only on importance, so would be disadvantaged in any scoring system which used level also.

Using the existing SOC definition of design occupations, the prevalence of elements, relative to all occupations, was explored across the domains identified above using the data provided by O*Net on the importance of each element within SOCs. The methodology for identifying the elements which are more prevalent in the design workforce is as follows:

For the whole workforce, calculate the mean average 'importance' values from the O*Net data (note that the elements within the Work Styles domain are not given a level value).

For the design workforce (using the Design Economy SOC definitions), calculate the mean average 'importance' values from the O*Net data. Note that we also tested employing median averages as an alternative but discovered that this approach made no difference to the results.

For each element, calculate an 'Importance Premium' based on the values for the design occupations against the values for the whole workforce. For example, if the importance value for the Operations Analysis element for the design workforce is 2.79 and the equivalent value for the whole workforce is 2.09, we divide the first by the second and calculate an importance index of 1.33. When converted into a percentage, this gives an Importance Premium of 33%. We have done this for importance for every element in the domains of interest.

Given that the analysis thus far takes no consideration of the *scale* of presence of each skills in the workforce, and that without doing so we may over-emphasise highly niche design skills and under-emphasise widely prevalent skills, the next stage was to weigh the indices according to employment density. We therefore applied a weighting according to the employment scale of each design occupation (calculated as a proportion of the whole economy), based on the design group in which it sits (using the estimates in the Design Economy study, which is published at Design Group level). Note that we also tested the application of weighting by GVA but decided that employment was a better measure of skills density, whereas GVA might be a better measure of value. However, the link between skills and value is to be explored in the subsequent analysis, and therefore to introduce a value-based weighting at this point would interfere with the results later.

In order to identify the most prominent elements (i.e. skills) for the design workforce, for each domain those elements that achieved an Importance Premium greater than 0% for design occupations relative to the workforce as a whole.

## Identifying design-skilled occupations and design-active industries

The process of identifying design-skilled occupations (to complement the design economy definition of designers) was as follows:

Using the 13 design skills elements identified through the taxonomy analysis, calculate an Importance Premium for all UK SOCs.

Review each of the 13 design skills individually, examining and identifying the occupations with the highest Importance Premium scores for each.

Apply criteria 1 – apply a simultaneous filter on the Design element to ensure all candidate occupations have an Importance Premium for Design of at least 0%

Apply criteria 2 – simultaneously apply an Importance Premium threshold to identify those occupations which rate at least two other elements at least 50% more important than in the workforce generally. In the case of two elements – Thinking Creatively and Interacting with Computers – the threshold was lowered to 30% as there were no occupations with an Importance Premium of at least 50%.

Filter - identify all occupations which meet both criteria 1 (for at least two skills other than Design) and criteria 2 above.

Deduplicate any occupations which are already within the design economy definition.

Having identified design-skilled occupations, the approach used in the *Design Economy* research to identify design industries was employed. All industries with at least 30% of employment in either design occupations or other design-skilled occupation were defined as design-active industries.

## Identifying innovation-intensive industries

The process of developing the innovation skills taxonomy is similar to that employed to develop the design skills taxonomy, but with one important difference; the starting point for the development of the design skills taxonomy was to take a pre-existing definition of the design workforce (from the *Design Economy* study) and to investigate, using the O*NET database, how this workforce differs from the wider workforce in terms of skills. However, as far as we are aware there is no pre-existing definition of innovation-intensive occupations that we could use in a similar manner.

Therefore, we compared the importance premium for the Innovation element (within the Work Styles domain of the O*NET database) for each occupation. This provided the basis of a ranking of occupations by the importance of innovation. However, there are 157 UK occupations with an Innovation importance premium of 1% or above. It was agreed that a definition based on such a large number of occupations would be relatively meaningless and that a mechanism by which the number could be reduced was required. Given the nature and objectives of the study, its inherent focus on design and the fact that the design element is the strongest in our analysis of design skills, it was decided that firstly, a more stringent selection criteria should be applied to the importance of innovation, and secondly that the importance of design to individual occupations should also be taken into consideration.

The definition of innovation-intensive occupations is therefore SOCs with:

a minimum Innovation Importance Premium of 10%, *and*

a minimum Design Importance Premium of 10%.

Table 22: Innovation-intensive industries

| SIC 2007 | SIC description | Design skills-intensive? |
|---|---|---|

| | | |
|---|---|---|
| 14.19 | Manufacture of other wearing apparel and accessories | Clothing Design |
| 16.29 | Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials | Product and Industrial Design |
| 23.41 | Manufacture of ceramic household and ornamental articles | Craft Design |
| 23.49 | Manufacture of other ceramic products | Design-active industries |
| 62.02 | Computer consultancy activities | Design-active industries |
| 81.30 | Landscape service activities | Design-active industries |
| 95.24 | Repair of furniture and home furnishings | Design-active industries |
| 01.43 | Raising of horses and other equines | – |
| 01.62 | Support activities for animal production | – |
| 03.22 | Freshwater aquaculture | – |
| 13.30 | Finishing of textiles | – |
| 17.23 | Manufacture of paper stationery | – |
| 18.20 | Reproduction of recorded media | – |
| 23.11 | Manufacture of flat glass | – |
| 46.23 | Wholesale of live animals | – |

## Employment estimates

Employment estimates are taken from the Annual Population Survey (APS). The APS is the largest ONS household survey, and is based on the Labour Force Survey but includes a boosted sample. Each survey includes around 130–140,000 individuals who are in employment (either employed or self-employed). The survey provides a wide range of indicators including demographics, employment, education and health, though a relatively small number of variables are used in this report.

The report uses APS microdata, analysed within the Office for National Statistics' secure data facility using SPSS. Employment estimates include main jobs and second jobs. Estimates are weighted using the appropriate variables in each APS dataset.

## Financial calculations

Gross value added estimates are taken from the Annual Business Survey (ABS). The measure of gross value added used in this report is *approximate gross value added* (GVA), which is the measure recommended by the ONS when analysis at a detailed industrial level is required.

The ABS is the key ONS survey for understanding the detailed structure and performance of businesses across the UK, and is one of the main sources of business information in the UK National Accounts. Around 47–49,000 businesses are surveyed each year. The survey only includes businesses with VAT and/or PAYE schemes. In addition, the ABS covers only the non-financial business economy. It includes the production, construction, distribution and service industries, and represents about two-thirds of the UK economy in terms of GVA.

GVA measures the contribution to the economy of each individual producer, industry or sector in the United Kingdom. GVA is closely linked to Gross Domestic Product (GDP), the measure more commonly used at national level:

GVA + taxes on products – subsidies on products = GDP

The ABS provides GVA figures for design skills-intensive industries only. This is apportioned to design skills-intensive and non-design skills-intensive occupations based on their share of gross earnings in design skills-intensive industries. The earnings data used in this analysis are taken from the Annual Survey of Hours & Earnings (ASHE)[77]. Similarly, an estimate of the contribution to GVA of people working in design skills-intensive occupations outside design skills-intensive industries is based on their share of gross earnings (derived from the ASHE). GVA is measured in current prices (i.e. estimates are not adjusted for inflation).

Productivity figures are calculated by dividing GVA estimates by employment.

## Innovation activity

Innovation activity is measured using the UK Innovation Survey (UKIS), the main source of information on business innovation in the UK. The UKIS is the UK's contribution to the Europe-wide Community Innovation Survey (CIS), and is conducted following the guidelines set out in the Organisation for Economic Co-operation and Development (OECD) publication known as the Oslo Manual (OECD 2005). As well as methodological advice, this manual provides a review of the range of concepts that fall together under the umbrella term ‘innovation’.

The survey has a sample of around 16,000 UK businesses. Only businesses with 10 or more employees in sections B–N of the Standard Industrial Classification 2007, which are registered for VAT and/or PAYE, are included. The report uses UKIS microdata, analysed within the Office for National Statistics’ secure data facility using SPSS. Estimates are weighted using the appropriate variables.

Note that the Design and Innovation section contains a number of charts which report percentages (e.g. Figure 6, Figure 7, Figure 8) and the section on Design Skills Productivity Gaps contains a number tables also doing so (i.e. Table 16, Table 17, Table 18 and Table 19)41. The absolute values associated with these percentages are not reported but, where the data refers to employment, these can be calculated with reference to base numbers set out in Table 12.

## Recruitment, skills and qualifications, and training

[77] The ASHE is one of the largest surveys of the earnings of individuals in the UK. Data on the wages and paid hours of work of almost 1% of the working population (around 140,000–185,000 people) are collected. While limited in terms of detail on personal characteristics compared to the APS, the ASHE is useful not only because of its larger sample size, but also the responses regarding wages and hours are considered to be more accurate since the responses are provided by employers rather than from employees themselves. Estimates based on earnings data from the APS in *The Design Economy 2015* have been revised and updated in this report using data from the ASHE.

Several data sources are used to investigate skills-related themes in this report, including the UK Employer Skills Survey (ESS), the Skills & Employment Survey (SES) and the Workplace Employment Relations Survey (WERS).

The ESS is a biennial UK-wide survey of businesses, providing the most detailed picture of training, vacancies, skills gaps, and investment in training. Each survey has a sample of around 90,000 UK establishments with two or more people working at them (regardless of whether they own the business or not). The report uses data from the 2011, 2013 and 2015 surveys.

The SES aims to provide data on the skills and employment experiences of working life in Britain, including the level and distribution of skills requirements of jobs in British workplaces. The report uses data from the most recent survey conducted in 2012, with comparisons to the previous 2006 survey where available. The 2012 survey interviewed 3,200 employed adults; the 2006 survey had a larger sample of 6,600 employed adults.

The WERS is a national survey of employment relations and practices in Great Britain. The report draws on two components of the most recent survey, conducted in 2011: a survey of managers (around 2,700 respondents) and a survey of employees (around 22,000 respondents).

Analysis of these sources was undertaken in Ortus' secure data laboratory using SPSS. Estimates are weighted using the appropriate variables in each survey.

## Cost of skills shortages and skills gaps

The cost of skills shortages and skills gaps was calculated using ESS estimates of the number of skills shortage vacancies and the number of people not fully proficient in their current jobs in design industries, and multiplying these by estimates of GVA per head.

# Appendix 4: Data sources

Department for Business, Innovation and Skills, Advisory, Conciliation and Arbitration Service, National Institute of Economic and Social Research (2015) *Workplace Employee Relations Survey, 2011* [data collection]. 6th Edition. UK Data Service. SN: 7226, http://doi.org/10.5255/UKDA-SN-7226-7

Department for Business, Innovation and Skills, Office for National Statistics, Northern Ireland Department of Enterprise, Trade and Investment (2016) *UK Innovation Survey, 1994–2015: Secure Access* [data collection].

Felstead, A, Gallie, D, Green, F, Inanc, H (2014) *Skills and Employment Surveys Series Dataset, 1986, 1992, 1997, 2001, 2006 and 2012* [data collection]. 2nd Edition. UK Data Service. SN: 7467, http://doi.org/10.5255/UKDA-SN-7467-2

Office for National Statistics (2017) *Annual Business Survey, UK non-financial business economy: 2015 revised results* [computer file]. Downloaded 18 July 2017. https://www.ons.gov.uk/businessindustryandtrade/business/businessservices/bulletins/uknonfinancialbusinesseconomy/2015revisedresults

Office for National Statistics (2017) *Annual Survey of Hours and Earnings, 1997–2016: Secure Access* [data collection].

Office for National Statistics (2017) *Business Register and Employment Survey, 2009–2015* [computer file]. Downloaded from Nomis 17 July 2017.

Office for National Statistics Social Survey Division (2017) *Annual Population Survey, 2004–2016: Secure Access* [data collection].

U.S. Department of Labor, Employment and Training Administration (2016) *O*NET 21.0 Database* [computer file]. Downloaded 7 December 2016. https://www.onetcenter.org/database.html

UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2011* [data collection]. 3rd Edition. UK Data Service. SN: 7430, http://doi.org/10.5255/UKDA-SN-7430-3

UK Commission for Employment and Skills (2016) *Employer Skills Survey, 2013* [data collection]. 2nd Edition. UK Data Service. SN: 7484, http://doi.org/10.5255/UKDA-SN-7484-2

UK Commission for Employment and Skills (2017) *Employer Skills Survey, 2015: Special Licence Access* [data collection]. 2nd Edition. UK Data Service. SN: 7997, http://doi.org/10.5255/UKDA-SN-7997-2

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