Alex KOUTSOURIS*

Facilitating Agricultural Innovation Systems: a critical realist approach

The turn of agrarian sciences and agricultural extension from reductionist and transfer of technology, respectively, towards systemic approaches has transformed agricultural/rural development thinking in the last decades. Nevertheless, the emergence of Agricultural Innovation Systems (AIS) has to confront a number of gaps among which the expert – lay knowledge gap is of major importance. This paper aims at exploring such a gap as well as obstacles to participatory development from a critical realist point of view. Critical realism (CR) with its realist, differentiated and stratified ontology aims at interpreting the world in order to ultimately bring about transformation. CR allows for new insights on the nature of knowledge as well as on development research and practice. It thus provides useful guidelines concerning the emerging 'intermediation' functions within AIS.

Keywords: Agricultural Innovation Systems, critical realism, knowledge, participation, intermediation/facilitation

* Agricultural University of Athens, 75 Iera Odos, 11855 Athinai, Greece. koutsouris@aua.gr

Introduction

Agrarian sciences have until recently been dominated by instrumental rationalist knowledge (Habermas, 1984), or the paradigm of experimental, reductionist science (Packham and Sriskandarajah, 2005). This, in turn, resulted in a 'culture of technical control' (Bawden, 2005) implying reliance upon scientific experimentation to create a 'fix' for agricultural problems (Nerbonne and Lentz, 2003). Along the same lines, the dominant in agricultural development 'diffusion of innovations' model, also known as the transfer of technology or knowledge (ToT/ToK) model, has been based on the understanding that innovations originate from scientists, are transferred by extension agents and are adopted/applied by farmers (Rogers, 2004).

However, despite reductionism's dazzling achievements, alternative proposals have, since the 1970s, flourished, based on the realisation of the inadequacy of linear and mechanistic thinking in understanding the source and thus the solutions of problems (Hjorth and Bagheri, 2006). Prominent among these alternatives have been systemic approaches (Ison, 2010). Such approaches look at a potential system as a whole (holistically) and focus on the relationships (important causal inter-linkages or couplings) among a system's parts and on system dynamics, rather than the parts themselves. Particularly the systems of innovations (SoI) approaches, including national systems of innovation (Edquist and Johnson 1997; Lundvall, 1992), technological systems (Carlsson and Stankiewicz, 1995; Hughes, 1987) and socio-technical systems (Bijker, 1995; Geels, 2004) imply that innovation emerges from networks of actors as a social (and institutional) as well as a technical, nonlinear and interactive learning process.

In parallel, despite its long history of innovations and increased effectiveness in food production, the 'diffusion of innovations' model has been heavily criticised as it fails to respond to complex challenges and rapidly changing contexts, including the shift to sustainable development. Among others, the 'traditional linear' model does not acknowledge farmers' experience and knowledge as well as the fact that general regional advice often does not match individual farm conditions and the socio-economic context of farmers; additionally, advice in ToT is seen to come out of a 'black box', since the reasoning behind it is not transparent (Chambers and Jiggins, 1986; Röling, 1988; Röling and Wagemakers, 1998).

A leap forward in this respect has been, in both theoretical and practical terms (Byerlee *et al*., 1982; Simmonds, 1986), the emergence of Farming Systems Research/Extension (FSR/E) approaches. Inspired by ecology and general systems theory (Schiere *et al*., 1999), FSR/E approaches have, on the one hand, demonstrated that local farming systems are complex adaptive systems that have co-evolved with human societies to fit local ecological conditions and satisfy human needs. On the other hand, through FSR/E vast experience has been accumulated in terms of understanding farmers, eliciting information and developing relevant tools and methods. FSR/E contributed substantially to the recognition of different actors in development and helped to create awareness about the need for new ways to conduct research and extension, taking into account context and relations (Collinson, 2000; Darnhofer *et al*., 2012).

A further important evolution has been, within the FSR/E tradition, the turn from Rapid/RRA to Participatory Rural Appraisal/PRA (Chambers, 1992, 1994; Pretty, 1995; Webber, 1995). This shift underlined the need for interaction and dialogue between different actors and networks (Chambers, 1993; Scoones and Thompson, 1994), based on the realisation that flows of communication and exchange between different actors are extremely important for existing knowledge to be either reinforced or somehow transformed or deconstructed, thus leading to the emergence of new forms and a 'fusion of horizons' (Leeuwis *et al*., 1990).

Therefore the question 'how do we go about generating innovation and development in agriculture' does not concern strictly technical issues. For Leeuwis (2000) it is important to consider farmers' views regarding the compatibility of new technical solutions with prevailing management demands and wider social-organisational conditions. This, in turn, implies that farmers must be able to set their own strategic goals, participate actively, and build upon their own experiences and knowledge within a co-learning process which does justice to individual differences and qualities of people. This also implies that the learning environment has to be secured as a mentally and socially safe space, and allow for effective interactive communication; it requires trust and time (Koutsouris, 2008a).

Subsequently, the emphasis has gradually shifted towards learning, i.e. the processes of human interaction from which learning emerges (LEARN Group, 2000; Röling and Wagemakers, 1988). The epistemological point of departure is that learning is an active knowledge construction process rather than the (passive) absorption and reception of knowledge. In this respect, learning is seen as a social process in which participants in interaction and negotiation determine what is socially known (Koutsouris and Papadopoulos, 2003). Thus the emphasis given on the principles of experiential learning (Kolb, 1984) and its advances such as participatory learning and action research (King *et al*., 2001) stressing, among others, the importance of reflection and dialogue.

In general, the attempts to solve the current, increasingly complex problems with a view to sustainability make clear that this is a particularly complicated task since while, at the same time, there is no single privileged point of view for their analysis. Besides, when dealing with such problems (and sustainability) there may be little useable science, high levels of inherent uncertainty, and severe potential consequences from decisions that have to be made. Moreover, the realisation that real-world problems do not come in discipline-shaped boxes calls for the cooperation of diverse academic experts and practitioners. Such a *problematique*, in turn, reinforces new forms of learning and problem solving integrating perspectives and insights. As a result, new, 'integrated' (cross-disciplinary) forms of learning (and research) strive to take into account the complexity of an issue and challenge the fragmentation of knowledge; they accept local contexts and uncertainties; they address both science's and society's diverse perceptions of an issue through communicative action; and, they work in order to produce practically relevant knowledge. New concepts, theoretical contributions and metaphors are thus flourishing nowadays to help understand and predict the links between the social, ecological and economic systems, meet the real world challenges and address sustainability as well as to organise various forms of 'cross-disciplinarity' into a coherent framework (Koutsouris, 2008b).

The requirement to move across the boundaries of different scientific branches as well as between extensive spectra of stakeholders has resulted in the emergence (both in theoretical terms and in practice) of a wide variety of approaches to collaborative-participatory development (Koutsouris, 2008b). Therefore, new configurations in sustainable natural resources management and integrated/sustainable agricultural/rural development also emerged including learning partnerships, group extension, farmer-field schools, communities of practice, study circles, farmer networks, etc. (Cristóvão *et al*., 2012).

The emergence of Agricultural Innovation Systems

As stressed by Hubert *et al*. (2000), 'The dominant linear paradigm of agricultural innovation based on delivery to, and diffusion among, farmers of technologies developed by science, has lost utility as an explanation of what happens', and therefore 'There is a search for new models of innovation and new roles for science' (p.17).

In this respect there has been a shift in conceptual frameworks in the study of agriculture-related policy, research, technology and rural development from the strengthening of National Agricultural Research Systems (NARS) to Agricultural Innovation Systems (AIS) (Rivera *et al*., 2005; Spielman and Birner, 2008; World Bank, 2006). The NARS framework, espousing a linear model of research, development and extension, aimed at investments in agricultural research institutes and higher education institutions in order to strengthen research supply. Subsequently, the Agricultural Knowledge and Information Systems (AKIS) framework brought attention to the demand side factors (Röling and Engel, 1991). It aimed at integrating farmers, education, research and extension and has been depicted as a triangular arrangement (knowledge triangle) with the farmer being placed at the centre of this arrangement. More recently, AIS emerged as a framework that embraces 'the totality and interaction of actors involved in innovation' and extends 'beyond the creation of knowledge to encompass the factors affecting demand for and use of knowledge in novel and useful ways' (Klerkx and Leeuwis, 2008a p.809, citing Hall *et al*., 2006; see also Klerkx and Leeuwis 2008b; Klerkx *et al*. 2010; Leeuwis, 2004). The AIS concept thus embraces the totality and interaction of actors (i.e. organisations, enterprises, and individuals) involved in innovation. It furthermore claims that the process of innovation is messy and complex with new ideas being developed and implemented by actors who engage in networks and make adjustments in order to achieve desired outcomes. Nowadays, as aforementioned, innovation studies increasingly focus on learning itself, with emphasis on facilitation and the processes of human interaction from which learning emerges (LEARN Group, 2000; Röling and Wagemakers, 1988).

The 'battlefield of AIS' will now be explored focusing on the expert – lay knowledge dichotomy. Such an exploration will take place based on the premises of critical realism (CR). Therefore in the next sections the general theory of CR is drafted followed by CR's account of knowledge. Based on these theoretical foundations the issues of expert – lay knowledge' conflict and participatory development are critically discussed. The article concludes with a brief discussion on the emerging 'intermediation' (facilitation/brokerage) function in AIS.

Critical realism

Critical realism (CR) holds to the view that, on the one hand, there is a mind-independent external reality and, on the other hand, it is possible that some things that exist in the world (external reality) can become progressively known – and that is why science and research, aiming to explore and understand the world, have been developed. In parallel though, CR acknowledges that there is a distinction between the way things are and our knowledge claims about those objects of knowledge as well as the fallibility of knowledge claims – the latter being always relative to the historical, social and political context in which they were produced (Bhaskar, 1978; Sayer, 1992, 2000).

Furthermore, for CR reality is differentiated/complexly structured comprising: (1) the empirical; (2) the actual; and

(3) the real domain. The 'empirical' consists of our experiences of what happens in the world; the 'actual' is constituted by our experiences as well as by events, independently of whether we experience them or not (i.e. whether they may go unnoticed); and the 'real' comprises of our experiences, events as well as causal powers and deep structures or what might, metaphorically, be called mechanisms with generative power, i.e. the power to produce events (Bhaskar, 1978; Collier, 1994; Outhwaite, 1998; Sayer, 1992). Crucially, generative mechanisms are circumstantial rather than deterministic; that is, depending on contingently related conditions, mechanisms may or may not be exercised and therefore are considered as 'tendencies'. Moreover, the exercise of generative mechanisms, the events they produce and our experiences are not normally in phase unless science makes them so. Therefore, the aim of (CR) research is to uncover these mechanisms, acknowledging that they may or may not be exercised; indeed, it is these mechanisms that make scientific investigation both meaningful and necessary.

Such a line of argument about generative mechanisms and counter acting mechanisms points, among other, to the importance of context. Given that events are produced in, more or less, highly complex contexts, the outcome of a mechanism is always dependent on the particular situations and contexts in which it is active; processes are always contextually determined. It follows that research has to be conducted in accordance with the context within which the respective, under study phenomenon is manifested. This is crucial especially as far as social sciences are concerned since social reality, on the one hand, has a limitless number of interacting 'variables' and, on the other hand, tends to resemble 'structured messes' (Carter and New, 2004).

Moreover, CR argues that reality is stratified, i.e. it consists of hierarchically ordered layers/strata (Bhaskar, 1978; Collier, 1994). Each of these has its own generative mechanisms; indeed, it is the existence of specific mechanisms that constitutes each of the layers. Crucial concepts within this perception of stratification are those of rootedness and emergence. That is, although a 'lower' level creates the conditions for a 'higher' level, the latter is not determined by the former; each 'higher' layer is qualitatively different from the 'lower' one with the former's mechanisms emerging, i.e. not being reduced to or determined by the latter's mechanisms. Therefore, for CR causal tendencies are multidirectional (both 'upward' and 'downward') and layers are neither independent nor closed.

The riddle of (and relationship between) knowledge forms

For CR, knowledge, including science, is produced in a context of work and communicative interaction with other people (Sayer, 1992). In this respect, on the one hand, knowledge is the outcome of work, either as the intended product of scientific work or the tacit concomitant of everyday work. On the other hand, the inter-subjective and conventional dimension, although necessary, does not imply that just anything goes; some conventions provide a useful guide to action while others do not. Furthermore, as aforementioned, CR agrees with weak social constructivists in that knowledge is situated while 'noting that the social character of knowledge does not mean that it cannot successfully identify real objects' (Sayer, 2000, p.90). Moreover, knowledge is not true as soon as it is useful to someone; contra instrumentalism CR claims that useful knowledge is useful because it is true – not that knowledge is true just because it is useful. Finally, for CR, the usefulness of knowledge is a question of how well it captures the generative mechanisms of the phenomena.

As far as the relationship between everyday/lay and theoretical knowledge is concerned, according to Collier (2003), the latter presupposes the former; the origin of theoretical knowledge is practical breakdowns which, in turn, trigger the need for explanatory knowledge, i.e. for a new kind of work with cognitive aims (science). Additionally, science, although being in all fundamental respects like any other knowledge, signifies examined concepts; interested in minimising fallibility through correction and testing, science consciously and systematically reflects upon concepts in order to be consistent and at a higher level of integration. Consequently, explanation in science is not like everyday explanation; the latter often involves the explanation of one event with reference to other events which based on implicit generalisations and unstated assumptions (or, the uncritical acceptance of the mental units with which people think as part of their cultural inheritance) results in the aggregation of disparate phenomena in 'chaotic conceptions' (Sayer, 1992). On the contrary, the development of abstractions is crucial for science (Danermark *et al*., 2002). Theoretical knowledge is acquired as (general, explicit and coherent) systems of meaning and knowledge integration (integration of meanings) is independent of specific contexts. For CR, in particular, explanations go beyond the description of observable events and their associations and thus strive to obtain knowledge of the mechanisms which contributed to the generation of the phenomenon under study. Therefore, scientific knowledge is something else and something beyond more unreflective everyday knowledge based on traditions, conventions and practical considerations 'here and now'.

Emerging issues

Following a CR perspective, a couple of issues/problems pertaining to agricultural/rural development theory and practice and particularly AIS emerge. The first concerns the attempted 'integration of knowledge'; the second addresses the obstacles to participatory development.

The expert - lay knowledge battlefield

The different tasks and thus approaches taken between experts and practitioners inevitably result in a gap between lay and scientific knowledge. According to CR, scientists try to identify and analyse mechanisms at the level each of them is trained. This specialisation, in turn, often implies (more or less) a 'rupture' between research and practice; often research does not correspond (straightforwardly) to the everyday reality of the practitioner, i.e. to the 'whole' (complex phenom-

enon) with which the practitioner is confronted. As a result, the effort of scientists to become concrete and 'practical' (i.e. to move from the abstract/real to the empirical domain) may well result in conflicts. This is often the case, since practitioners are likely to expect research to provide them with as accurate predictions for practice as possible. Sometimes this may work; but it usually does not work at all (especially for social science). This is so since, as already mentioned, the experiential outcome of a mechanism 'depends' on the interplay between mechanisms at various levels and the specific context (and scientists do not have continuous contact with each particular field); research thus in many cases can only provide (scientific) knowledge about mechanisms and tendencies, i.e. knowledge with little value in terms of tangible prescriptions of how to do things once and for all. Therefore, research does not necessarily result in practical recommendations; in most of the cases further, concrete analysis, to bring in all sorts of factors that do not figure in a particular science, is needed, out of which concrete knowledge to guide practice will emerge (Collier, 2003).

The consequence of the differentiation of knowledge forms between scientists and practitioners is that the relationship between the two parties cannot but be a reciprocal learning process. That is, researchers may pass on knowledge on mechanisms and tendencies identified by scientific theories. In turn, practitioners can learn how mechanisms work at different levels and thus increase their knowledge and understanding of the outcome of the complex interplay of such mechanisms/factors. On the other hand, practitioners, confronting the whole complex phenomenon (and applying scientific knowledge on concrete problems) can provide research with insights on how mechanisms and their interplay is empirically manifested (and challenge scientific knowledge) thus allowing researchers to further develop their knowledge (Danermark *et al*., 2002).

It follows that the issue of how concepts and values of lay knowledge are integrated in research is extremely important. For CR the contents of lay knowledge constitute the immediate mechanisms behind activities (i.e. they exist, inform and motivate concrete actions) and thus are the 'raw material' that scientific knowledge must systematically take into account (Bhaskar, 1989). A lay concept of a phenomenon is thus of crucial importance to the researcher as it may be an essential aspect of the phenomenon under study. The understanding of the material setting and the cultural meaning of social practices (tentatively) allows for the understanding of people's options and reasons for acting the way they do. Therefore, research must attempt to report those ideas, as they are held, and debate in what respects they are correct or false and, thus, make a difference to what happens.

Yet it has to be underlined again that both researchers' and (lay) actors' knowledge is fallible. For, in science too, and despite our efforts, we tend to see only some aspects of reality and are blind to others; given that in every epoch certain (societal) assumptions seem unshakeable as well as that any research project reflects a particular worldview (Joseph, 2004). Nevertheless, as already mentioned, science signifies examined concepts; within such a process, ruptures with self-evident/unexamined assumptions to which a theory subscribes lead to the emergence of new theories.

The participation battlefield

A second issue, related to this discussion, has to do with the participation hype in the sense that nowadays it is difficult to find development projects that do not in one way or another claim to adopt a 'participatory' approach. A basic principle, among others, of participatory methods is that the starting point should be the internal knowledge, priorities and perceptions of local people (Chambers, 1993); therefore, the importance of indigenous (or local/lay) knowledge and competence. It follows that, although their application is still challenging, interactive approaches characterised by 'knowledge integration' are of extreme importance.

However, in the context of the issues addressed in this paper the following points emerge. The first concerns a well-known obstacle prohibiting participation: experts' attitudes that 'they know best' and thus have the monopoly of solutions which they aim to transfer to the local communities who by definition 'know less'. Scientism, i.e. the view that only science can give knowledge (based on the positivist triumphalist models of knowledge; Parker, 2001) results in the denial and loss of local and practical knowledge. Indeed, in many projects, 'participatory' processes begin only after the project has been already designed; 'participation' is meant to promote the legitimatisation and acceptance of already taken decisions - to convince 'beneficiaries' about what is 'good for them' (Botes and van Rensburg, 2000). This may have further repercussions, such as: the perceived (on the part of the experts) commonality with respect to the problem, the homogeneity of the community addressed (Quaghebeur *et al*., 2004), selective participation (Botes and van Rensburg, 2000) and 'hard-issue' bias (Mosse, 2001). As a result, in most such cases experts propose answers that address the wrong question, which, in turn, leads to failures. When people are offered specific ways in which they should 'participate' (they have to participate but this opportunity is offered by the 'project' under prescribed conditions), the 'paradox of participation' arises (Quaghebeur *et al*., 2004).

The second issue refers to participatory techniques which, nowadays, have become an obligatory part of 'bottom-up' development efforts. Among other considerations, such as an over-preoccupation with methods and the unrealistic confidence in the efficacy of methods *per se*, an issue directly related to CR is that participatory techniques easily fall into the trap of empiricism. Based on the premise to take participants or stakeholders seriously and to fundamentally base project activities on their knowledge, needs and interests, they heavily rely on empirical information provided by project participants. As Henkel and Stirrat (2001) note, the 'participation orthodoxy' celebrates the local, indigenous and marginal at the expense of the antipathetic and deprecated technical or scientific. However, for CR such an implicit ontology (based on experience) confuses the 'empirical' with the 'real' domain (Subramaniyam, 2007). As argued by Sayer (2000) 'Observability may make us more confident about what we think exists, but existence itself is not dependent on it' (p.12). Furthermore, not only is the generation and use of local knowledge shaped by power relationships but the articulation of 'needs', as expressed by locals, is influenced by projects themselves in the sense that

the objectives of the project and local's perceptions of what the project is able to yield shape 'needs' (Quaghebeur *et al*., 2004). Finally, in many cases, the context is largely ignored (Warner, 1997). Then, lip service is paid to development: generative mechanisms are ignored, choice is limited (re: poor knowledge of opportunities) and the 'establishment' is not challenged; focusing exclusively on local knowledge, discrete and self-referential, may well prove unfortunate.

Aftermath: The intermediation function

As already pointed out, SoI approaches build on networks as social processes encouraging the sharing of knowledge and, notably, as preconditions for innovation. Such approaches, therefore, focus on processes (instead of the emphasis on structures) with knowledge conceived as being constructed through social interaction – i.e. not unproblematically transferred but instead continuously created and recreated. Thus particular attention is given to (social) coordination and networking.

In the same vein, and given that, in relation to the functioning of AIS, a number of gaps (cognitive, information, managerial or system) have been identified, resulting in network and institutional failures (Klerkx and Leeuwis, 2009), growing attention is nowadays given to various types of (process) 'intermediaries/facilitators'. Such 'intermediaries' are increasingly found in contemporary literature as third parties, (knowledge/technology) brokers, bridging organisations, intermediaries, boundary organisations and so on (Howells, 2006). Despite the fact that extensive reviews on the topic show that the field is still theoretically fragmented, not well-grounded and largely practice-oriented (Dogherty *et al*., 2010; Howells, 2006), it is quite clear that such 'intermediaries', taking an independent systemic role, are involved in 'indirect' innovation processes (i.e. in enabling stakeholders / process facilitator) rather than in direct ones (i.e. in actual innovation projects / innovation source or carrier) (Haga, 2009).

Social learning (SL), i.e. the collective action and reflection that occurs among stakeholders as they work towards a mutually acceptable solution to a problem pertaining to the management of human and environmental interrelationships (Keen *et al*., 2005), lies at the heart of such multi-stakeholder processes. Intermediation, therefore, in general implies a (social) mechanism for facilitating SL, i.e. participatory processes of social change, through shared learning, collaboration and the development of consensus about the action to be taken (including innovations to be explored).

Consequently, in terms of AIS, a new extension approach aiming at participatory and group learning and networking with extension agents acting as facilitators is required. 'Conventional' extension, identified with the linear model of innovation, is concerned with 'exploitation', i.e. with the capturing, transfer and deployment of knowledge in other similar situations. On the contrary, nowadays new extension approaches are emerging, operating on systemic perspectives and aiming at enhancing the interaction between a variety of actors; they thus focus on 'exploration', i.e. with the sharing and synthesising thus with the creation of new knowledge (Levinthal and March, 1993; Murray and Blackman, 2006). A major role of the new extension is that of the co-learning facilitator (usually found in literature as 'facilitators' or 'brokers') aiming at the development of shared meaning and language between dialogue partners in order to stimulate change and develop solutions and innovation. The engagement of stakeholders in dialogue, despite its difficulties and its time consuming nature (since (social) learning and change are gradual), is necessary so that critical self-inquiry and collaboration will be achieved. According to Sriskandarajah *et al*. (2006), '[L]earning among heterogeneous groups of stakeholders and among different epistemologies has become one of the most central issues today' (p.27).

As already noted, intermediation (facilitation and brokerage) has yet to be thoroughly described, operationally defined or well evaluated. Explicit attention has to be given to theoretical developments; without a nuanced understanding of the concepts, terminology and controversies, study findings will be difficult to interpret and guidance to practice change may become untenable. In this respect some points of concern have already emerged. For example, the experience of Landcare groups in Australia has shown that (Campbell, 1997) (1) in many instances '[L]andcare facilitation often looks anything but strategic, and its purpose is often lost' (p.147); (2) although the key premise is that facilitators (and brokers) hold an impartial-independent position, 'there is no such thing as a neutral, detached, value-free facilitator' (p.147; see also Devaux *et al*. 2010; Klerkx and Leeuwis, 2009); and (3) a facilitator should have both facilitation skills and appropriate technical background (see also Ingram, 2008; Leeuwis 2000, 2004). The sustainability of 'intermediation' is a further point of concern since as Cristóvão *et al*. (2008) have shown the withdrawal of 'external', i.e. project supported facilitators results in the end of such work in the localities concerned. Finally, the dilemma of 'top-down' vs. 'bottom-up' roles of an intermediary should be pointed out.

Especially as far as AIS are concerned special attention should be given, as argued in this paper, to issues concerning, firstly, the bridging of / dialogue between expert – lay knowledge (as well as the demand and supply side), as espoused by CR as well as by approaches such as 'post-normal' science (Funtowicz and Ravetz, 1993) and 'Mode 2' research (Gibbons *et al*., 1994), and, secondly, as argued, the use of participatory methods and the working out of the 'paradox of participation'. On the other hand, Klerkx and Leeuwis (2008c) underline that, despite inherent difficulties, there is a need to become able to measure the added value of intermediaries. This way their contribution will become explicit and thus recognised in the knowledge infrastructure. Such an agenda will help in further highlighting gaps in our knowledge as well as strategies to address such gaps and, thus, in building a solid knowledge base which will be valuable for policymakers, academics and researchers, and practitioners. In this respect the role of policy and Higher Educational Institutes in fostering 'intermediation thinking' and practice remains an open question.

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