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Housing performance evaluation: challenges for international knowledge exchange

Fionn Stevenson ^a and Magdalena Baborska-Narozny^b

^aSchool of Architecture, The University of Sheffield, Sheffield, UK; ^bFaculty of Architecture, Wroclaw University of Technology, Wroclaw, Poland

ABSTRACT

Developing effective building performance evaluation and feedback processes is a vital part of global efforts to reduce building energy use and gain insight into the actual performance of buildings and technologies. Although attempts have been made to introduce internationally agreed models for these processes, it is clear that various countries are producing different approaches according to their cultural, institutional and policy differences. Knowledge exchange is potentially a key means of developing a shared understanding of values, meanings and practices in relation to building performance evaluation. This paper identifies cultural and institutional barriers in the European Union for international building performance communities of practice utilizing knowledge exchange, from an experiential ‘real-world’ perspective. The preparation of a 30-month research project to help develop building performance evaluation in Poland and an associated bilateral symposium is closely evaluated through an action research case study in terms of the stakeholders, the national contexts in which they operated and the key challenges they faced. Recommendations are then made in terms of the support needed to develop more responsive research programmes in relation to developing international knowledge exchange, and the capacity-building elements required for these international communities of practice.

KEYWORDS

building performance evaluation; communities of practice; culture; feedback; housing; international policy; knowledge exchange; performance assessment

Introduction

The need to address issues of climate change through improved building performance is critical according to the latest International Panel on Climate Change (IPCC) 5th Report (2013). Globally, housing is the single largest emitter of all CO₂ emissions in terms of all building development (Jennings, Hirst, & Gambhir, 2011), and households represents around 19% of all greenhouse gas end-user emissions in the European Union (EU) with over 800 million tonnes equivalent CO₂ emissions per year (European Commission, 2014a). Housing also routinely emits more than 2.5 times the amount of carbon emissions compared with design predictions in the UK (Innovate UK, 2016a). Developing effective building performance evaluation (BPE) processes for the housing sector is therefore vital to reduce carbon emissions and gain insight into the actual performance of buildings and technologies (Leaman, Stevenson, & Bordass, 2010).

The broad definition of BPE adopted for this paper is as follows:

a systematic and rigorous approach encompassing a number of activities including research, measurement, comparison, evaluation, and feedback that takes place through every phase of a building’s lifecycle including: planning, briefing/programming, design, construction, occupancy and recycling.

(Mallory-Hill, Preiser, & Watson, 2012, p. 3)

BPE has its roots in the early building monitoring and post-occupancy evaluation (POE) that developed in the 1960s and 1970s (Markus, 1972; Sanoff, 1968). A number of reviews have covered its global development over the last six decades (Göçer, Hua, & Göçer, 2015; Hadjri & Crozier, 2009; Mallory-Hill et al., 2012; Stevenson, 2009), but no conclusive evaluation of all the methods and methodologies is available, as they vary between disciplines and typologies (Chiu, Lowe, Raslan, Altamirano-Medina, & Wingfield, 2014; Sanni-Anibire, Hassanain, & Al-Hammad, 2016). There have also been attempts to provide internationally agreed models for BPE processes by Preiser and Schramm (2012) and others. The International Standards Organization (ISO) notes, however, that:

CONTACT Fionn Stevenson  f.stevenson@sheffield.ac.uk

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The characteristics and relevance of local contexts make the co-existence of regional and national methods for the assessment of the environmental performance of buildings possible . . .

(ISO, 2010, p. 6)

The challenge presented by the ISO is reflected in some of the typically differing approaches to BPE that occur in countries according to their cultural, institutional and policy differences. In the UK, there is a strong pragmatic emphasis, stemming from a 'Real World' research agenda (Robson, 2002), which informed the development of the first UK government-endorsed national BPE programme (Innovate UK, 2016b). When the UK author of the current paper first presented this programme in the US at a BPE symposium (EDRA, 2012) it became clear that the US audience was more wedded either to a systematized building science approach (Brager & Baker, 2009; Park, 2015¹; Prieser & Vischer, 2005) or to a more qualitative environmental behaviour approach (Zeisel, 2006), with relatively little crossover. In Germany, there is the maxim '*Wenn schon, den schon*' – if a job is worth doing, do it properly (Galvin, 2011). As such, their POE studies tend to have a rigorously technical element, as in the Passivhaus programme.² In Italy, the emphasis has been largely on conservation values, given the historic nature of its building stock (Fontana, 2012). For Australians, BPE is used to question overly rigorous building standards in a country with a tradition of challenging authority and a strong emphasis on living outdoors (Williamson, Soebarto, & Radford, 2010). In South America, BPE can be linked to a strong tradition of social justice in this region and the development of effective affordable housing (Barbosa Villa & Walber Orenstein, 2013).

The situation in some Eastern European countries such as Poland has also proved particularly challenging in terms of developing BPE. Poland emerged in the 1990s from relative isolation with an acute post-war shortage of building stock. A rapid building programme followed to address this fact. A steep learning curve for the Polish construction industry occurred when international property (real-estate) actors imposed new rules on the commercial sector (Heeg & Bitterer, 2015). In housing, however, the international corporate actors were absent and spatial planning also weakened substantially (MIB, 2016). The market became dominated by the prevailing self-build economy and private developers. These actors replaced the economically inefficient housing cooperatives. The learning process in the housing sector was heuristic, driven by an immature market characterized by supply shortage and inexperienced stakeholders (Adamczyk, 2015). A lack of focus on long-term quality coincided with lack of performance-based

benchmarks and clarity on what 'best practice' should be (Rozwadowska, 2013). Years of a centrally planned economy have resulted in parallel realities (the 'official' and the 'actual' building processes) due to low trust in top-down-imposed guidelines (Kolczynska, 2015; Nowakowski, 2008) and a belief that the 'invisible hand' of the market can best solve any issues (Balcerowicz, 1995). This habituated mismatch between official aims and project outcomes is a key challenge to the transfer of BPE knowledge and understanding between countries. In Poland, for example, the regulated air-tightness target is more ambitious than in the UK. However, unlike the UK, actual as-built performance testing has never been a standard industry practice or a regulatory requirement. Poland also tends to have either quantitative monitoring studies (Nowak & Nowak-Dzieszkowski, 2017) or qualitative POE studies (Ostanska, 2017; Tymkiewicz & Kucharczyk-Brus, 2017) related to BPE, unlike the more holistic UK BPE discourse that has developed (Chiu et al., 2014). As such, a broader BPE discourse, which bridges qualitative and quantitative methods, is only just beginning to emerge in Poland (Baborska-Narozny & Bać, 2013; Baborska-Narozny & Stevenson, 2017).

All the above differences in BPE studies, as related to the historical development and embedded cultural values in particular countries, highlight the need to understand the limits to any global homogenization of BPE methodology due to differing assumptions, attitudes and approaches. This involves taking account of national and localized building cultures (Cole & Lorch, 2003) when developing any international platforms for sharing BPE practice. This case-based paper aims to identify cultural, policy and practice barriers preventing BPE knowledge exchange, specifically between two countries within the EU, from supporting international BPE communities of practice, to questioning the common assumptions that underlie policies and processes in these contexts, and to beginning to define a more nuanced approach towards the internationalization of BPE processes.

The paper is structured as follows. The next section sets out the theoretical basis for examining the effectiveness of knowledge exchange in relation to BPE communities of practice and their cultural values. The third section identifies institutional barriers presented by EU funding policies. An action research case study follows in the fourth and fifth sections, which explores knowledge exchange issues related to transferring BPE 'know-how' between UK and Polish researchers and communities of practice through mutual learning. The paper concludes with key insights and recommendations for future work related to embedding international knowledge exchange for BPE development in the EU context.

Theory

Action research involves iteration, incorporating research, reflection and action in a cyclical process to achieve practical solutions for issues of pressing concern with researchers working directly with other stakeholders to achieve this (Reason & Bradbury, 2008). The authors use the relatively unusual approach of interrogating their own case study in a reflexive manner³ (England, 1994) in order to deepen their understanding of the knowledge-exchange processes and contexts in which they are involved and to learn from this (Wilner et al., 2012). The theoretical relationship between knowledge exchange and international communities of practice, and how this relationship is affected by cultural practices, provides a coherent platform to examine the multidimensional issues involved in developing cross-cultural BPE.

Knowledge transfer and exchange

‘Knowledge transfer’ was a developing process in the 1990s that ‘pushed’ messages from producers of research to users. ‘Knowledge exchange’ (KE) emerged as new concept when it became clear that the successful uptake of knowledge needed genuine interaction among researchers, decision-makers and other stakeholders (Lavis, Ross, McLeod, & Gildiner, 2003). The theoretical definition for KE adopted here is a procedural one derived from management as an act of transferring knowledge that has already been shared in a community of practice (CoP) (Glowitz, 2015). The key criteria for KE to be effective are (Young, Corriveau, Nguyen, Cooke, & Hinch, 2016):

- the perceived merits of the knowledge by the potential users
- the character and motivation of the knowledge provider picked up by the potential user, and
- the social and political context in which the new knowledge and user operates

There are different interpretations for these criteria according to the stakeholders involved, leading to different knowledge preferences and normative expectations (Young et al., 2016) which need to be overcome for KE to be successful, particularly between different communities of practice.

Communities of practice

Typically a BPE CoP is framed in terms of its identity, function and the capability it produces. It consists of a joint enterprise that is continually renegotiated by members who are bound together through mutual engagement

which develops for the group a shared repertoire of communal resources over time (Wenger, 2003, 2010).

The development of BPE CoPs is aided through the use of ‘boundary objects’, and ‘brokers’ who promote KE using mutual and situated learning. Boundary objects are physical or virtual entities such as building monitoring datasets that allow BPE CoPs to form and develop working relationships, and allow local understandings to be reframed in the context of wider collective activity (Bechky, 2003). A BPE broker will aim to translate, coordinate and align perspectives between BPE CoPs using these boundary objects among other means. Effectively, this broker translates knowledge created in one BPE group into the language of another so that the new group can integrate it into its everyday practices. Brokers need to be able to evaluate the knowledge produced by the different BPE CoPs to which they belong and to earn the trust and respect of the various parties involved. This can then lead to the development of a shared repertoire between these CoPs such as agreed rules, procedures and boundary objects (Kimble, Grenier, & Goglio-Primard, 2010).

There has been extensive study concerning how CoPs operate in the built environment sector (Bresnen, 2013; Faulconbridge, 2010; Love, Edwards, Love, & Irani, 2011; Ruikar, Koskela, & Sexton, 2009). KE can help to develop BPE methods both formally and informally between BPE CoPs operating at local, national and international levels through a variety of brokers working across BPE networks, seminars, conferences and platforms and within practice. Explicit BPE boundary objects used by brokers typically consist of existing sets of rules, technologies, research projects, documents and drawings (Kimble & Hildreth, 2005). But what values and practices underlie the use of these methodological objects?

Cultural practices

BPE methodology has recently taken a ‘practice’ turn (Schatzki, 2002) with the new understanding that building performance is informed by ‘know-how and habits’ alongside ‘institutionalised knowledge and explicit rules’, ‘technologies and products’ and ‘engagements’ (Bartiaux, Gram-Hanssen, Fonseca, Ozoliņa, & Christensen, 2014). This goes beyond traditional BPE survey methods and helps to explain the building performance gap in terms of bundled-up interactions between occupants, the technologies they use, and other human and non-human influences. This approach was developed in Denmark by Gram-Hanssen, and has now been picked up by others in the UK (Chiu et al., 2014). The hidden tacit values and *in-situ* types of knowledge acknowledged with this socio-technical ‘practice’ turn (Vlasova & Gram-Hanssen, 2014) are also particularly

difficult to surface and share within professional BPE CoPs (Gann, 2003). These aspects of practice draw on a cultural set of attitudes, beliefs, behavioural norms, and basic assumptions and values that are shared by a group of people within a particular society, and which influence each member's behaviour and their interpretation of other people's behaviour (Oliver, 2003; Spencer-Oatey, 2000). These assumptions often fall below the perception radar of stakeholders, when BPE CoPs from different countries are trying to make sense of a BPE problem (Bird & Osland, 2005). Vlasova and Gram-Hanssen (2014) go on to state that: 'Society's implicit or informal values constitute the limits of what is considered a possible or an impossible choice...' (p. 514). Understanding how culturally bounded BPE practices come up against assumptions at an international level can help to reveal where the limits and key challenges are for developing specific international CoPs through KE in BPE (Gann, 2003). This is discussed next in a European context.

Case study: UK and Poland BPE knowledge exchange

The Marie Skłodowska-Curie Action within the EU Framework for Research and Innovations programmes aims to develop 'high quality and innovative research training and knowledge sharing opportunities' (European Commission, 2014, p. 4). The authors of the present paper – a senior BPE researcher in the UK and an experienced researcher in Poland – set out to obtain a European Fellowship grant (FP7-PEOPLE-2012-IEF) within this Action. The aim was for the two researchers to co-develop an innovative BPE approach, test it through a live case study project and then co-develop a KE process for transferring this BPE knowledge to Poland. The project included a two-year in-depth BPE comparative study of residential developments in England which aimed to provide a rich learning environment for the Polish researcher. The results of this study are described elsewhere (Baborska-Narozny, Stevenson, & Grudzinska, 2017; Stevenson, Baborska-Narozny & Chatterton, 2016). A number of key themes emerge from the evaluation of this case study in relation to supporting the development of international BPE KE and CoPs.

Institutional barriers

In 2009, the UK government invested £8 million in a national BPE programme which ran from 2010 to 2014. This programme aimed to provide 'real-world' performance data, facilitate BPE learning, embed a culture of BPE and generate a national knowledge base

(Innovate UK, 2016a, 2016b). The UK author was part of a national BPE CoP consisting of brokering researchers, consultants and industry stakeholders, which ensured that this programme formally captured state-of-the-art BPE methods being used in the UK at the time. The specific CoP culture behind this initiative was a certain pragmatism based on BPE know-how and methods that had been developed and improved using trial-and-error processes over four decades to produce a 'portfolio' of approaches (Innovate UK, 2016c). Sharing the BPE tacit knowledge and values underlying this relatively institutionalized formal BPE process in another national context proved challenging within the current institutional European research context.

The current EU Framework Programme Horizon 2020 (EU, 2014) has a number of generic tacit assumptions and values within the Framework itself which make it particularly difficult for BPE KE to take place. The assumption that: 'breakthroughs, discoveries and world-firsts by taking great ideas from the lab to the market' (p. 5) fails to recognize that BPE is not set in laboratory conditions, but operates within the 'real world' with cultural and resultant knowledge conditions that are not always replicable. Equally, different Member States have been at different stages of regulatory development in relation to building performance with many new Member States having previously had no building energy performance requirements in their legislation (de T'Serclaes, 2007). In the recent past, almost 90% of research and development budgets in Europe have been spent nationally without coordination across countries (European Commission, 2011). The requirement of a 'single market for knowledge, research and innovation' (European Union, 2014, p. 31) is embedded in the Framework assumptions. Yet, there is clearly a need to take into account how real-world differences and political considerations influence the preferences and expectations of potential knowledge users between EU countries (Young et al., 2016). The Fellowship guidance also demanded that the original application be placed in one of eight designated categories: Chemistry, Economic sciences, Information science and engineering, Environmental and geo-sciences, Life sciences, Mathematics, Physics, Social sciences and humanities, plus a Career Restart Panel (European Commission, 2012). However, the authors felt that the proposed BPE project overlapped at least four of these categories. Worryingly, none of the real world differences or the category restrictions mentioned above was considered in the impact analysis of the EU 7th Framework Programme, which informed the development of the subsequent Horizon 2020 Programme (European Commission, 2011). It seems that the European Commission considered that

KE in the Programme would improve simply by virtue of the various projects undertaken, rather than considering the wider socio-cultural issues underlying KE in Europe as a means to prefigure the design of the Programme itself. These barriers, among others, played out in the case study considered next.

Personal assumptions

The Fellowship guidance stated that ‘training-through-research under supervision by means of an individual personalised project’ would lead to ‘Inter-sectoral or interdisciplinary transfer of knowledge’ (European Commission, 2012 p. 15). This presumed that the senior researcher would simply transfer new knowledge and skills to the experienced researcher. In fact, the Fellowship led to a continuous exchange of views through two- to three-hour weekly meetings between both authors and the gradual development of KE through mutual learning and reflexivity. This involved both authors having to become skilled brokers, able to communicate across the different values and assumptions belonging to each of their national perspectives. Numerous personal assumptions also initially impacted on the Fellowship application:

- The UK researcher assumed that Poland had a similar level of development to the UK in relation to tackling CO₂ emissions. However, Polish climate-change mitigation policies are relatively passive (Kundzewicz & Matczak, 2012). The researchers, therefore, wrote the application from a mutual understanding that the Polish government was particularly interested in ‘security’ and ‘finance’ rather than ‘environment’, using an appropriate BPE ‘frame of reference’ (Bird & Osland, 2005).
- The UK researcher assumed that the Polish researcher was familiar with pragmatic ways of conducting building research: working with industry and preparing short, accessible reports. In reality, a Polish researcher is typically more concerned with producing research publications for their peers and is less familiar with the more direct reporting for BPE in the UK.
- The Polish researcher assumed that a defined BPE process existed in the UK with nationally agreed methods, procedures having a strong impact on the mainstream building industry and policies. In fact, UK BPE methodology is much more evolving, open and niche rather than a part of mainstream industry practice.
- The Fellowship programme required ethical procedures to be in place to secure the consent of all involved in BPE research. The UK researcher assumed

that the same happened in Poland. However, this was unfamiliar territory for the experienced Polish researcher.

Both researchers, therefore, had to reach beyond their own cultural assumptions in terms of unearthing each other’s national tacit values and knowledge through continuous interpersonal and critical dialogue. They challenged themselves personally and, from the other researcher’s perspective, in a reflexive manner (England, 1994) to reach a point of mutual understanding and development using culturally appropriate ‘translators’ for BPE as set out in the Fellowship application (Table 1). Each researcher thus readjusted their assumptions by learning about each other’s country from the other researcher’s experience. This was a vital KE alignment process, before the researchers could broaden out their work to try to develop a nascent transnational BPE CoP based on their joint cross-cultural experience.

Governing knowledge exchange

Love et al. (2011) identify a number of criteria required for a successful governance framework for developing CoPs. These include: a clear mission with strategic objectives, governance committees, sponsors and leaders of ‘best practice’, regular input of external expertise, access to other networks, driven leadership, measurable performance for the sponsor and demonstrable results for the CoP members. These criteria are clearly identifiable in the UK BPE CoPs where there have been a number of large government-funded projects to help drive the BPE agenda forward, but are less so in Polish practice. Underlying these criteria are three critical factors, which are examined next:

- the kind of knowledge the CoP shares
- how closely integrated sharing knowledge is with people’s daily work
- the degree of connection and identity among its members

The kind of knowledge shared

The authors, as brokers, developed a one-day bilateral UK–Polish BPE symposium in Wroclaw, Poland, in May 2016, which brought together 50 stakeholders from both countries to continue the KE process from the Fellowship project (see <http://www.centrumrose.pwr.wroc.pl/>). The main objective of the event was to link the various Polish disciplines and domains present, and to begin to form an emergent bilateral CoP in order to develop BPE as a new process in Poland by:

Table 1. Decoding British and Polish cultural contexts.

Category	Domestic building performance evaluation (BPE) national context characteristics		Culturally appropriate BPE 'translators'
	UK	Poland	
Policy	European Union Directives on climate change and energy efficiency	European Union Directives on climate change and energy efficiency	Shared objectives
	International leadership ambition – shaping and testing environmental policies	Peripheral role – tradition of coping with the top-down rules set by others – not fully engaging in enforcing them (Kundzewicz, Painter, & Kundzewicz, 2017)	UK broker sense-making of the Polish context
	Supportive government environment for BPE	Unsupportive government environment for BPE	Demonstrator project – BPE outcomes disseminated to government
	Evidence-based policy development and impact assessment culture	Lack of evidence-based policy development and impact assessment culture	Raising public interest in Poland for the need for evidence-based BPE policy development
	Consultation culture for developing policy	Poor consultation culture for developing policy	Develop consultation culture through bilateral symposium with multiple agencies
	Public access to evidence-based reports	Few consultation reports commissioned	Develop channels for BPE evidence-based dissemination
Building stock	Domestic building stock dominant CO ₂ emitter	Domestic building stock dominant CO ₂ emitter	Housing improvement – domestic BPE relevant
	Dwellings sold with consistent fit out in developments	Developer-led dwellings sold with shell finish and individual modifications	Need to take account of custom-fit outs in the BPE process and be aware of confounding variables
	Growing industry experience with testing low- or zero-energy housing procurement supported by BPE feedback	Marginal industry experience in testing low- or zero-energy housing procurement through BPE support	Strengthen Polish industry experience in testing low-carbon housing via BPE initiatives and disseminate
Culture/ attitudes	Performance gap perceived as a serious challenge to be tackled	Energy-related gap unknown, CO ₂ emissions gap perceived as irrelevant	Adjust BPE toward Polish culturally accepted significant values of security and fuel poverty – prioritize in BPE reporting
	Ethics procedures well developed in BPE studies	Lack of ethical procedures for BPE studies	Develop an ethics procedures for the Polish audience and disseminate
	Strong research links between academia, building-related policy and industry	Weak research links between academia, building-related policy and industry	Introduction of BPE communities of practice (CoPs), knowledge transfer partnerships and industry-led doctorates
	Emphasis on the wider impact of researcher research results	Emphasis on peer-reviewed researcher outputs	Develop outreach communication skills among researchers to help industry understand what it might learn from academia

- providing an overview of the UK BPE programmes
- sharing experiences of field studies in occupied buildings in Poland and the UK
- understanding the existing expertise and facilitating BPE connections
- establishing key challenges within Polish industry, design practice and policy that might be tackled through BPE

Key UK researchers and industry BPE experts, including the UK author, were invited as further brokers to help build interest and trust among their Polish counterparts, based on their expertise. The Polish participants, drawn from universities and industry, were targeted by the Polish author based on their relevant research and professional record.

Prior to this event, an introductory one-day scoping seminar was held in November 2015 to provide a 'safe' environment for 30 Polish stakeholders from various

backgrounds in the built environment to discuss and understand the state of the art in Poland and help shape the symposium itself. Significantly, climate-change mitigation was not mentioned during this seminar, but indoor air quality and financial savings were. This finding was passed on to the UK speakers to encourage them to build a wider case for BPE beyond climate change-related policies, and resonate with the symposium audience. This proved particularly challenging for the speakers, given that the UK BPE programmes were so deeply embedded within the UK low-carbon policy framework. The four UK experts were primed to deliver their knowledge more through knowledge transfer than as KE, as each had prepared short talks to deliver to the audience based on their own experience. However, this knowledge was transmitted without enough contextualization and lacked any cultural translation for the Polish audience, given the acknowledged cultural differences. The Polish counterparts also gave their presentations and the day

finished with a plenary. In hindsight, the symposium may have benefitted from some breakout KE workshops to help further facilitate a situated mutual understanding, establish connections and identify the key challenges.

Sharing knowledge versus daily work

A number of key Polish insights, presented in the symposium challenged the potential integration of UK BPE knowledge and practices into the Polish stakeholder's daily work:

- *Developers*

The chief executive officer (CEO) of the Polish Developers Association (PZFD) stated that the industry's main interest in BPE was in gauging key factors for customer satisfaction and optimal fireproofing of urban housing. There was no particular interest in measuring carbon emissions, despite the 2020 deadline imposed by the Energy Performance of Buildings Directive (EPBD) for delivering zero-energy housing. The BPE for individual dwellings was considered less important with the developers assuming that an occupant's tacit knowledge of standardized building services was good enough.

- *Professionals*

A Polish architect stated: 'It's just a game where you have to learn how to play to win the credits' in relation to using the environmental Leadership in Energy and Environmental Design (LEED) certification process. The challenge for embedding BPE in Poland is how to make it trustworthy to architects and clients as something beyond a tick-box exercise that stays on paper (Baborska-Narozny, 2017). The prevailing lack of specialization in the smaller enterprises meant that Polish architects constantly learnt by doing, with few repeated business commissions, and this made it difficult to embed a BPE CoP due to lack of best-practice leaders in this field.

- *Researchers*

The Polish researchers stated a difficulty in accessing sites for research, a reluctance by the industry stakeholders to engage, and lack of interest in their research results beyond academia. One participant had 20 years' experience of evaluating schools through user surveys, but without involving the client, design team, contractor or facility manager, as would be the case in the UK. Her team's work was also driven by proving a hypothesis rather than a 'real-world' approach focused on impact. As a result, she was finding it hard to recruit willing schools for her work.

- *Local authorities*

The City Architect of Wroclaw said his authority had never had a systematic assessment of the impact of local planning decisions on inhabitants' quality of life, health and wellbeing. He had a longer and more structural perspective on BPE as a policy issue.

Degree of connection and identity

The symposium plenary feedback from the Polish participants showed that trust-building had worked as a first step for the KE process, with key potential BPE CoP members in Poland convinced that BPE was taken seriously in the UK and was capable of delivering useful insights for industry, policy and research. It was agreed that fine-tuning technical regulations and providing *in-situ* training for small design practices were the first steps for introducing BPE in Poland. However, it was apparent to the authors that the degree of connection between the Polish participants themselves also needed strengthening through demonstrator projects in practice to help form a nascent Polish BPE CoP. There was little direct connection between the various stakeholders at the symposium, despite their common interest in BPE.

Addressing capacity barriers

A number of underlying absorptive capacity differences (Gann, 2003) were identified through the EU Fellowship and the symposium. UK BPE CoPs have access to BPE knowledge via government-funded websites as well as through publications, and there is a high degree of connectivity through researchers and practitioners via their daily formal and informal learning through work (Brown & Duguid, 1991), as evidenced through practice-based seminars, workshops and conferences. This accumulation and on-going improvement of context-specific evidence-based knowledge on building performance in the UK has built absorptive capacity. As a result, there is growing expertise and a degree of trust in the BPE process and its results among industry stakeholders and policy-makers. This is fundamentally because a key driver for the UK is the belief in an evidenced-based BPE endeavour to close the carbon emissions 'performance gap' as supported by the UK Climate Change Act 2008. The various government-funded BPE programmes are a direct consequence of this initial commitment and have also helped to develop capacity for BPE development in the UK. This situation does not exist yet in Poland, partly due to the 'parallel realities' habituation, inherited from the centrally planned economy, where there is not a belief in outcomes necessarily matching intentions.

BPE absorptive capacity is also lacking in Poland because while official Polish and UK policy follows the same EU guidelines linked to future obligations for zero carbon buildings by 2020, the climate-change discourse in Poland is not as prioritized due the prevalent coal industry. The various building industry stakeholders thus wait for new building regulations to force them to change. This points towards the key need first to establish a bottom-up locally significant BPE focus, *i.e.* security of energy or occupant wellbeing and satisfaction (Colmer, 2017), to help Polish BPE CoPs develop, with regulation to follow best practice, and a reduction in carbon emissions as a consequence. There is also a major gap in understanding the actual performance of buildings in relation to their users in Poland, with no user-based BPE benchmarks available and only technical legal requirements, building stock statistics or technical audits to turn to. Finally, there is no approach yet that places Polish building performance within its broader context of policy, procurement and user practices. At the same time, it can take up to three ‘generations’ or cycles of behaviour for innovation to become accepted as a tradition in any society (Oliver, 2003). The above capacity factors demonstrate additional barriers for developing international KE via an emerging BPE CoP given that all stakeholders draw upon knowledge and capabilities that are historical accretions of past practice and understandings (Ferne, Leiringer, & Thorpe, 2006).

Nevertheless, there are changes going on in Poland now where the market has matured and where there is a growing understanding that market forces cannot deliver building performance on their own without an investment in evidence-based quality processes. Academia can potentially support shaping these expectations by indicating and promoting performance-based ‘best practice’ (Baborska-Narozny, 2017) as the Usable Building Trust did in the UK two decades ago (see <http://www.usablebuildings.co.uk/>). It is hoped the Polish co-author through understanding local context and with on-going KE with the British BPE CoP will act as a broker to trigger the development of a BPE CoP in her country. However, as Curwell (2003, p. 221) pointed out some time ago:

The strategies that should be employed should not be based on a fixed target or blueprint, but on an integrated and flexible approach that adjusts to local conditions.

This is particularly relevant at a time when EU countries are taking different approaches to reducing their carbon emissions.

A vernacular approach

Given the multiple challenges for developing KE and related BPE CoPs within differing national contexts, is

there another way to view the development of BPE CoP practices transnationally? Oliver (2003) has pointed out some key conditions that dictate the successful introduction of new technological processes or products from one culture to another through a more visceral and vernacular approach based on necessity, borrowing from adjacent cultures, circulation of specialists, diffusion by contact, evidence of practical skills and assistive efficiency, admiration, envy and the desire to emulate, the passing on of material artefacts, and the adoption or adaptation to satisfy local needs, values and economies. BPE processes, products and practices developed under these conditions, through a succession of minor modifications rather than radical change, can allow substantial cultural exchange while retaining local identity and local values.

A vernacular BPE approach, using small, incremental and affordable demonstration examples, which recognizes local conditions and methods in detail and in practice, while still communicating key BPE principles at a high level, could assist in relation to the diffusion of BPE through international CoPs, recognizing the subsidiarity of different countries and cultures within the EU. This is human resource intensive compared with the digital diffusion of BPE information, but it can provide an essential platform for promoting BPE best practice in a way that can be readily assimilated through local adaptation, and avoid any sense of unwanted and inappropriate technological ‘intrusion’ into an existing practice (Oliver, 2003, p. 259). We suggest that giving a role to a relatively neutral and independent cultural anthropologist, or someone with equivalent ethnographic skills, within any international BPE CoP can also help to support and develop its practice by articulating, particularly from the outset, the more intangible cultural differences that need to be addressed, and facilitating feedback on how well any BPE KE is being received, to help develop BPE across the EU.

Conclusions

This paper has set out to demonstrate some of the key cultural, practice and policy barriers facing the development of housing BPE practice and international BPE CoPs in the EU, within the current EU research framework, and between two Member States. The authors’ reflexive analysis and learning from their own case study has identified five underlying cultural barriers that challenge international communities of practice attempting to develop BPE in the EU through mutual learning using KE:

- institutional barriers due to category errors⁴ in the EU Horizon 2020 research programme related to BPE and KE

- personal assumptions and lack of cultural translation of BPE merits suitable for different audiences
- varying national histories, policies and priorities in relation to buildings, *e.g.* tackling climate change issues that challenge the governance of BPE KE through CoPs
- poor cross-cultural absorptive capacity for BPE KE due to non-aligned practices between stakeholders in different countries
- lack of a broader cultural context for developing BPE building studies

As Cole (2003, p. 80) suggests:

A key factor in the success of green building practices may lie in developing supply-side capabilities that critically assess and adapt global information to local cultural expectations and habits and patterns of living, coupled with local climate conditions, materials and technologies.

Developing international BPE brokers is critical for any EU attempt to develop an international (pan-EU) CoP for BPE to succeed. International research programmes such as the EU's Marie Curie Action are excellent vehicles for nurturing this potentially, but need reforming to recognize cultural difference and 'real-world' research which does not fit into a 'lab'. At the same time, there is a natural limit to the remit of any pan-EU BPE CoP in terms of attempting to unify the specific investigatory methods that may be required in each country at each stage of development. Establishing unified high-level principles rather than detailed methods is more culturally appropriate, as national BPE CoPs begin to emerge. The methods should be connected to the principles, but suitably differentiated in order to solve specifically local problems. Similarly, any international BPE project has to take account of local cultural expectations and conditions through mutual and reflexive learning between partners when utilizing KE in order to develop supply-side capabilities to deliver BPE. Where national institutional frameworks are ill-defined, it can be helpful to have building project-specific requirements related to BPE standards and methods which are carefully adapted to the culture and practices of the country and that do not 'intrude' unnecessarily and inappropriately on local approaches which are working well. The level of success depends on the international BPE broker making sense of what their audience is and how to respond to them through learning and using appropriate cultural translation.

Although the findings from one case study are limited, there are a number of valuable recommendations in terms of supporting the development of international BPE CoPs and BPE practice.

Policy

- the EU should promote KE through situated mutual learning, which acknowledges cultural difference in the design of its research programmes, rather than simply aiming for knowledge transfer and training between countries
- the absorptive capacity needed in Member States for international KE processes and development to take place should be recognized in the design of EU research programmes which ask researchers for this to be identified first in their proposals
- international research programmes need to develop more reflexive methods to help draw out the situated tacit knowledge and values underlying the 'scientific objectivity' in any proposed BPE studies
- the EU should ensure that international CoPs associated with key demonstrator projects and BPE are explicitly asked to identify and overcome cultural barriers in order for these CoPs to become effective brokers in relation to other CoPs in the built environment

Practice

- BPE CoPs need to develop an explicit understanding of the tacit cultural values, assumptions and practices that underlie national approaches to BPE, and the consequences for this in terms of promoting international understanding, using critical and reflexive interpersonal and intercultural dialogue
- introducing a neutral cultural anthropologist, or someone with equivalent skills, into international BPE CoPs can aid understanding of tacit cultural differences and identify the means to address these; they can also help set up the introductory expectations in a specific research project
- the BPE team should first establish what is relevant and appealing to stakeholders in terms of stakeholders' needs and then feed in the BPE process through these, rather than promoting a culturally inappropriate and 'intrusive' approach
- reflexive action research is recommended as a process for overcoming personal cultural assumptions, enabling brokers to engage with international stakeholders to help build their capacity to absorb BPE practices and provide feedback for future design
- the development of culturally situated and appropriate 'translators' (Table 1) for enabling BPE KE is essential to help support the development of international BPE CoPs

Notes

1. Researchers use a standardized approach at Carnegie Mellon University where POE is seen as a service used to gauge user experience to inform refurbishment decisions. Surveys and expert walk-throughs with spot-check measurements occur *before* design decision-making, which is generally very different from UK practice, where POE occurs *after* the completion of projects.
2. The Passivhaus standard in Germany, as developed by the Passivhaus Institute, has been widely adopted as part of a rigorous low-carbon housing building programme with open-source data for improving performance through measurement (see https://passipedia.org/operation/operation_and_experience/measurement_results/energy_use_measurement_results#literature/)
3. Reflexivity as a concept is best defined as an understanding that 'the research encounter is structured by both the researcher and the research participants, and that the research, researched, and researcher might be transformed by the fieldwork experience' (England, 1994, p. 250). It involves a 'self-critical sympathetic introspection and the selfconscious analytical scrutiny of the self as researcher' (p. 244), which allows the researcher to be more open to any challenges of their theoretical position, which the fieldwork raises.
4. A 'Category Error' is defined as a semantic or ontological error in which things belonging to a particular category are presented as if they belong to a different category, or, alternatively, a property is ascribed to something that could not possibly have that property.

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ORCID

Fionn Stevenson  <http://orcid.org/0000-0002-8374-9687>

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