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'Portfolio Professionals' in the digitised Built Environment = Education + Skills + Commercial Environment + Communications Network

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Authors: MacLaren, A., Thompson, N. for *dotBuiltEnvironment, 2017*

The Portfolio Professional

= Education + Skills + Commercial Environment + Communications Network

Abstract

Inspired by the Edge Commission Report 'Collaboration for Change' (Morrell, 2015) and ongoing Careers-Mapping research by the cross-industry network 'dotBuiltEnvironment', this paper presents a thesis on how, and why, the traditional view of the linear 'specialist' professional does not reflect the reality of the modern employment market. This leads to a concluding mandate to increase our cross-disciplinary teaching and learning in built environment Higher Education.

The paper references extant teaching initiatives and innovations across built environment disciplines, and professional criteria from CIBSE, RICS, CIOB, IStructE, and the RIBA¹. Links between professions and the emergence of the transient professional, frequently traversing the traditional institutional silos, will be discussed. New research from dotBuiltEnvironment will demonstrate graphically the evidence collected from multiple industry events and contributors, evidencing that the 'norm' in built environment career paths is a world away from the narrow definitions of institutional membership criteria. Observations will be made on communication networks; professional development; accreditation criteria and future models of employment.

We propose a 'portfolio professional' view, and provide a perspective which posits a fundamental shift in the operational framework for the institutions of the construction industry. We conclude by recommending a concerted evolution of built environment institute operations, and the development and delivery of multi-disciplinary and cross-sector learning in built environment education at all (lifelong) levels.

This paper is a collaborative endeavour from a group of young professionals across built environment disciplines, and representing consulting, contracting, policy and education sectors.

Keywords: Digital, Construction, Education & Skills, Multidisciplinary, Economics

¹ The Chartered Institute of Building Services Engineers; the Royal Institution of Chartered Surveyors; the Chartered Institute of Builders, the Institution of Civil Engineers, the Institution of Structural Engineers, the British Institute of Facilities Management, and the Royal Institute of British Architects.

Introduction

Interdisciplinary collaboration is imperative for success in the contemporary built environment industry. This knowledge sits at odds with an operational landscape divided into specialist professional institutions, and their uncoordinated accredited education and training. Hill *et al* (2013) argue that fundamental failings lie in the gaps between professional codes of the different professions, leading to an ethically incoherent position in which 'effective interdisciplinary work is assumed by many to be a necessity' (2013: 9) and is supported by institutional rhetoric, but not codified into action. Their solution is to propose one single 'ethical framework for the built environment professions' (2013: 22). This proposal is echoed by Morrell (2015), who argues that the most profound ethical challenge facing the construction industry is not the articulation of social or financial transactional propriety, but the imperative of sustainability in our built environment. It is through developing a shared response to climate change that institutions can best support built environment professionals in serving society, encourage young people to join the industry, and enable us to win back the respect and trust of the public (*ibid*).

At the same time, recent advances in digital technology and the subsequent effect on communications, transactions, the sharing of knowledge and the ability to create and utilise specialist networks, have democratised many of the activities previously within the domains of professional membership (MacLaren, 2016). It is possible to suggest, as Susskind and Susskind (2015) do, that this fundamental shift in the way professional knowledge is exchanged will reform the nature of professionalism itself. In this situation, the education of future professionals should also be subject to significant change. However, as the first section of this paper explores, the disciplinary-specific professional institutions who accredit academic courses are justifiably concerned with their own longevity as organisations, and tend to turn inwards to explore routes for developing education. This insular perspective is not conducive to educating inter-professional collaboration and communication.

In contrast, the membership of such organisations is increasingly restless. This is slowly being addressed through cross-institutional initiatives such as the '21st Century PEI' (professional engineering institutions) and the acknowledgement 'that an [engineer] will move through several PEIs during their career, depending on where that career leads them and their professional focus at that time.' (Meyrick, 2017). The flexibility and cross-disciplinary nature of built environment careers is supported by original research carried out by dotBuiltEnvironment presented in the second section of this paper, mapping the movement of individuals who navigate between Higher Education (HE), Further Education (FE) and Continuous Professional Development (CPD) providers in order to develop their careers to suit the developing workplace. It is argued that this landscape of professional activity contrasts starkly with the assumed 'professional role' inherent in the aims, objectives and operation of many construction institutions, formed in the very different economic context of the nineteenth century.

This emerging scenario (the changing nature of built environment **professionals**; the 'portfolio professional'), feeds into a discussion of contemporary transactional

relationships within the construction industry, reflecting the different economic landscape within which those individual agents now operate (the changing nature of built environment **professionalism**). This latter aspect is finally explored via an analysis of the historic relationship between remuneration, skills and productivity, that suggests a high incentive to automate previously significant elements of professional roles within the next decade (Susskind, 2017; Duffy & Rabeneck, Hill *et al.* 2013). The paper concludes by drawing on economic theory from Milgrom *et al.* (1990), Pendergast (1992) and Varian (2013) to explore the components of transactional relationships and incentives in order to identify the ways in which automation is likely to affect the professions, and highlights the importance of individuals maintaining a broad contextual awareness and of retraining in contemporary skills.

Education

Professional Institutions accredit specific undergraduate and postgraduate degrees at higher education institutions (HEI). Some also accredit further education (FE) and continuing professional development (CPD) courses, to suit additional, sub-chartership levels of institutional membership, for example Incorporated Engineer and Engineering Technician. Seeking the best employment prospects for their students, and a clear endorsement of their educational provision, FE and HE providers develop their curricula in response to institutional accreditation criteria. Institutions therefore bear a responsibility for developing criteria that support the future marketplace. Their accreditation requirements prescribe the parameters for educating the professionals of tomorrow.

An increased rate of change of the professional landscape has made this projection all the more difficult; and all the more essential. Most fundamentally, institutions must embrace the necessity of integrated collaborative working in the construction industry, and urgently seek to co-operate and correlate their wildly diverse accreditation criteria and processes in support of this.

Institutional accreditations require the mapping of specific, complex criteria over curricula spanning several years. The weight of institutional prescription leads to minimal options for modular or generalist study, especially at undergraduate levels. There is an emphasis on direct subject-specific learning, and a focus on the carefully-curated semantics of each criterion, leading directly to specialised course content specific to the accrediting institution. Over an extended period this, coupled with a narrowing focus of specialisation amongst lecturing academics (Tennant *et al.*, 2015), has been a contributing factor in the development of focussed, abstract, specialist and professionally isolated degree programmes.

Promisingly, recent revisions to many institutional criteria have incorporated direct acknowledgement of the importance of cross-disciplinary awareness and collaborative skills. Auditing a sample of current accreditation criteria from four leading built environment institutions, references to 'cross- or multi-disciplinary', 'co-professionals', and/or 'teamwork' / 'collaboration', appear across all those sampled. The Chartered Institute of Building Services Engineers (CIBSE) raises these issues

in three criteria (ref: A2, C1, D3); the RIBA in four of their forty-four points (ref: GC 5.1, 6.1, 7.3, 11.2); the Royal Institute of Chartered Surveyors (RICS) in three of their *Assessment of Professional Competence* requirements; and the Chartered Institute of Builders (CIOB) three times, in their 2013 Framework for Undergraduate Education. These citations have increased in frequency with recent revisions. This raised awareness parallels an increased interest from HEIs in promoting 'Graduate Attributes' of professionalism, citizenship and associated qualities across their disciplinary programmes (Oliver, 2013). The advent of freely-available knowledge, peer-reviewed and open for access via the internet, has reinforced the demand for university degrees, and professionals themselves, to deliver skills and abilities, rather than to transfer knowledge; which is increasingly available without cost, though of varying quality, online.

Observations of the changing value of a university education are reinforced by the 2016 'Future of Jobs' Survey and Report from the World Economic Forum (WEF, 2016). This international report suggests that the greatest skills in demand when current school-leavers graduate from their undergraduate degrees or apprenticeship training will be 'complex problem solving', 'social skills', 'process skills' and 'resource management' (figure 1). These are skills that by necessity and definition cross disciplinary boundaries and require a developed awareness of, and ability to collaborate with, individuals with different expertise to our own.

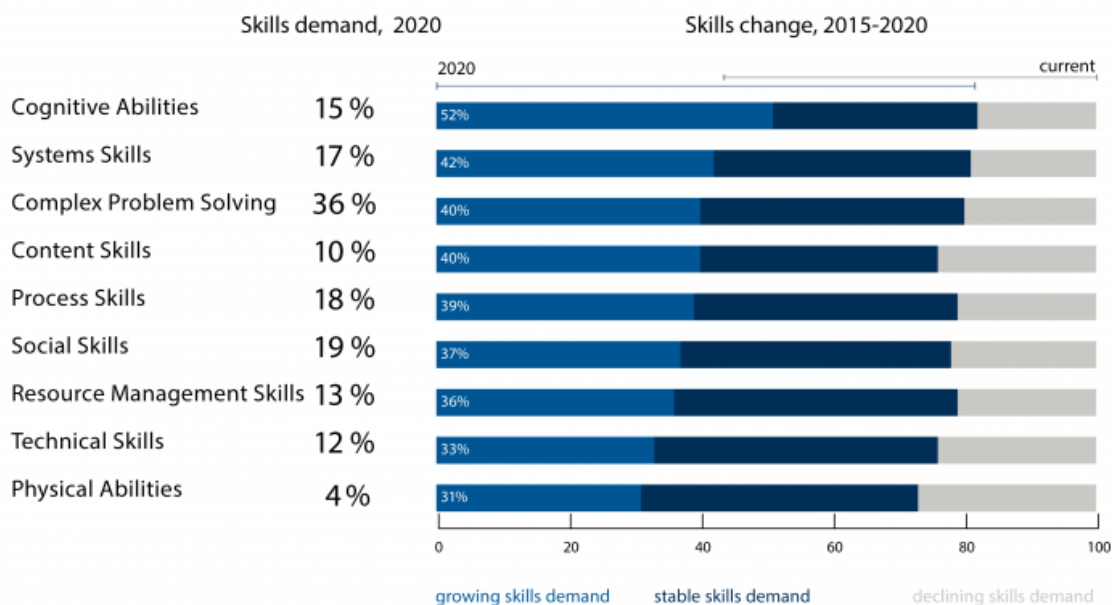


Figure 1: Change in Skills demand and composition. Source: Future of Jobs Report (WEF, 2016).

'Tacit learning-in-action' and 'skilled behaviour' (Eraut, 1994) and are better taught in cross-disciplinary groups; a forum more similar to that the students will experience in industry, and more effectively allowing students to practise the interpersonal and communications skills they will require when operating in their disciplinary role alongside other specialist colleagues. Institutional criteria need to recognise the

imperative of offering this type of education in accredited programmes. This is keenly felt at the undergraduate level, but remains applicable in discussions of Further, Post-Graduate, and CPD education.

Careers Mapping Evidence

Research by dotBuiltEnvironment (MacLaren and Birchall, 2016) has highlighted the increasing number of people returning to education in mid or late career, to retrain and update contextual knowledge to support professional advancement.

dotBuiltEnvironment developed a simple framework for mapping individuals' career paths across a graphical representation of the silos represented by traditional built environment institutional memberships (figure 2). The 'y-axis' detailed a series of professional identities or roles; the 'x-axis' indicated time. Red dots were used to indicate education or training, and blue dots were paid employment. In each case only events of a minimum of six months' duration were including, seeking to exclude periods of work experience or workplace CPD.

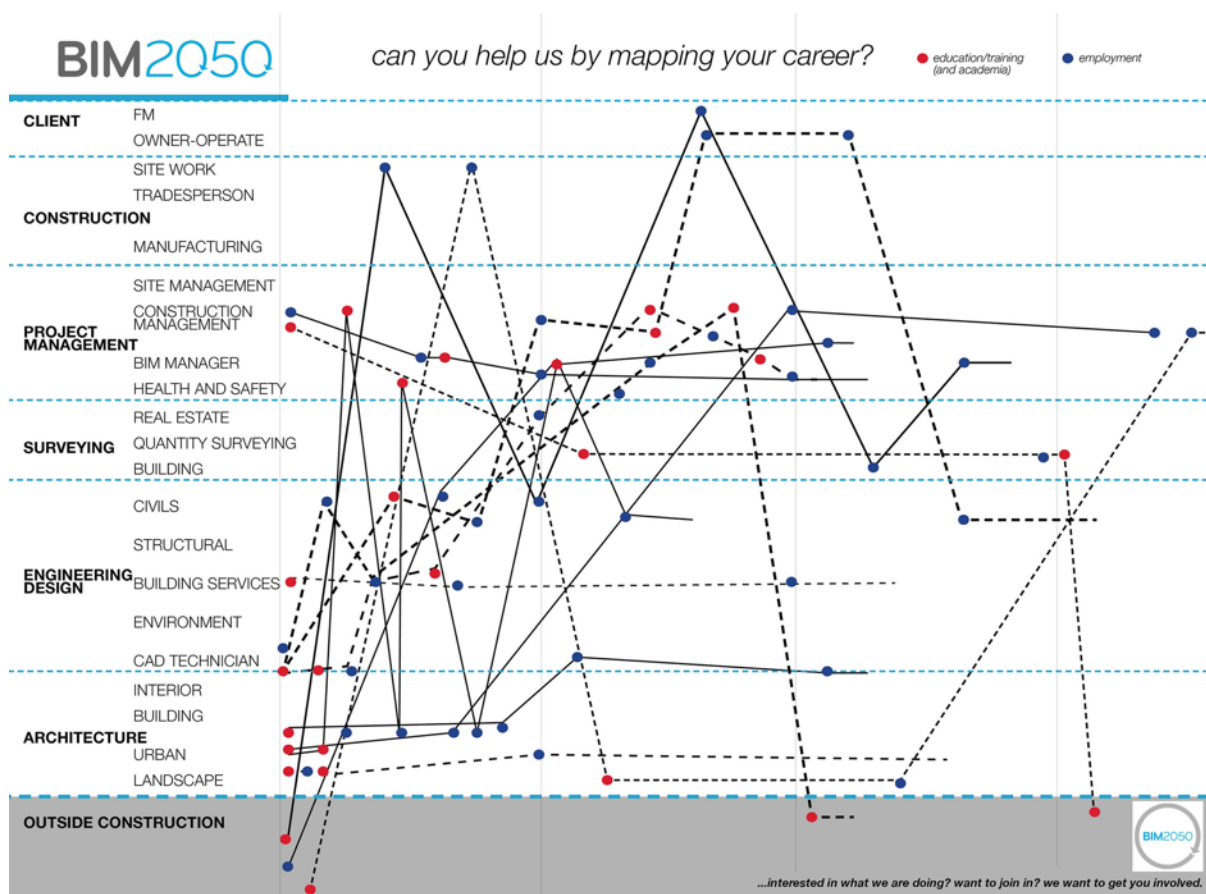


Figure 2 : 'Careers Mapping' (example) Completed by dotBuiltEnvironment (then 'BIM2050'), with attendees at 'Digital Construction Week' 2015. The chart shows 12 individuals' career paths to date. (source: dotBE, 2017)

What began as a playful way of engaging professionals and eliciting commentaries on their experience of the construction industry, became a fascinating visual representation of the movement of professionals between disciplines (figure 2).

dotBuiltEnvironment has now run this exercise at multiple events (*Digital*

Construction Week 2015; Construction Industry Summit 2016; CIBSE/ASHRAE Technical Conference 2016). It should be recognised that the participants are generally self-selecting, and the events attended have had a majority attendance from those engaging specifically with the digital frontier of current industry activity: the results cannot be held to accurately represent a cross-section of the industry.



Figure 3 : 'Careers Mapping' (example) completing the mapping exercise in conversation. (source: dotBE, 2015)

The charts do reveal trends worthy of further investigation. Firstly, and most importantly, a clear spread of 'educational' experiences across the x-axis, indicating engagement with education mid and late career, and often coinciding with a change in the y-axis; a move between professional silos. Secondly, a trend towards construction project management in later career, especially from those who began in engineering education. Finally, the conversations revealed a requirement for a more nuanced understanding of professional activity, requiring the mapping of work in policy and research; understanding institutional overlap (widespread, but most noticeable between CIOB and RICS); and developing differentials in some areas (site and office based work, for example). The mapping framework is currently under development and **dotBuiltEnvironment** hope to secure funding to launch an online self-administered version in 2017-18.

It is apparent that in a fast-changing workplace, individuals will be required to re-train repeatedly throughout the multiple decades of their careers. It is also clear that professional individuals choose to re-train or to move into new roles at the boundaries of their disciplines, or entirely outwith their previous experience. This may be a result of the extended working life expectancy, or a growing understanding, amongst professionals working in industry, of the value of a breadth of understanding and skills, and of tacit, extra-disciplinary knowledge. Standing (2011) goes so far as to suggest that the contemporary professional consciously seeks this transient 'portfolio' professional identity;

Alongside the salariat, in more senses than one, is a (so far) smaller group of 'proficians'. This term combines the traditional ideas of 'professional' and 'technician' but covers those with bundles of skills that they can market, earning high incomes on contract, as consultants or independent own-account workers. The proficians are the equivalent of the yeomen, knights and squires

of the Middle Ages. They live with the expectation and desire to move around, without an impulse for long-term, full-time employment in a single enterprise. The 'standard employment relationship' is not for them.

(p8)

The contemporary 'profician' posited here calls into question two fundamental tenets of the c19th professional institution; the division between 'skilled workers' and 'professionals'; and the specialisation of professionals into recognised and delineated roles. To paraphrase Standing; the 'standard institutional membership' is not for them.

Tacit knowledge, and Skills

The division of 'education' and 'skills' has previously been equated to higher education and further education respectively; or in traditional role descriptors, differentiating the more highly-educated 'white collar' workers, and their lesser-educated, skills-based colleagues, 'blue-collar' workers (Gallie, 1996). The industrial revolution had an extraordinary impact on the roles of and demand for blue-collar workers. The current context of digital revolution, termed by the World Economic Forum the 'fourth industrial revolution' (2016), is instead most clearly targeting the functions of 'white-collar' workers including those in more complex administration. These roles may be attractive to automate in the advancement of machine learning and the speed, accuracy and reliability of digital transactions. This is a new realisation: machines can automate more than we had until recently believed. The example of driverless cars explored by Susskind (2017) is a clear example, leading to the suggestion that "tasks that require 'tacit' knowledge are at greater risk" (p12). This latter group of roles includes several functions hitherto undertaken by chartered professionals from built environment institutions. In the short and medium term, members of professional institutions will find their employment functions parsed and sometimes replaced by AI. Built environment institutions will find themselves representing individual members whose jobs are threatened by machination and automation; perhaps a novel position for professional institutions, but a scenario very familiar to the Trade Unions representing those whose jobs were mechanised and automated decades ago.

Communication Networks

In addition to this potentially fundamental change in their role as a membership organisation, institutional autonomy is threatened by changes in modern society, summarised by Broadbent *et al* (1997) as 'institutionalised control...being degraded by the introduction of systems of individual accountability based on customer reaction'. 'Traditional institutions rely on hegemony of controlling communications between groups, and of the inherent power in connecting communities of people-now democratised / made open by the internet' (Moser, 2014). New technology, particularly social media, have allowed peer and client networks to come into being outside of institutional control, with a speed and agility that ensures their relevance to modern practice. Cumbersome institutions are unable to react so swiftly, and their

imposed bureaucracies and boundaries of operation can render their networks less valuable than those emerging externally.

Communications networks threaten to transform the landscape at both the institutional network level, and the 'node' level- in the role of individual professionals. In order to understand the threat to professional roles from advances in digital technologies, we can explore the dynamics of information networks and flow. The following analysis assumes that business models and employment structures are influenced by the nature of their transaction costs in a market: a fair assumption amongst economic theorists. Transaction costs characteristics are introduced to present why information technology will fundamentally change how employment contracts are structured and incentives are designed.

There are two main types of transaction cost:

1. **Coordination costs**
2. **Motivation costs**
 - a. informational incompleteness and asymmetries.
 - b. imperfect commitment.

Transaction costs are bounded by five attributes (Williamson 1985) listed in Milgrom & Roberts (1992). It is worth noting that these costs are difficult to identify and separate from production costs:

1. The **specificity** of the investments required to conduct the transaction.
2. The **frequency** with which similar transactions occur and the duration or period over which they are repeated.
3. The **complexity** of the transaction and the uncertainty about what performance will be required.
4. The **difficulty of measuring performance** in the transaction.
5. The **connectedness** of the transaction to other transactions involving other people.

These mechanisms have been studied in terms of procurement systems. Google's Chief Economist Hal Varian (2013) found that Kickstarter projects (crowdfunding with the promise of 'perks', delivered via an open-access website) are the optimal routes of procurement. This demonstrates an interesting outcome for the design of incentives for delivering goods and services (including employment contracts) because applying an individual's skill and capacity to work in this way supports a possible market place for portfolio professionals. Pendergast (1999) tested a range of incentive scenarios and observed that incentives are more effective in forms of pay for performance and prize money. Team-based pay was not as effective. Pendergast also found that agents still shirk and pursue personal gain to the inefficiency of the firm, despite using optimal incentive schemes. This generates an interesting challenge to current research in collaborative procurement of infrastructure.

For the purposes of this paper we posit that the structure of digital crowdfunding platforms can be seen as a proxy for an employment market for portfolio professionals. If team-based incentives are not as efficient as incentivising the individual, and the optimal procurement method for products and services is via crowdsourcing, what does this mean for employment and delivering projects? Are we incentivising moral hazard in current collaborative working structures? As technology enables a major shift in transaction cost profiles, we will see disruption in current business models? Perhaps the crowdsource model provides insight into what a future employment model looks like for coordinating resources for delivering projects?

Commercial Environment

As introduced above, the nature of employment is driven by our commercial environment. This environment is based on the configuration of the transaction costs; however, transaction costs can be difficult to measure and separate from production costs. The following (Thompson, 2013) is an illustration of the outcome of different configurations of the characteristics of transactions presented previously.

The aim is to identify roles via the average remuneration of employees in construction firms. The data used calculates average remuneration by dividing the aggregate remuneration of a firm by the number of employees. This does not provide information about the distribution of wages within a firm, and accounting data can be inconsistent with the reality of the firms' operation as figures are supplied annually.

The current cross-section of employment patterns is captured in Figure 4. It shows the average remuneration per employee for different members of the supply chain. This analysis assumes that level 2 employees' work is infrequent, more complex and requires a high level of skill (such as a mechanical engineer). The level 4 employee works more frequently on less complex tasks and require less skill (such as a plant operative).

Average Remuneration Per Employee
2004 - 2013 (£th)

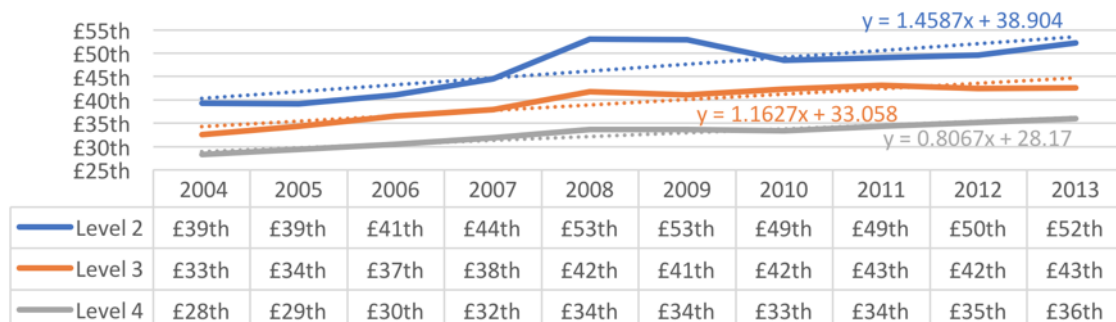


Figure 4: (Thompson, 2013) Level 2 = Tier 1 Suppliers (contractors and consultants), Level 3 = Tier 2 (Contractors and specialist consultants), Level 4 = Plant, material and product suppliers. SOURCE Financial Analysis Made Easy database. Sample size 327 (not including firms turning over less than £100,000).

Allen (2006) suggests that lower wages give little incentive to automate, whilst higher wages incentivise capital investment in automation.

This is the crux of a possible crisis for professionals and their respective institutions, as the rate of change and base level of pay is much higher than the other levels. Innovation is generally a commercial driven factor as a function of annual labour rates vs rate of return on capital investment on new equipment/software. As soon as technology reaches a price point that is below the annual rate of employment, the role is automated (Allen 2006). This is only one side of the construction wages coin, the other side is the role of building cycles (Barras, 2009) and the cobweb effect of labour costs (Ive & Grunberg, 2000). However, this paper suggests that transaction costs impact both sides of this dynamic.

This means the professions are possibly next in line for role automation in the fourth industrial revolution. Bonekamp & Sure (2015) introduce the role of unemployment in Industry 4.0 and Frey & Osborne (2013) and Bowles (2015) introduce the automation of some professional roles, but more research is required to explore the impact of Industry 4.0 on the professions as most research in this area focuses on the automation of low skilled labour.

Conclusion and Recommendations

This paper is written in support of the emerging 'portfolio professional' in construction. We have demonstrated the emergence of this cross-disciplinary skilled worker, navigating a career path traversing traditional specialist silos, and developing networks, transactions and operations outwith the provision of the institutions traditionally designed to provide her with support.

She is likely to re-train for a sustained period at several points throughout her career. She is extremely unlikely to remain with a single employer for the duration of her career, and may well explore different and emerging forms of employment derived from new transactional behaviours, developed in response to market forces and digital abilities. She may find her early-career roles increasingly taken over by AI as machine learning develops, and as she moves through her career, she will seek support and direction in this rapidly-developing scenario from trusted networks and sources of knowledge.

Professional Membership Institutions and Educational Institutions seek to be those trusted sources of support, advice and development. We have argued that many of the founding tenets and assumed behaviours of these organisations are rooted in a context no longer applicable to the rapidly-changing environment of industry operation. If built environment institutions and higher education providers wish to continue to be relevant to this new breed of portfolio professionals, they must review

their aims and operations in the light of these new external pressures operating on their members and putative students.

We recommend that Institutions, as a matter of urgency, work together to produce correlated criteria, and to lead the industry in developing future skills in students and trainees. We recommend that institutions (educational and professional) prepare for an increasingly age-diverse profile of students and entrants to membership, as individuals re-train throughout their careers: and actively prepare for this scenario by providing new (inter-disciplinary) routes to membership and more flexible education provision.

Table 1: Recommendations for Construction Institutions

Recommendation	Detail	Reasoning
Collaborate inter-institutionally	<ul style="list-style-type: none"> • Agree common approaches to accreditation • Adapt criteria to incentivise practice-based, collaborative learning 	<i>To support the acknowledged requirement for multidisciplinary skills, in order to meet core sustainability targets and future needs.</i>
Revise scope of membership	<ul style="list-style-type: none"> • Consider new routes to membership that recognise mid- / late- career-change • Consider possibilities for membership parity/conversion between institutions 	<i>To support an increasingly transient inter-disciplinary professional membership, with a wider age span and ex-disciplinary ambitions</i>
Review function / operation	<ul style="list-style-type: none"> • Review required support for members in a knowledge/sharing economy • Review support for members who may imminently face roles being taken over by AI 	<i>To advise and support members in a rapidly developing economic context, preparing for more diverse employment experiences</i>
Invest in Communications	<ul style="list-style-type: none"> • Develop more agile means of communicating with membership and delivering intra-institution CPD and networking • Consider provision of resources freely-available online 	<i>To modernise the operation on institutions, demonstrating value in a context where knowledge is readily available freely online</i>
Pilot emerging professional structures	<ul style="list-style-type: none"> • Engage with emerging means of transacting operations (blockchain, machine learning) 	<i>To lead the advent of professional operation in the context of a digital economy</i>

dotBuiltEnvironment is formed of and represents early and mid career professionals across the built environment. We are aspirational for our industry, whilst admitting the fundamental failures of our current operation. Construction is an industry we are proud to be part of, but we cannot currently be proud of our output. McKinsey (Changali, 2015) show 98% of projects are >30% over budget and on

average 20 months late. They also demonstrate that construction productivity is lacking by 33% when compared with global industrial average (\$25p/h and \$37p/h respectively) this inefficiency represents 2% of global GDP (\$1.6 trillion) (ibid). Failures of communication are at the core of much of this inefficiency, and we look in vain to our institutions to lead the way in providing collaborative platforms for improvement, and to use their position to develop educational and professional structures that will benefit industry.

Returning to the key tenet of the Morell (2016) report, the effective production of sustainable buildings and environments is predicated on an informed, collaborative workforce of skilled professionals, continuously improving their practice. This is the future we must support. Institutions must relinquish their roots in protectionist specialism and profile development, and must instead develop as we have shown, to support a sustainable, efficient construction industry which is able to generate wealth and wellbeing.

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