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PLACE WORK KNOWLEDGE

Putting knowledge in (its) place: knowledge exchange/transfer and clustering

Author: Andy C Pratt (City University London)

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Putting knowledge in (its) place: knowledge transfer/exchange and clustering

Andy C Pratt
Email: andy.pratt.1@city.ac.uk

Abstract

In this paper we argue that existing mainstream conceptualizations of knowledge, knowledge transfer, and knowledge exchange (KT/E) have reached their limits. Those limits are embedded in a physical conception of knowledge as 'thing'; we counter this with the notion of knowledge as 'relation'. The paper is divided into four sections. The first sketches out the macro- view, the great transformation of the knowledge economy and how it has been characterized. Second, we review micro accounts of KT/E in locational studies. The third part of the paper points to some fundamental questions concerning knowledge common to both approaches. We present the challenge of the relational knowledge conception, and suggest that this throws normative expectations of the knowledge economy (as an iteration of the physical economy) into difficulty. It is indicative that normative theory has struggled at its limits to capture these 'effects', floundering on over- and-under socialization/economization and vague terms such as 'buzz' to indicate the problem. In the fourth part we explore the consequences of the relational concept of knowledge to the re-explanation of KT/E and clustering which we refer to as the learning ecosystem.

Keywords: space, knowledge exchange, knowledge transfer, cluster, new economy

1.0 Introduction

The aim of this paper is to interrogate the idea of knowledge transfer/ exchange (KT/E) in economies dominated by production and transactions of 'low-material content goods'1. We argue that despite researchers' empirical endeavours, the concepts of knowledge exchange and knowledge transfer2 (KT/E) essentially relate to an economy of physical transactions. This mis-conception is a problem because KT/E have been posited as an essential component of innovation, which is itself foundational to economic growth in a knowledge economy. KT/E debates are presented as automatic and consequential, a logical fiat, and not as situated processes. Quite simply, it is argued that normative explanations have been extended beyond their limits of utility (as a result of adopting some fundamentally inappropriate assumptions about knowledge). Hence, a particular difficulty remains in accounting for the localization of knowledge intensive activities, and deciding if localization is a proxy of efficient KT/E process. The assumed solution that underpins much policy debate about knowledge hubs and clusters is that proximity, with facilitated by the social glue of trust and ubiquity of buzz is a sufficient explanation. It is worrying that such imprecision is nested in a foundational argument for creating regional competitive advantage and economic growth. This

[1] We use this awkward expression to signify an intermediate position between immaterial and material goods. This paper is written on the basis that both positions are unhelpful and misleading abstractions, and hybrid forms are the norm, and therefore need our analytic attention.

[2] As will be clear, although we accept that there are differences of interpretation of both KT and KE terms (see Polkinghorne, M. (2011). "Review of the Use of the Terms 'Knowledge Transfer' and 'Knowledge Exchange'." 4.),our paper questions the common conception of knowledge underlying KT/E debates.

paper offers to repair this state of affairs; however, in doing so it signals the potential inadequacy of the KT/E metaphor and the underlying causal model. We suggest a substitute notion: the learning ecosystem.

Proximity is a beguiling concept. Location theories make much of transport costs and their minimization, and the consequential potential returns to scale of spatial monopoly. In a digital economy, economic theory would suggest that these transport costs trend to zero as has been popularized in the 'death of distance' hypothesis (Cairncross 1998). However, proximity clearly has an additional role in 'the making', not just distribution. Here proximity is commonly used as a proxy of the exchange of ideas and innovations. Of course, even Marshall (1920) in his classical analysis of industrial districts based on material goods acknowledged the circulation of ideas and knowledge; but now, as then, this has been conceptualized as a residual to the formal model. Researchers – especially in the most extreme digital and knowledge intensive activities – struggle to account for the compulsion of the social: in the absence of a formal causal process much attention has been allocated to what is commonly referred to as 'buzz', the magic ingredient in such interactions (Bathelt, Malmberg et al. 2004, Storper and Venables 2004, Asheim, Coenen et al. 2007, Currid and Williams 2010). Empirical researchers accept that 'buzz' is indicative of a gap in our explanations, but find it difficult to integrate it into explanations satisfactorily, let alone ones that form the basis of insights that might help practitioners enhance or hinder such activities. Even when proximity is achieved it would seem that KE/T remains elusive.

In normative accounts of the digital economy, as outlier of the economy but an accepted exemplar of the knowledge economy, where there is an absence of physical products various strategies have emerged as a means to turn ideas into commodities (Daniels, Leyshon et al. 2007). On one hand, (conventional) business models have been modified to shift the focus to an income stream that may not come from transactions of physical goods; on the other hand, efforts are made to create unique intellectual property that in effect subdivide what were once integral physical goods3. The physical product is no longer analogous to the value of a product. The regulation and governance of physical goods is the expertise of the old economy; regulation of digital entities is the hallmark of the new economy. In one sense, it may be argued that this is not a problem for economic, knowledge has become another good to be traded. However, as we will see, this generates another challenge.

Where is knowledge in all of this? As we have suggested, it has been assumed, or overlooked. This was not a problem where the physical good could 'stand in for' the bundle of knowledge, rights and values that are bound up in a physical product. Knowledge can be the intellectual property, but it can also be various enabling 'ways of doing', or means of supporting processes and skills. This is where we run into the problem that this paper addresses: what does knowledge 'look like' and what are the barriers to its exchange/transfer, and what are the consequences? We argue that physical analogies are still strong in the minds of theorists, and regulators, and policy makers. Thus, as if one were discussing a virus (diffusion), or a mechanical system, where linkages and transfers are critical,

[3] A popular example is in the music industry where records – with high reproduction costs, and rapid quality decline – were in effect physical goods and effectively 'locked in' a bundle of rights and profits streams that could be managed through physical control. However, with digitization music becomes physical and virtual, or just virtual, goods. Moreover, the rights and income streams, and business models could be redesigned in multifarious ways leading to new modes of income and new beneficiaries.

and fail due to leakages, or blockages, in the plumbing of the system4. The means of regulation or control are social/organizational, and/or economic/market. However, some pertinent questions are left unresolved: Control of what? What is knowledge? Is knowledge like water flowing in a pipe that can be turned on or off, or blocked and redirected?

In the following sections of the paper we survey a broad swathe of research from a range of related disciplines; essentially we have to stand on the shoulders of some key contributions to the debates. The selectivity is carried out with particular purpose, to engage with a priori foundations that are thus not questioned within such debates. All of the approaches that we indicate share a common struggle to apprehend an empirical reality that is at variance with the outcomes predicted therein. Our argument is that re-calibration is insufficient if the causal model, and ontological assumptions are inappropriate. Our contention is that such philosophical and theoretical problems are undermining empirical research.

In this paper we argue that existing mainstream conceptualizations of knowledge and KT/KE have reached their limits. Those limits are embedded in a physical conception of knowledge as 'thing'; we counter this with the notion of knowledge as relation. The paper is divided into four sections. The first sketches out the macro- view, the great transformation of the knowledge economy and how it has been characterized, and what the solutions to its problems are. Second, we review micro accounts of KE/T in locational studies. The third part of the paper points to some fundamental questions concerning knowledge. We present the challenge of relational knowledge, and suggest that this throws normative expectations of the knowledge economy (as an iteration of the physical economy) into difficulty. It is indicative that normative theory has struggled at its limits to capture these 'effects', floundering on over- and- under socialization/economization and vague terms such as 'buzz' to indicate the problem. In the fourth part we explore the consequences of the relational concept of knowledge to the re-explanation of KT/E and clustering, and point to a more adequate account for 'buzz' that is embedded in debates about situated knowledge, which we refer to as a learning ecosystem.

2. Knowledge society/economy

This section deals with what are generally referred to as the macro- approaches to social and economic life; the following with the micro- scale. Predictably, we will seek to question this division, and offer a more integrated approach. Moreover, both debates are fractured into many sub-debates; we try to organize these into two very broad perspectives: one that owes more to neo-classical economic thought; and the other that has roots in an institutional or evolutionary body of work. We are aware of the fact that such divisions cover many differences; however, we argue that it is a useful division based upon our primary classification, that is, philosophical and ontological assumptions.

[4] Of course diffusion model of innovation were once dominant, they share the lack of causality with other normative models.

Debates about the transformation of economic production, ranging from a focus on manufacture to one of services, or of knowledge, dates from the 1960s5. In particular the economic crisis of the 1970s gave such debates about relative balance of services and knowledge in economies considerable momentum; the transformation was not a slow change towards a post-industrial leisure society imagined in the 1960s, but took on new and more urgent dimensions with the oil crisis and the subsequent de-industrialization of many nations in the Global North. Under such conditions the political and economic concern was shifted to the question of what would be the future motor of growth in advanced societies. Three debates now ran in parallel: first, what the character of economic change would be (commonly assumed to be an increasing focus on adding value through knowledge, notably the incorporation of scientific knowledge to products and processes); second, the nature of, and consequences for, the social changes of non-routinized manufacturing work and the workforce; in particular how could a scientific or knowledge worker be created (in part by an expansion of higher education); third, what would they demand (in political and social terms), and what accommodation (in terms of policy programs) would nation states and capital have to make to maintain this (social and political concessions to the new middle classes). This was the burden of writers such as Bell, Drucker and Toffler, amongst others (Bell 1973, Toffler 1980, Drucker 1993).

Leaving aside whether the analysis or social, economic and political prescriptions were valid (see for example (Webster 2006, Kumar 2009); the important point to pick up is the emergence of a focus on knowledge as the new thematic of development compounded and conflated with the business cycle models of Kondratieff that reduced change to technological themes (Marshall 1987). Drucker, whose writings predate the debate, as those who followed, saw the solution in management: new forms of management of organizations, people and societies. The implication being that knowledge needs different handling to raw materials; and that this is promoted as an inevitability of modernization and change. The latest iteration of this mode of thinking is Bell's inheritor, Florida (2002), who offers an analysis of a new sub-group of the scientific workers, the 'super-creative class', and the consequential necessary steps that City Mayors' must take to grasp the competitive advantage for their citizens (Florida 2008)6.

A counter analysis of the transformation in social, economic and political life focused less on 'knowledge' as the resource in demand and its management, but more on its governance and politics in the whole society. Broadly regulation theory, and debates about post-Fordism, focused on an organizational response to a crisis in production (over production, and competition of lower wage costs), which in turn generated a political re-configuration to respond to, or manage, these new conditions (Aglietta 1979, Lipietz 1992). Debate focused on the one hand on the complex organizational logics to minimize costs (such as stockholding costs) and internationalization of production systems (to utilize cheaper labour). On the other hand, social and political end of one state-capital regime, of corporatism, and the rise of neo-liberalism were examined (Peck 1996, Jessop 2008). Much analysis was concerned with the changing structural conditions, pointing to the

[5] The broad notion of economic transformations of the structure of economies is represented by the early work of Clark, C. (1940). *The conditions of economic progress*. London, Macmillan. Work on the knowledge economy extended and developed this developmental discourse.

[6] See a critique of this Bellian vision in Pratt, A. C. (2008). "Creative cities: The cultural industries and the creative class." *Geografiska Annaler Series B-Human Geography* 90B(2): 107-117.

ways in which the organizational transformation, of, at extreme, the project-based workplace created new complex divisions of labour (Boltanski and Chiapello 2005), ranging from core and peripheral work (Atkinson and Meager 1986), to the new precariat and immaterial labour (Hardt and Negri 2004) that suggested a new hierarchy of whom has knowledge and the conditions under which it can be used.

Although seldom directly articulated with this lager scale political change, institutional analyses have a very influential tradition with innovation studies. Developed in response to rather simplistic linear applications of the scientific method (Godin 2006), institutional analyses sought to consider the conditions under which innovation occurred. A particularly strong and influential programme was the National Systems of Innovation approach (Lundvall 1992) which has sought to focus attention of the institutional capacity, sustainability, and ability to learn (Godin 2009). These approaches have also been examined at the regional scale (Cooke 2005). One of the tensions within such analyses is the degree to which a 'resource' model of the firm is central, or the region. This inside/outside approach has been the focus of a body of work on so called open innovation (Chesbrough 2003) . These initial ideas related to an open system of closed firms; however others have modified this concept in a number of important ways in more social modality (Amin and Cohendet 2003, Lester and Piore 2004, Hippel 2005). It is these more 'social' analyses that begin to loosen the concept of knowledge and turn attention to the processes of knowledge acquisition, absorption and learning.

In both dominant macro-scale arguments there is a sense that change was in process from large scale manufacturing that had been common in the Global North in the mid-twentieth century. Of course, one might point to the fact that this did not change, but was simply moved East-ward. However, the point about the shift from manufacture to knowledge seems shared – albeit in different ways. In both a form of governance, or management, of processes, and the reflexive insight provided by management, is the strategic control element.

However, in the post-industrial debates the conflation of technology and science, and the deterministic accounts of both in transformation were common: knowledge was the new raw material. At the same time the focus on the new knowledge workers - first scientists, then technologists, then some were restyled as symbolic analysts (Reich 2000) or cognitive creatives (Scott 2008) - leads to a second order conflation of individual genius (or, national genius) with transformation and economic growth. Again, the 'genius' notion is one that closes down a discussion of where innovation comes from and how it is promoted, reducing it to something one either has or does not.

Whilst, variously, both traditions deal with social, political and economic dimensions of the debates the idea that is often central – knowledge – is seemingly left untouched (Fløysand and Jakobsen 2011). Interestingly, in normative post-industrial analyses, the focus is much the same as in classical Fordism and management, that is to increase the rate of circulation. This is translated into innovation studies, to rationalize the innovation process, and to replicate a production line mentality, with the pipeline flow of innovation. It is management's job to make it run smoothly. However, those studying knowledge and science, let alone innovation, have questioned the utility of such an account. In common with micro scale analyses, which we will refer to later; macro scale accounts tend to assume a particular character to knowledge, as we have suggested, one that

presents it as a 'thing', like a resource or raw material, that can be traded, exchanged, and transported.

3. Knowledge Spaces

A body of work that deploys notions of knowledge exchange and transfer is that concerning the co-location and clustering of economic activities. The classic exemplar is the 'hub'. However, taking up Howells' challenge we can note how most normative theories fail to be based on an adequate notion of knowledge. Broadly, the idea of exchange is a version of an idealized economic market where knowledge is traded; this enables a 'bolt on' to neo-classical theories of clustering. Secondly, the idea of a knowledge network or institution is a sympathetic infrastructure along which knowledge might flow; this is the perspective operationalized in institutional and evolutionary theories. However, both are built upon tenuous extensions of this ontology of knowledge as thing.

Neo-classical economics has a real problem with knowledge, as it is assumed to be freely available, and therefore not part of the model of economic life. Attempts to bring knowledge back into the equation are four fold: first, to adapt formal scientific model as analogues of the process, notably by adopting the linear model of innovation. Second, to wrap knowledge up in either economic transactions costs (Williamson 1987), or formal networks (Easton 1992); both of which tended to reification of social factors such as trust in the process of network action (Gambetta 1988). Third, to simply admit knowledge as a commodity, in the form of intellectual property, and thus function as any other traded goods. Fourth, to adopt a management perspective throughout the value chain such that knowledge is captured for the use of the firm, and thus can attain strategic and competitive advantage (Porter 1998). Each of the strategies represent a retroactive attempts to make good a basic blind-spot. Moreover, they are based on the concepts of knowledge that Howells critiques; in the latter case the transformation of knowledge into an intellectual property right that can be traded clearly involves much work, and it is not always successful.

Polanyi's (1957) work has played a significant role in articulating the evolutionary and institutional position away from the reductive focus on the firm. Interestingly Polanyi was interested in knowledge, which he divides into two types: tacit and codified. The former are important in that they require a more complex in situ type of interaction; what later writers have discussed as learning by doing.

A correlate of the post-Fordist debates gave rise to very fertile strand of work that articulated organizational changes with spatiality. Broadly under the rubric of flexible specialization this argument highlighted the functionality of close physical linkages for just in time delivery of part finished goods within complex industrial districts (Piore and Sabel 1984). Again this debate turned on the role of the social and political setting to mobilize action; as illustrated in particular by the Italian example (Becattini 2004). A notable geographical twist was provided here with the articulation of the local and the global in flows, and the particular character of 'thick networks' (Amin and Thrift 1992, Amin and Thrift 1994). The notion of embedding, and then the situated nature of networks emerges from this agenda; suggesting the uniqueness of place, and the particularity of individual industries. Amin and Thrift had examined the financial services industry, other such as Cooke (2005) had examined pharmaceuticals, and Scott (2000) had explored the creative industries. As innovative

and insightful as these are they are still caught on the side of treating knowledge as thing; although a multiple dimensional thing (in a Polanyian sense), and building better environments for it to flourish.

These Polanyain debates have been revived in importance of in discussion of practice and in situ learning; a prime example is the writing on communities of practice (Wenger 1998, Ibert 2007, Amin and Roberts 2008, Ibert 2010) . These approaches are heir to an open socialized, rather than reductive, economy of the firm. Other authors have similarly sought to struggle with the configuration of complex networks as we will discuss in more detail later along with network analyses, which also come up against this challenge of micro – macro. Granovetter for example in his latter work (Granovetter 1992) is moving toward a social constructivist route way.

This leaves us in a difficult position in that knowledge is assumed as ubiquitous in neo-classical approaches, and reinforced by technological determinists, where static (and tradable) information is valued a recognized as any other market good. Or, it is a magic ingredient that is 'in the air' and can be plucked and used for the fortunate few who are present (another form of spatial monopoly).

By contrast in the evolutionary, institutional and conventions literature we have a wide variety of social shaping of economic action through routinisation, normalization, and organizational forms; an increasingly significant one of which is social networking. However the failure to reconceptualise knowledge means that the closer we get to social network integration, perhaps the buzz, the more distance we get from KE/T. The next section provides the core critique of this position on knowledge, which we argue destabilizes both micro and macro- explanations, which in turn erodes the foundations upon which policy debates proceed: the examination of the nature of knowledge itself.

4. Knowledge

One set of ideas view knowledge and digitization as examples of free exchange; in this sense it seems to replicate an idealized form of neo-classical economics7. In fact, as any primer on neo-classical economics will state, there is no analytical concern with knowledge, as it is an assumed a priori as it is believed to be ubiquitous input to production. A second perspective characterizes knowledge appears to be the nub of the question, who has it, and who does not; who has the skills, or who does note: it is the source of competitive advantage, and has to be managed (Drucker 1993, Porter 1998). This is the paradox of neo-classical economic studies: knowledge is everywhere, but the skill is in its application (or transfer). This is logically why the dominant themes of debate owe more to an institutional field of analysis (which has conflicting roots in both evolutionary economics and management theory). This can be seen played out in a whole series of debates that are regularly revived in which universities have been implicated, not simply as the trainers (and the growth of whom was driven by this), and producers of an 'educated, well off, consumer'; but critically as 'producers of knowledge: research'. And here we begin to reach the core issue. Simply producing, or having, knowledge is not sufficient, it has to be applied, or transferred. Hence the debates about KT/E that inform debates about the science parks movement, as well as the more recent notion of

[7] It is important to note that the free exchange idea of the Internet had to be created, and the practice maintained and campaigned for (by bodies such as the Electronic Frontier Foundation) see Rheingold, H. (1993). *The virtual community : homesteading on the electronic frontier*. Reading, Mass., Addison-Wesley Pub. Co. It did not just 'exist', and it could have been otherwise.

innovation and creative vouchers. These debates initially sought to reproduce the idealized free flow of ideas in the senior common room or the seminar room, of universities and bring SME's inside; hence, the idea of physically co-locating new businesses on the university campus (Monck 1988, Massey, Quintas et al. 1992, Goddard 2005). Later developments saw the co-location extracted from the social setting and interaction as property development became more valuable (Macdonald 1987). A second wave of ideas that has emerged more recently has been the innovation or KT/E voucher that is a monetary incentive to partnership (Cornet, Vroomen et al. 2006); not surprisingly, there is an on-going debate as to whether partnership leads to KT/E.

In a period of neo-liberalism, and austerity, such a debate has literally changed the way that universities operate. Their public funding has been increasingly incentivized through the metrics of particular 'outputs' and 'impacts', the very language of which betrays a lineage of a naïve notion of linear innovation. In the current environment, notably in the UK, such ideas and assumptions of process imply an evaluative position, generally universities are deemed to have failed in this newly anointed task of providing the competitive advantage to the nation state and economic development. In this they fail to achieve what some commentators view as their raison d'etre8. From a neo-liberal perspective, being the public sector, one would expect this. Hence, interventions are needed to turn universities away from their ivory towers and to the real world.

Knowledge is clearly a contested terrain, but less commonly explored as a concept. Jeremy Howells (Howells 2012, Howells and Bessant 2012) pulled together existing critiques and highlighted some of the core issues of a new agenda that he called for. For brevity, we will draw upon his key points here. The object of Howells' critique is both to reveal and to challenge the passive, atomistic, and universal nature of knowledge as commonly deployed within social and economic explanations of innovation and KT/E. Drawing on an extensive literature he stresses the active and reflexive nature of knowing, and its (problematic) translation into knowledge. Furthermore, he argues that knowledge is best seen as a condition; it is individually centered, and accordingly that is it is subject to interpretation. In a direct challenge to normative assumptions, and lay descriptions, knowledge cannot 'flow' as its 'movement' is interrupted and rearticulated in every instance; therefore we should conceptualise knowledge as contextual and situated. This agenda is bold, but perhaps superficially could be interpreted as an emergent common sense that is reflected in current empirical studies of KT/E. However, as we stress here, if taken seriously, such a conceptual shift has profound implications that need to be teased out. This paper is a contribution to such a task.

In his paper Howells (Howells 2012) also debates the interpretation of Polanyai's work as meaning that tacit and codified knowledge are a dualism. He argues that codified knowledge can never be completely extracted from its tacit form; and the tacit is always to some extent codified. As we have noted above, this challenges the normative reading of Polanyai that we find in evolutionary and institutional accounts of KT/E. Arguably it is an academic sleight of hand. Codified knowledge can be exchanged in books and online. This leaves tacit knowledge as a sort of residual that happens in situ

[8] A contested assumption, see Collini, S. (2012). *What are universities for?,* Penguin UK. For other justifications of the University in society.

and is messy an inexplicable9. This leads Howells to state that the nature of the challenge that has to be faced to explain precisely how and what knowledge, and how, and under what conditions, its 'transfer' or 'exchange' takes place. The oft repeated KE/T terms slide over a domain of practice that cannot be - although, as Howells reminds is, often is - assumed away, or achieved by fiat. It is the very process of translating information into knowledge that is a considerable achievement, as is the act of translating knowledge from one setting, or from one situation to another.

5.0 Situated knowledge and the learning ecosystem

Recent empirical work at the intersection of co-location and KT/E challenges the ability of normative theoretical frameworks to account for, and to adequately explain, outcomes. The lack of specification of causality - effectively presenting KT/E as a black box - and the consequential misdirection of research methods to collect appropriately significant or relevant information lies at the heart of the problem. Variants of evolutionary economics come closest, in many versions pointing to the salience of situated and embedded processes; however, at base they still face challenges due to the conception of knowledge adopted. In both cases this leads to a vicious circle where the collection of data on proxies that are not reliably linked to the 'target variables'. We argue that such situation requires more than minor modification and the addition of some additional factors (of which buzz seems common), but rather full-scale reconceptualization that brings the 'proxy variable' - buzz - into clear definition and in a proper causal relationship that can be interrogated. Thus, we argue that both Marshall (Marshall 1920), as well as contemporary commentators, are pointing to a undefined empirical process that has eluded their analytical frameworks. This cannot be resolved In neo-classical economics, as it has been pre-defined as non-relevant. From an institutional perspective there is a different category of problem implicit in the ontological approach between structure and agency. Hence, the tendencies for buzz, and related notions,10 to oscillate between structural and agent-based, and between economic and social, and between under- and over- socialized accounts.

To take up Howells' challenge it is necessary to further to the ontological debate a further one of epistemology. Here we have found an insightful resource in a body of new economic sociological literature. This work ranges from conventions literature (Boltanski and Thévenot 2006), through to actor network approaches (Callon 1998) they are taking a constructivist perspective on knowledge. Significantly, they have initiated with a new disciplinary debate within economic sociology, as Stark (2009) points out. This position fundamentally challenges the legacy of the Parsonian division of economic and sociological realms, reformulating them as a hybrid. This tensions keeps re-appearing, the trajectory of Granovetter is revealing in this respect; initially identifying the tensions between under and over-socialization of networks (a core literature that underpins the field of clustering, embeddedness and networking)(Granovetter 1985); whilst his early work is heavily cited, surprisingly little attention is paid to his later work, which echoes that of other authors referred to in this section moving toward a constructivist position (Granovetter 1992). It is the work of Karin Knorr-Certina and Donald Mackenzie (Knorr-Cetina and Preda 2006, MacKenzie, Muniesa et al. 2007,

[9] The number of modalities that populate the literature betrays the uneasy and fuzzy nature of tacit knowledge and its exchange: learning by doing, watching, etc. We understand that they indicate something important, but what, is left unexplained.

[10] To which we can add the various formations of tacit knowledge.

MacKenzie 2009); on the working of financial markets that has moved this work on enormously; linked with work of those such as Aspers (2010, 2011) on the new sociology of markets; and Grabher and Powell's (2004) work on networks. It is implicit in this emerging body of research that the particularity of industries generate these innovation effects in different ways, and that knowledge is differently configured and conceived of within those various practices.

This work brings with it a legacy of co-constitution of knowledge either through communities of practice, or communities of knowing (Amin and Cohendet 2003) which underlines Howells' argument to valorize the process of active knowing, rather than the passive known. This is, after all, the life-blood of what we as educators do in our careers. Important works in pedagogy have underlined the fact that knowing is a heuristic, social and critical process (Freire 1971). As Howells further suggests, it is precisely this theme that has animated and re-invigorated innovation studies (Simmie 1997, Moulaert and Sekia 2003, Jensen, Johnson et al. 2007) – approaches that have tended to be previously dominated by formal scientific models of action; but again, have been found wanting in practice. Critically, for some, this has led to a reappraisal of the scientific method and the philosophy that underpins it. The debates about critical realism in the field of the philosophy of science is precisely focused on this point (Harré 1986, Bhaskar 1989); as are those working in the field of the sociology of scientific knowledge (Latour and Woolgar 1986, Woolgar 1988, Law 1991): which brings us back to the authors cited above in relation to the new economic sociology, all share a constructivist and relational perspective on knowledge. As has already been noted, and keeping with the philosophy of science theme, the situation that we have described in the economics and sociology of knowledge is precisely a Khunian paradigm shift that requires 'revolutionary' science (Kuhn 1962). Howells' challenge represents such a position.

So, as Howells outlines, as well as the authors discussed above indicate in detail, a reconceptualization of knowledge itself will require the identification of new variables, and different methods of capturing processes. A crude example of this is the way that proxies of patents are commonly been deployed as evidence of innovation; or, the way that the centrality, or connectives of networks, is used as a proxy of information flow. Neither broad approaches address the issue of knowing, and its situated, and historically related reception, let alone understanding it; in short, the error of confusing information with knowledge.

Clearly, following the logic, this has the potential to generate a massive disruptive effect on policy debates. If the process of causality, and the relevant metrics are not measuring what it was thought they were, and the processes are different to those previously imagined, then policy prescriptions will also need to be completely revised.

The logic of the preceding argument suggests that clusters may be better conceptualized as learning ecosystems11 that facilitate particular types of interaction that generate relevant learning. A learning ecosystem is essentially a social interaction that may be embedded in an economic logic or not. Three dimensions of these ecosystems point to indicative foci for future research (see also (Ibert 2007, Ibert 2010).

[11] We avoid the term learning environment that is suggestive of a passive or determined social action. Ecosystem is chosen to suggest a co-constitution of person/s and social and economic settings.

First, the material form of an ecosystem may be facilitated by a building style and design, or blocked by it and this will be a relational process, not a determinate one: the same space may be positive for one ecosystem and negative for another. In short, a building on its own does not cause a cluster: learning is facilitated particular social conditions, and variety of economic circumstances. It is very important that we investigate what those who participate in learning bring with their particular histories and training as these affect the degree to use, or define, opportunities.

Second, and related, learning ecosystems are in degrees open and situated in placed, times and activities. Simply being in the right place at the right time is necessary, but not sufficient; what one 'brings' of the self (and others) is critical, the potential ingredients of any learning experience. Being situated should remind us that an ecosystem would also be positioned in a social and living environment, one that crosses the formal and informal, every day and work, etc. We seldom hear accounts of what might be called 'socially open' innovation and learning12. Moreover, the embodiment of such positioning generates a co-dependency, or co-constitution, with others; repetition may bring routinisation and a particular way of leaning. A further important aspect of such processes will be labour mobility, or the lack of it; and the flexibility – in some industries - required to maintain a self-employed 'career' (Blair 2003). Research also points to the important role of workers constructing relevant identities, and affective dispositions, aligned to such practices, a further co-constitution (Banks 2007, Gregg 2011). Working in a project-based industry depends on the existence of a critical mass of relevant employment opportunities. These labour markets require workers to remain embedded in, and connected to, even when 'between jobs' (Ross 2009). Absence from the ecosystem can quickly degrade one's ability to participate as knowledge and experience is acutely timely in some 'knowledge intense' industries. Research on knowledge transfer has been deficient so far in exploring the constitution of knowledge based upon workers and their learning resources.

Individual workers bring a level of knowledge and experience (enhanced by performing similar activities previously), and hence it is self-reinforcing if it is sustained, in areas of specialist expertise many share similar functional skills and they form a tight self-identified peer group. Membership of such a group is informal and its entry card is reputation. It's a 'Catch-22' situation: participation and action affirms presence and insider status, which is very difficult for outsiders to access. The very rules of reputation and critical acclaim – an internal filtering mechanism- are constantly shifting. Whilst, the gaining of access and entry is hard, achieving and losing such reputation, based on actions, can also lead to exclusion. This is another emergent research agenda that is linked to the production of internally referenced value systems.

Finally, it is very clear that these processes are articulated and expressed in different activities in various ways, even within the 'knowledge economy'. As noted above, a body of work has begun to investigate the constitution of knowledge constitution in the financial sector; another very productive area, as indicated in the references citied above, is the creative industries. This takes the notion of situated action in another direction, the particularities of work, and markets, and value

[12] An exception is Hippel, E. v. (2005). *Democratizing innovation.* Cambridge, Mass. ; London, MIT Press.; but even this does not succeed in breaking through the boundaries of the conventional work/home, or formal and informal.

systems in this set of activities has yielded a number of 'peculiarities' from normative or generalised 'industry' norms (Gill and Pratt 2008, McKinlay and Smith 2009, Pratt and Jeffcutt 2009, Banks, Gill et al. 2013). Exploring the particularity and diversity of situated knowledge productions in learning ecosystems is clearly a challenging agenda; but research thus far stresses the diversity of experiences and the inadequacy of generalised approaches.

6.0 Conclusion

This paper has interrogated the notion of KT/E in the case of low material content goods. That is, those which are least likely to be susceptible to traditional location factors. According to normative theories this put space and knowledge as inconsequential to the location and activities of economic actors. Of course, empirically, this is far from the case. This leaves the substantial policy concern with KT/E and clustering without much underpinning.

Our paper drew upon a review of research across a wide range of fields and showed that the normative concept of knowledge, unexamined in much of the work, was in need of reconceptualization. Recently developed explanatory frameworks, which were based on constructivist notions of knowledge, seemed to offer more adequate forms of explanation, and opened up a new direction for empirical research. A critical insight raised in the research reported on here is the importance of attending to the situatedness of learning, a process and condition that gives rise to particular knowledge, relevant to specific activities at a point in time. Being in the right place at the right time; or having particular knowledge in the right place and time may be necessary but it is not sufficient for the application of knowledge to be realised. This depends upon a social and economic trajectory of the persons concerned; individuals and organisations are not always 'ready' to learn; or, able to act upon potentially useful knowledge.
Another dimension of situated knowledge clearly relates to specific industrial activities research has pointed to a diversity of experiences in various industries, in part associated with how those industries are themselves constituted, what the rate of new product turn over is, and the degree of certainty in forecasting new products and markets. Interestingly, those areas that have been the subject of recent research are at the extreme edge of this field: creative industries and financial services. It may be concluded, on the basis of further comparative work, that these are exceptional outliers. However, they do offer a challenge to normative conceptualisations of KE/T as they push models to the limit. In that sense, we can learn much that may otherwise be obscured or overlooked.

We found Howells' call for a reconceptualization of knowledge helpful, but also indicated that if followed though it points to not only new agendas, but requires new methods to register and measure objects that were not formerly seen as either relevant, or observable. The case in point might be the notion of 'buzz' that points to a process of KE/T activity, but is at best a place holder, or at worst a residual. If knowledge is viewed from a constructivist point of view, such interactions are not exchanges or transfers, additive or subtractive, but new constructs, and generative process: in which sense a better metaphor might be 'gained in translation'.

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