

The Potential of Generative Mechanisms for IS Research

Completed Research Paper

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Abstract

Critical realism is attracting attention in a range of disciplines as a philosophical approach that can reconcile positions previously seen as distinctly different or even incommensurable. In this paper, I argue that the most important potential contribution of CR to the IS field is through the concept of generative mechanisms, in both the practical sense of explaining real world problems and as a contribution to the development of middle range theory within the field. I highlight their potential contribution in a particular domain of empirical work – research on information systems in developing countries (ISDC), and describe a conceptual framework which has been widely used in ISDC research, outlining how the explanatory potential of this approach may be strengthened by adopting a critical realist perspective. Finally, I summarize the potential for generative mechanism based accounts within IS research as a whole and outline some particular considerations for interpretive researchers.

Keywords: Critical realism, generative mechanism, middle range theory, socio-economic development, capability approach.

Introduction

This paper is the result of a research effort aiming to understand the potential of critical realism for IS research. It is also the result of my personal reflections on 15 years of engagement with interpretive IS research – as a doctoral student, an academic, and a reviewer, author and editor for many leading IS conferences and journals. In my mind, these two endeavours are related. The position I adopt in this paper is that critical realism has the potential to make a significant contribution to IS research, particularly through the explanatory potential of generative mechanisms. While such potential should be of interest to researchers working within different traditions, I focus here on the value to interpretive research, while pointing out some of the implications for positivist work (which could constitute an area for further study).

In essence, I sympathize with the view that ‘whether one regards oneself as a positivist or an interpretivist or a scientist’ may not be the most important question in framing one’s research goals. Rather, one needs to ‘think very carefully ... about issues such as causality, explanation, generalization and prediction in framing theory’ (Gregor 2006, p. 634). Indeed, anecdotal evidence from my roles outlined above and from related networking activity at conferences and workshops and through IS forums, suggests that interpretive researchers are going through a significant period of reflection on matters such as the nature of contributions and how researchers may go about making them. Such discussions focus on the different ways that the goals of interpretive research are understood and actioned (Avgerou 2013b; Gregor 2006),

and the future for the single intensive case study (King et al. 2013), which historically has been the mainstay of interpretive work.¹

The overarching goal of interpretive research has been expressed as aiming for insight (Alvesson and Deetz 2000), a concept which may be mobilized by researchers in a variety of ways, typically as seeking 'to understand', 'to explore' or even 'to examine'. Such work tends to frame its object of study in terms of a social theory which provides a conceptual lens through which the insights are presented and discussed (Walsham 1993). Some refinement of the general propositions of the chosen theory may also be outlined. In general, though, interpretive researchers are cautious about expressing their intention as aiming 'to explain', since such a goal is intimately linked to ideas of causation (Gregor 2006); nor has much attention been given to developing new theory with some level of generality beyond the immediate object of interest (Avgerou 2013b), which typically is studied in a single case study setting. In short, the issues of causality, explanation and generalization receive little or no attention in interpretive IS research. Such issues are, however, of key concern to critical realism, specifically through the concept of generative mechanisms. This paper is premised on the view that engaging with such concerns could strengthen the contributions of interpretive research and thus address some of the current anxiety within the IS field.

The remainder of this paper is organized as follows. In the next section I present the case for middle range theorizing, in particular its implications for the development of explanations in practice disciplines, such as information systems. Then, I address the current nature of explanatory theory within the IS field, highlighting the potential for mechanism based accounts of why things are as they are. Next, I develop the notion of generative mechanisms, explaining their importance as a central plank of critical realist explanations as well as positioning them within the wider body of social science research on mechanism based theory building. I then highlight their potential contribution in a particular domain of empirical work within the IS field – research on information systems in developing countries (ISDC). In the following section, I describe a conceptual framework which has been widely used in ISDC research – the capability approach of Amartya Sen – outlining how the explanatory potential of this approach may be strengthened by adopting a critical realist perspective. These arguments are illustrated with examples from existing research. Finally, I summarize the potential for generative mechanism based accounts within IS research as a whole and outline some particular considerations for interpretive researchers.

The Case for Middle Range Theories

At the end of his term as editor-in-chief of *MIS Quarterly*, Allen Lee invited the senior editors of the journal to contribute to the Editor's Comments by sharing their thoughts on what we have not yet learned within the IS field (Lee 2001). The need for good theory and how to derive it was raised by several contributors. For example, Watson highlighted our use of theoretical bases from other disciplines and argued for a grand theory of MIS to act as the foundation and driving force for our contributions to practice. Ziguers, on the other hand, questioned our contextual understanding of particular technologies in use, despite the emergence of useful theoretical perspectives and good examples of practical work. Sambamurthy identified the need for research that examines how and why questions concerned with the relationship between IT capabilities and firm performance, while highlighting the challenges of combining field-based insights with existing theory in an empirically rigorous approach. Finally, Agarwal called for richer, more rigorous and field-based research to advance both theory development and IT management practice within the IS field.

Although they approached the issue from a diverse range of perspectives, the contributors to the Editor's Comments were concerned with the nature and role of theory in IS research, in particular the relationship between theory and empirical findings. Of particular note in the context of this paper are the

¹ The debates and anxieties to which I refer will be familiar to readers through publications which address such concerns across the IS field as a whole, for example, debates about the need for good theory (Gregor 2006; Lee 2001). In this paper, I focus on a particular community of IS researchers because I wish to argue about the potential of critical realism. This potential has differential implications for researchers dependent upon the ontological and epistemological assumptions underlying the researcher's preferred research paradigm.

contributions that ask: How rich is our knowledge of collaboration technologies in use (Zigurs); and what business and IT capabilities influence superior firm performance, and how and why do they do so (Sambamurthy)?² In the first case, Zigurs acknowledges that despite a significant body of research on collaboration tools, IS researchers would still be hard-pressed to address a practical query about what tools work, for whom, in what contexts, and why they do so. This view suggests that theory is at too high a level of abstraction or generality to address the many dimensions of context applicable to technologies in use. In the second case, Sambamurthy suggests that initially he would address his topic by seeking descriptive relevance, and then making subsequent moves to empirical rigour. In effect, he would first seek an answer to his question in empirical findings and then blend these emerging insights with prior literature and theory to inform further rounds of empirical work.

The question of how to produce better explanations of phenomena of interest has been a matter of perennial importance for social scientists. At the heart of these debates are three major concerns: where the explanations come from, what form they take, and how to go about assembling them. Referred to as the 'theory-methods' gap (Pawson 2000), these concerns were the inspiration for middle range thinking which aimed to provide a bridge between two bodies of social science research predicated on the use of grand theory or abstracted empiricism.³ Middle range thinking is generally associated with the work of the sociologist Robert Merton in the 1950s and 1960s, but these ideas have been subject to ongoing development since that time and have influenced theory building across a wide range of social science disciplines (for example, Bunge 2004; Elster 1989; Gross 2009; Hedstrom and Swedberg 1998).

Referring to the three concerns identified above, middle range thinking suggests that explanations derived from grand theory – or other forms of theory with high levels of abstraction or broad generalizations, such as meta-theory – are often unsatisfactory because such general theory is too abstract or too general to deal with the variety of contexts within which the phenomenon of interest may be embedded (as I suggested above, using the Zigurs example). Furthermore, the use of general theory to guide research may lead to theory-laden observation (Pawson 2000), mitigating against the development of novel and interesting insights by reinforcing rather than complementing existing perspectives (Avgerou 2013b). On the other hand, where explanations are derived from empirical findings, there are challenges with consolidating emerging insights and incorporating them with prior work (as identified in the Sambamurthy example). Middle range thinking is an approach to building theory that is only moderately abstract and has limited generality, yet is capable of consolidating otherwise segregated hypotheses and empirical regularities into wider networks of theories (Merton 1968b). Consider the example of a multi-lane traffic queue which produces driver reactions of 'mild impatience when totally stationary but boiling blood if one of the lanes to the left or the right starts to move along more freely' (Pawson 2000, p. 288). The concept of relative deprivation can be used to explain these reactions and others, where the outcome is dependent on the reference group the driver uses as a natural comparison point (for example, other drivers in the queue, other drivers in the same lane, drivers on other freely-moving roads, and so on). Further development of the theory then involves deriving the conditions under which people select their natural reference group for self-evaluation and attitude formation in particular situations (Merton 1968b).

Pawson (2000) argues that Merton provided us with the vision of middle range theory, but failed to focus on the means of getting there, that is, the process of conceiving and assembling the hypotheses of limited generality that form the building blocks of such theory. Drawing from a realist methodology, Pawson suggests that these hypotheses are configurations of context-mechanism-outcome, which 'explain social outcomes in terms of the action of generative mechanisms acting in conducive contexts' (p. 285). In other words, Pawson proposes a 'middle range realism' in which the process of deriving middle range hypotheses is captured perfectly by the realist strategy of explaining social regularities in terms of the action of underlying generative mechanisms. Before I turn to a discussion of the potential of generative mechanism based explanation, I want to highlight the current nature of explanatory theory within the IS field.

² My concern here is not with the domains of the research, but with the types of question the researchers are asking and how they propose to address them.

³ I am grateful to an anonymous reviewer for this clarification.

Explanatory Theory in IS Research

In her examination of the structural nature of theory, Gregor (2006) identifies ‘theory for explaining’ as one of five types of theory used within the IS field. Within this type (labelled type II), she highlights two forms of theory for explaining phenomena of interest: high level abstract theories used as sensitizing devices (for example, structuration theory) and lower level case studies which analyse how and why things happen in a particular real world situation (for example, the study by Avison et al. 2006). She argues that type II theory could well be called ‘theory for understanding’, since it is frequently oriented towards providing insight with a view to bringing about an altered understanding of how or why things are as they are. Furthermore, she suggests that forms of type II theory correspond closely to some views of theory in the interpretivist paradigm. These clarifications are very important, and their implications are at the heart of the argument I go on to make about the need for better explanatory theory in IS research and the associated considerations for interpretive researchers.

Gregor defines the structural nature of each theory type in terms of four common components – a means of representation, constructs, relationships among constructs, and scope – and up to three contingent components – causal explanations, testable propositions and prescriptive statements – dependent on the purpose of the theory, i.e. to analyse, to explain, to predict, to explain and predict, or to prescribe. Her example of high level type II theory is Orlikowski’s (1992) structurational model of technology which, Gregor suggests, contains causal explanations of the form:

‘Technology facilitates and constrains human actions through the provision of interpretative schemes, facilities and norms’ (p. 410).

Many interpretive IS studies have drawn on Orlikowski’s model, endorsing the above statement of relationships which is consistent with the broader interpretivist epistemology of IS research, that is, an information system influences and is influenced by its context (Walsham 1993). This work has identified particular modalities – interpretive schemes, facilities and norms – through which different technologies can shape and be shaped by action in specific contexts described by researchers (Walsham 2002). Moreover, work has been done to refine the general theoretical claims of structuration theory by combining structurational concepts with other theories and concepts which give further insight into the operation of particular modalities (Orlikowski 2000). Nevertheless, I suggest that, despite this significant body of thoughtful work, we would still struggle to answer the type of middle range questions posed earlier which, in this case, might ask which schemes, facilities and norms operate for whom in what contexts, and why they do so.

One may argue that these issues are not the goals of interpretive work; that its goals are to provide interesting insights (Alvesson and Deetz 2000), not causal explanations, and generalizations which may prove useful in other settings (Orlikowski and Baroudi 1991; Walsham 1995). In relation to the use of theory as a sensitizing device to provide understanding and rich insight, DiMaggio (1995, cited in Gregor 2006) suggests that, from this perspective, theory serves as:

‘A device of sudden enlightenment ... complex, defamiliarizing, rich in paradox. Theorists enlighten not through conceptual clarity ... but by startling the reader into satori. The point of theory, in this view, is not to generalize, because many generalizations are widely known and very dull. Instead, theory is a “surprise machine” ... a set of categories and domain assumptions aimed at clearing away conventional notions to make room for artful and exciting insights.’

Compelling examples of research that provide such insights are undoubtedly a very important part of the body of interpretive work within the IS field. Indeed, one may argue that early studies within a research domain would lack the empirical evidence to present causal explanations with a certain minimum level of generality. However, subsequent work within the domain could address these goals, but for the most part is not doing so (Avgerou 2013b).⁴ Moreover, if taken to extremes, tentative claims about generalization would allow every interpretive study to be presented as a novel case, making the possibility of addressing

⁴ Avgerou addresses this matter for the practice perspective of IS research. I will address it later in this paper for a further domain of IS research, although my argument is that these domains are examples not exceptions.

the type of question raised by Zigurs ever more elusive. Yet, as I read such work, it does not seem to me that all of the examples are as startling and surprising as the most compelling ones.

Gregor's lower level example of type II theory is an analysis of three case studies of fairly catastrophic IS failure (Avison et al. 2006) in which the authors identified a lack of attention to IT governance and project management principles in all cases. The study appeared in *Communications of the ACM* and is largely descriptive in the sense identified by Orlikowski and Baroudi (1991). So, while Avison et al. explain their findings in terms of what they refer to as 'common themes/causes', I suggest that 'themes' rather than 'causes' is consistent with the way I am addressing causal explanation in this paper.

In reflecting upon interpretive research, as the tradition to which I feel most closely aligned, clearly I am not arguing for explanatory theory with universal validity, but I do suggest that information systems is a practice discipline and therefore that we should be able to offer managers, policy makers and practitioners something more than a body of research that somewhere within it may have some useful lessons for them in their particular situations. I suggest that it is our role as researchers to make more sense of our body of work than that, but I also wish to be clear that the suggestions I make in this paper are but one way of doing that, and I hope that this work may spark discussion about others. Adapting terminology that Burrell and others have applied to Foucault's body of work: interpretive research has done some very useful work uncovering 'the different in the same' (in our field, the particularities of introducing similar information technologies), now seems an appropriate time to attend *also* to 'the same in the different' (the commonalities across contexts perceived to be different).

Generative Mechanisms

Critical realism has been presented as a powerful alternative to other research traditions owing to its ability to combine and reconcile realist ontology with epistemic relativity. In this way, it is seen as resolving some of the most enduring philosophical debates of modern times about the nature of reality and knowledge and how we may explain observed outcomes. Arising from an elision of the terms *critical naturalism* and *transcendental realism*, critical realism is an approach with intellectual roots in both the philosophy of science and the philosophy of social science (for example, Archer et al. 1998). This intellectual provenance is indicative of the way that critical realism is positioned relative to other research traditions such as positivism and interpretivism. In effect, critical realism challenges the empiricist view that the world is reducible to those events that can be empirically observed, while advancing the position that reality is comprised of objects, entities and structures that have real (independent of our perception) internal mechanisms that can be triggered to produce observable outcomes. At the same time, critical realism acknowledges that our observations and knowledge are never perfect and unmediated, rather they are relative to a particular time and place (Bhaskar 1978).

The term *generative mechanism* is used to refer to the real, manipulable, internal mechanisms at the heart of critical realist accounts of why things are as they are. These causal mechanisms may be seen as part of a wider body of research on social mechanisms and the associated development of middle range theory within the social sciences (Merton 1957; Mills 1959). This work pre-dates the early development of critical realism in the 1970s while continuing in parallel with it (Bunge 2004; Elster 1989; Gross 2009; Hedstrom and Swedberg 1998). In his typology of social mechanisms, Gross (2009) argued that the principal contributors to mechanism based research see social mechanisms as causal processes that unfold over time, have a certain minimum level of generality, and are composed of elements analysed at a lower order of complexity or aggregation than the phenomenon they help explain. In effect, social mechanisms are the 'gears in some social machinery' (p. 363), for example, the processes of diffusion by which ideas and practices spread via networks. In addition, the generative mechanisms discussed by critical realists, notably Bhaskar and Collier, have the following qualities: they can be triggered (or not) by other events and mechanisms, are generally unobservable except in their effects, and tend to be studied in terms of collective (rather than individual) action (Archer et al. 1998; Bhaskar 1979). These three aspects of generative mechanisms are a direct consequence of the distinctive combination of ontology and epistemology in critical realism.

Ontologically, critical realists accept a domain of physical and social objects separate from our knowledge of them, which have (generally unobservable) capacities for behaviour called generative mechanisms. Language is such an object which has mechanisms that enable people to communicate. Epistemologically,

constructing mechanism based explanations involves analytical movement across three layers of reality: from the *empirical* domain, where the effects of the mechanisms may be observed, through the *actual* domain of events (and non-events) which generate the observed effects, to the (highest order) *real* domain of objects with the associated causal powers. Since the real domain contains a host of structures, processes and events, mechanisms are in constant interaction with one another in an open system such that they are sometimes triggered, sometimes not triggered, and sometimes cancelled out altogether. Thus the tracing of mechanisms involves a transcendental style of argument which takes an empirical observation and then asks what the world must be like for this to occur (Mingers 2004).

Furthermore, critical realists subscribe to the notion of emergence, in which higher level objects – for example, the market – emerge out of lower level objects, such as financial institutions, investors, regulation and so on, but the mechanisms of the former are not reducible to those of the latter. The methodological implications of this position are that critical realists prefer to study social collectives since it may be infeasible to trace all of the individual level causal chains which bring them about – a preference for social ontologism as opposed to methodological individualism.

What are the implications of these mechanisms for theory building and practice within the IS field?

Generative mechanisms are the causal powers of an object, that is, the range of ways in which it can act (Bhaskar 1979). In the case of social (rather than natural) structures, Bhaskar argues that these ways of acting are best seen as tendencies, given the high dependency of social structures on context-specific social interaction. Given the nature of an information system as a complex social structure, its generative mechanisms may be seen as social processes that are capable of bringing about or preventing some change in all or part of the system. Such processes comprise structures, activities and events that interact to produce or inhibit the change. For example, Bygstad (2010) investigated innovation in information infrastructures and proposed two self-reinforcing mechanisms which explained how the process of innovation led to the provision of new services which in turn attracted more use of the infrastructure and more profits from its customers which could then be used to finance further innovation.

Critical realists seek not just to identify generative mechanisms but also to invoke them in an explanation of why things are as they are. This means establishing the conditions under which they come into being, fail to operate, and so on (Merton 1968a). This is done in a process of *retroduction* which involves hypothesizing the structures and processes that give rise to observable events and then treating the hypothesized mechanisms as candidate explanations which may be refined through further empirical observations (Mingers 2004; Sayer 2000). For example, Zachariadis et al. (2013) employ a five-stage retroductive approach to uncover the generative mechanisms which explain how the adoption of a financial telecommunications innovation (SWIFT) affected the performance of banks. They adopt a mixed methods approach involving interviews, archive analysis, econometric modelling and a single bank case study to progressively refine their candidate explanations.

Mechanism based accounts aim to go beyond description to explanation, but nevertheless do not strive for the generality of highly abstract theories or universal covering laws (Hedstrom and Swedberg 1998). In effect, they are explanations tailored to a limited range of phenomena, such as innovation in information infrastructures, information systems failure, social collaboration using Web 2.0, etc. In this way, mechanism based explanations are associated with the development of *middle range theory*, the origins of which are associated with the work of Robert Merton. They are seen as theories which are more than sensitizing devices because of their explanatory potential (ibid.); as addressing ‘problem-driven’ rather than ‘paradigm-driven’ work (Davis and Marquis 2005); and hence to have particular relevance for addressing the kind of practical problems dealt with in the IS field (Gregor 2006).

How do such explanations differ from interpretivist and positivist accounts of the same phenomena?

Much has been written in various branches of the social sciences about the merits of mechanism based versus variable based explanations. Summarizing the main arguments, variable based explanations (which form the prominent strand of research in the positivist tradition) focus on associations between factors or constructs which are tested through statistical correlation, whereas mechanisms produce the observed associations. Hence mechanisms explain what brings the relationships between variables into existence. In short, variable based explanations may be seen as addressing *what*, while mechanism based explanations address *why*. (For a fuller explanation, see Avgerou 2013b; Gregor 2006; Hedstrom and Swedberg 1998; Mingers 2004).

As argued earlier, in the interpretivist tradition of IS research, theory is frequently used a sensitizing device in which the researcher's goal is understanding and rich insight, rather than causal explanations. The most compelling examples would meet DiMaggio's (1995, cited in Gregor 2006) description of the use of theory included above. The danger with such an approach is that it is all too easy for the theoretical concepts to become little more than a template for presenting the research, such that the work lacks the subtlety, touch and surprise elements that characterize the better examples. More significantly, in the context of this paper, the goal of interpretive studies tends not to be the development of explanatory mechanisms in the form of causal processes unfolding over time with a limited level of generality to real-world phenomena.

In short, notwithstanding the contribution of philosophical debate about the merits (or otherwise) of critical realism (for example, Klein 2004; Mingers 2004; Monod 2004), I suggest that its most important potential contribution to the IS field is the concept of generative mechanisms as building blocks of explanatory middle range theories, as indeed Hedstrom and Swedberg (1998) argued about Merton's (1968a) seminal essay on social mechanisms in sociology. In this paper, I illustrate this argument in the context of IS innovation in developing countries (DCs), that is, the development and implementation of IT applications and associated organizational changes viewed within the broader socio-economic context of the organizations hosting new technologies (Avgerou 2009). My rationale for choosing this domain is twofold. First, there is a very significant body of interpretive research in this area on which to base my argument, to the extent that interpretivism is, arguably, the dominant paradigm in ISDC research. Second, the conceptual framework I use as an illustrative example has been much used in research in a DC context, yet it is acknowledged to be abstract and counterfactual, and hence to present methodological challenges in use (Smith and Seward 2005). Again, though, I reiterate the view expressed in my earlier footnote, that the approach to explanation in this domain tends to be the norm for interpretive IS research rather than an exceptional example of it. In the next section I review the main strands of ISDC work to indicate the potential contribution from a mechanism based research orientation.

IS Innovation in Developing Countries

In her critical review of ISDC research, Avgerou (2008) identifies three discourses on IS innovation – defined as IS implementation and associated organizational and social change. In the *transfer and diffusion* discourse, she discusses work that assumes the validity for particular DCs of mainstream IS knowledge and good practice models, if suitably adapted to the specific context of use. Such work aims to address the complexity and richness of the DC context by modifying the variables, factors or prescriptions for action in the mainstream models (Bada 2002; Mursu et al. 2003). As such, it may contribute variable based explanations of IS innovation (Al-Gahtani 2003) or theories for design and action (Gregor 2006) in IS development and implementation, often as adaptations to a systems development methodology (Korpela et al. 2000). In the first case, such explanations differ from critical realist accounts because they focus on the associations between factors rather than on how such manifestations are brought into being in the first place. In the second case, although prescriptions for action may result from mechanism based explanations, this strand of ISDC research tends not to focus on the underlying theories on which the action strategies are based.

In the *socially embedded* and *transformative* discourses of ISDC research, IS innovation is viewed as a socially constructed course of action. Research in the socially embedded discourse reveals a wide range of perceived contributions that information and communication technologies (ICTs) might make in improving the socio-economic conditions in DCs, alongside a diverse range of insights into what constitutes locally meaningful action in such cases. This work uses a wide range of socio-theoretical perspectives, with structurationist (Walsham 2002), ANT (Braa et al. 2004) and institutionalist (Avgerou 2000; Silva 2007) accounts being especially popular. Like the interpretivist research discussed earlier, such theory is frequently used as a sensitizing device with the goal of rich insight. Any proposed refinements to the theory tend to be oriented towards its general theoretical claims rather than to develop theory for explaining the narrow research topic (Avgerou 2013b), in other words, to refine its high level, abstract claims rather than to develop middle range theory of limited generality.

The transformative discourse is less well developed in ISDC research. Such work questions the validity of IS innovations whose merits would be taken for granted in the transfer and diffusion discourse (e.g.

Ciborra 2005; Kruger 2011). Furthermore, it focuses on how such innovations strive to change the socio-political and economic relations in DCs (Akpan 2003; Kanungo 2003) – conditions which the socially embedded discourse take as given (Avgerou 2008). The socio-theoretical underpinnings of the transformative discourse can be the same as those of the socially embedded discourse, but the insights developed are the basis of a critical reflection on what is happening rather than a way of understanding the *status quo* with a view to guiding local context-sensitive action. Less evident, even in this research, is a concern with uncovering the causal mechanisms that give rise to the observed outcomes and developing associated, explanatory theory of limited generality. Given the concerns of the transformative discourse such explanations are particularly crucial to understanding the causal processes that would need to be manipulated to achieve the desired outcomes.

Overall, ICTs have a part to play in transforming the life conditions of citizens in DCs in areas like capacity building and poverty alleviation (Corea 2007; Kenny 2000; Madon 2004), good governance (De' 2008; Navarra 2010), and healthcare coverage and delivery (Miscione 2007; Zheng and Walsham 2008). However, concerns have been expressed about the value to citizens of particular projects, scalability from small projects to regional or national initiatives, and long term sustainability of the developments (Madon et al. 2009). In practice, outcomes are mixed, socio-economic development is uneven, and some countries have very poor records with implementing IS innovations (Avgerou 2008; Heeks 2002). Notable successes, such as India's software industry, contrast sharply with other countries' frustrated attempts to develop substantial ICT capabilities and infrastructures to support their major industries and public services. Furthermore, the relationship between ICT success and the development policies and achievements in the countries concerned is not well understood. Mechanism based research appears to have significant potential not just for explaining these enduring concerns, but also for theory building about persistent issues in IS research more widely, such as the failure of IS innovations to contribute to expected outcomes in a wide range of organizational and socio-economic contexts.

The Capability Approach of Amartya Sen

In this section I highlight a conceptual framework which has been widely used in ISDC research, yet one that is sufficiently meta-theoretical in nature to be used and developed in different ways and approached from different epistemological positions (Gregor 2006). The capability approach of Amartya Sen (Sen 1999) may be seen as a framework of thought or mode of thinking (Robeyns 2000) which provides a means to analyse a range of issues concerned with socio-economic development. It may be mobilized by researchers with normative intent, for example, to measure and evaluate levels of well-being within a community or by researchers with intent to provide insight and/or critique on the nature of such development. Within ISDC research, these concerns are generally addressed in terms of the contribution and role of ICTs within the development process. In this section, I focus on the way the capability framework has been used in interpretive ISDC studies and how its explanatory potential may be strengthened by adopting a critical realist perspective.

Sen's (1999) capability framework is informed by the human development approach which arose in opposition to an earlier focus on economic growth as the measure of development. By contrast, Sen argues that human capabilities are the evaluation space for development. *Capabilities* are notions of freedom in the sense that they represent opportunities for individuals or groups to lead lives of their choosing and, in so doing, to achieve valued outcomes or *functionings*. For example, the right to vote may be seen as a capability that allows individuals to achieve the functioning of participation in the choice of a nation's political leaders. Capabilities provide potential to achieve desired goals, but they require choice and the exercise of human agency to convert that potential into actuality. Furthermore, personal characteristics and social structures may facilitate or constrain the realization of opportunities. In our example, individuals may choose not to exercise their right to vote – say, because they are disillusioned with their country's political system – or they may be constrained in exercising their rights by civil unrest which threatens sympathizers with particular political regimes.

Capabilities occupy a central role in Sen's approach, as a mediator between commodities (i.e. the goods and services to which a person has access) and functionings (i.e. a person's actual achievements in life). Capabilities are constitutive of a person's development because they determine the extent to which the individual can benefit from goods and services and convert opportunities into actual achievements

(Robeyns, 2000). Nevertheless, social arrangements can enable or constrain such achievements. Sen identifies five distinct types of arrangements (instrumental freedoms) that can contribute, directly or indirectly, to the general capability of a person to participate in developmental activities:

- i. Political freedoms: opportunities to choose leadership and other kinds of representation based on principles people value, and the possibility to challenge and scrutinize the authorities;
- ii. Economic facilities: arrangements which enable people to have and use economic resources for consumption, production or exchange;
- iii. Social opportunities: arrangements for public education, healthcare and other interventions which improve the living standards of people;
- iv. Transparency guarantees: arrangements which allow interaction with others based on some basic presumption of trust;
- v. Protective security: institutional measures which provide relief to vulnerable people to mitigate against further deprivation.

These instrumental freedoms can contribute, individually and jointly, to enhancing people's capabilities (Sen 1999). For example, the creation of social opportunities, such as education and health, can increase public participation in political activities. Similarly, transparency guarantees which tackle corruption and financial irresponsibility can encourage people to participate in economic activities that contribute to economic growth.

ICTs have a part to play in initiatives which seek to increase people's capabilities, for example, an e-voting system may influence individuals' decisions to vote because they may believe that information technology increases the security of the system and hence the likelihood of a representative outcome. From this perspective, development involves making improvements not just in the capabilities (or freedoms) of individuals and groups but also in the processes through which they engage in activities that contribute to their growth. In this way, the expansion of freedom is both the primary end and also the principal means of development.

The 'theory-methods' gap in the capability approach

The relationship between capabilities and functionings is consistent with the stratified ontology proposed by critical realists. Specifically, capabilities are often unobservable except in their effects as functionings. Moreover, the conversion of a capability into a functioning is dependent upon the interaction among the individual's capability set, their personal characteristics (biologically and motivationally) and prevailing social arrangements (structures, processes and events). In essence, the observed functioning may be seen as the outcome of human action resulting from the actualization in a particular context of the causal generative mechanisms of social structures and human capacities for intentional behaviour.

The abstract nature of Sen's conceptual framework presents implementation challenges for researchers owing to the ontological gap between capabilities, as the evaluation space for development, and functionings, as the proposed empirically observable outcome of exercising one's capabilities. Questions arise about the indirect nature of functionings as a proxy measure. For example, can a functioning be achieved other than by exercising a particular capability? If a functioning is not observed, what does this say about the existence or otherwise of the associated capability? In the first case, the answer is clearly 'yes'. Consider the case of a government worker who owns a bank account because this is the mechanism by which their salary is paid. Clearly, possession of such an account is no evidence of transparency guarantees operating in that context. Indeed, government workers in some countries may withdraw their salary as soon as it is paid because of a lack of trust in their banking system. In the second case, the absence of a functioning need not imply the absence of the associated capability since choice and the exercise of human agency are required to achieve the functioning, as I highlighted earlier in the case of individuals choosing not to exercise their right to vote. These issues can be addressed by conceptualizing capabilities as configurations of mechanisms that are causally connected to functionings (Smith and Seward 2005). The issue then becomes one of determining how, for whom, and in what contexts these mechanisms operate (Pawson 2000). As I argued earlier, this gap was the inspiration for middle range thinking, and more specifically the search for causal explanations in terms of generative mechanisms.

Smith and Seward (2005) present a fuller explanation of the arguments supporting the view that Sen's capability approach is consistent with a critical realist philosophy. For the purposes of this paper, I am more concerned with the pragmatics of how to go about implementing such an approach and what it may contribute to improving explanatory ISDC research. These goals are particularly important, given that Sen's framework is meta-theoretical in the sense that his goal is neither to provide a prescription for development nor to explain how capabilities give rise to observed functionings. Indeed, he does not suggest a set of essential capabilities that everyone should strive for or a list of desirable functionings with universal validity. Therefore, how a research study identifies capabilities and related functionings is highly context dependent and therefore it is crucial to understand how these different contexts give rise to achieved outcomes.

The retroductive process of critical realism

Earlier, I referred to a process of *retroduction* which involves hypothesizing the structures and processes that give rise to observable events and then treating the hypothesized mechanisms as candidate explanations that may be refined through further empirical observations (Mingers 2004; Sayer 2000). I now outline the steps in this process (Mingers 2011), highlighting what they would involve in the context of explanatory ISDC research using the capability approach.

- i. *Description of the phenomenon of interest in terms that make it relevant to the concepts or issues of some particular theory (theories).* For example, consider a study where the phenomenon of interest is financial inclusion – defined as participation in the consumer credit industry of a country – and the research goal is to explain how biometric identity cards contribute to this process. The description would then focus on a necessary capability to achieve such participation, that is, the need to provide trustworthy means of identification. Such means are lacking in many DCs where birth registration is a relatively recent phenomenon and other recognized means, such as international passports and driving licences, are not widely held within the population. These issues would make the phenomenon of interest amenable to the concepts of Sen's capability approach since participation in consumer credit could be conceived as a functioning which trustworthy means of identity verification provide the potential to achieve. While the focus of the study would be on the role played by the identity cards, the research would need to consider how prevailing social arrangements and individuals' personal characteristics would enable and constrain the achievement of outcomes. The explanatory mechanisms produced by such research would aim to uncover why, for whom and in what contexts the capability gives rise to the desired functioning;
- ii. *Retroduction, a process of hypothesizing mechanisms whose existence would generate the observed phenomenon of interest.* In the above case, the degree of participation in the consumer credit sector of a country varies across contexts. For example, empirical findings may suggest that social arrangements – such as poor availability of bank branches in some areas or the high (relative to disposable income) cost of conducting low value transactions – constrain participation. Moreover, personal characteristics – such as a lack of trust in the banking system or religious convictions about the appropriateness of charging interest on loans – may also have this effect. Furthermore, high participation may be better explained by coercion than identity verification in some contexts, as I suggested earlier in the case of government workers paid directly into bank accounts. Thus retroduction will produce several configurations of context-mechanism-outcome which need to be subjected to further rounds of empirical work;
- iii. *Elimination of competing explanations and attempts to demonstrate the existence of the mechanism through further empirical research.* The above configurations will contain competing explanations. The aim is to find the mechanism which provides the best explanation of outcomes on the basis of the empirical evidence. Further rounds of empirical work will be required to demonstrate the existence of the proposed key mechanism. Analysing the potential explanations will also involve searching for mechanisms that are either too limited or too general to be useful explanations (Bygstad and Munkvold 2011). In both cases, the judgement of the researcher is important in reaching these key decisions. In the first case, a mechanism that only appears to occur in the context in which it was identified might be eliminated on the grounds that the study

is searching for tendencies not absolutes. On the other hand, the context in question may be very significant, suggesting that this mechanism with limited scope be incorporated within another mechanism with greater explanatory power, in the same way that the concept of relative deprivation (highlighted earlier) was able to absorb a range of context-mechanism-outcome configurations about reactions to a traffic queue. In short, the key mechanism is itself likely to comprise several interrelated mechanisms without being so abstract or so general that it lacks the explanatory power to address observed outcomes in significant researcher-defined contexts;

- iv. *Identification of the generative mechanism that provides the best approximation of observed reality and appropriate development to the theoretical base.* Given the critical realists' acceptance of the fallibility of knowledge, the mechanism selected can always be subject to elaboration or challenge in further studies. At this stage, though, the key mechanism will need to be incorporated within wider networks of theory, in our case, to either refine the general theoretical claims of Sen's capability framework or to complement them with novel insights.

Improving the explanatory potential of ISDC research

ISDC research using the capability framework has generally adopted the approach of using Sen's ideas and concepts as sensitizing devices with the goal of providing insight into particular phenomena and thereby improving our understanding of them. For example, Zheng and Walsham (2008) focused on the relationship between commodities and capabilities and highlighted the conversion factors that affected individuals' abilities to participate in what they termed the e-society (i.e. public access to ICTs of various kinds). They conceptualized the information systems in question as commodities and used the notion of capability deprivation to outline the conversion factors associated with social exclusion from the e-society in two different DC contexts – South Africa and China. The authors do not express their goal as providing an explanation in either case, nor do they claim to conduct a comparative analysis that would explain the different outcomes in the two countries. Rather, they have a concern to improve our understanding of the phenomenon of social exclusion and to show the adaptability of the capability approach to the different conditions in the two countries.

In a similar vein, Sen's instrumental freedoms have been used as sensitizing devices with the aim of understanding the development impacts of particular ICT interventions in other DC contexts (Ibrahim-Dasuki et al. 2010; Maiye and McGrath 2010). Furthermore, refinements to the capability framework have been proposed in an effort to improve its operationalization potential for evaluating development interventions and to include a clear role for information technology (Hatakka and De' 2011). Notwithstanding the contribution of these studies, some key questions remain which require the development of 'tested and refined middle range theories that tell us *why, for whom, and in what contexts* these capabilities work' (Smith and Seward 2005, p.23). Such theories can strengthen the explanatory potential of ISDC research, providing a firmer theoretical foundation for the IS field, as well as providing a basis for action strategies for practitioners and policymakers involved in similar development projects.

Implications for other related forms of IS research

For the most part in this paper, I have focused on the potential to improve the nature and use of theory most common to the interpretivist tradition of IS research. Referring again to Gregor's typology, I note a further type of theory with explanation as a goal, that is, 'theory for explaining and predicting' (type IV), which in addition to addressing how and why a phenomenon occurs aims to predict whether or not the phenomenon will occur in the future or in other contexts. Gregor's example of the use of type IV theory is a study by Bhattacharjee and Premkumar (2004) in which the authors expressed goal is '[e]xplaining *temporal changes* in users' beliefs and attitude towards IT usage' (p. 230, emphasis in the original). She highlights the authors' use of causal reasoning, nevertheless the 'theoretical model is given in a very general form; boundaries are not stated and the hypotheses have no modal qualifiers' (Gregor 2006, p. 627). In this case, then, there is scope to improve the explanatory potential of the research by deriving middle range hypotheses with a lower level of generality. In other examples of the use of type IV theory, authors are ambivalent about the need for causal logic (Gregor 2006). As discussed earlier, they focus on the associations between variables or constructs and test them through statistical correlation, without

feeling the need to establish the conditions under which such structures come into being, fail to operate, and so on (Merton 1968a). Much work using type IV theory shares similarities with research in the positivist tradition of IS research. Although such work has not been the focus of this paper, I suggest that critical realism also has a contribution to make to this tradition.

Conclusion

In this paper, my aim has been to adopt a pragmatic approach to examining the potential of critical realism as an underlying philosophy for information systems research. My approach was informed by the claim that critical realism offers prospects for ‘shifting attention toward the real problems that we face and their underlying causes, and away from a focus on data and methods of analysis’ (Mingers et al. 2011). In this way, I engaged with philosophical arguments only to the extent that was necessary to evaluate different kinds of contribution and hence to compare research outcomes from critical realism with other more familiar research traditions in the IS field, such as positivism and interpretivism. Rather than looking for constant conjunctions of events, as in the statistical correlation models of positivist research, critical realism seeks explanations in the form of (causal) generative mechanisms that give rise to observed outcomes. It also avoids the use of theoretical concepts as sensitizing devices or as highly abstract theories to be refined by experience from a case study, as in the interpretive tradition of IS research.

I have highlighted the importance of generative mechanisms as a central feature of critical realist explanations and outlined their potential contribution in a particular domain of empirical work – ISDC research. I illustrated these arguments by reference to a conceptual framework which has been widely used in ISDC research, typically as a sensitizing device, arguing that its explanatory potential could be strengthened by adopting a critical realist perspective. More generally, I suggest that a critical realist approach presents opportunities not just for explaining enduring issues in ISDC research and across the IS field as a whole, but also for deriving theoretical and practical implications contributing to middle range theory and action strategies useful for practitioners and policymakers. In effect, I am engaging in some causal reasoning, hypothesizing that adopting the critical realist concept of generative mechanisms will tend to improve the explanatory potential of IS research. Experience will tell how, by whom and in what contexts such achievements will be realized.

Returning to my comment in the Introduction that I approached this work with a pragmatic interest in the relevance of a critical realist approach for my research, I think it is appropriate to offer some personal reflections on what I learned during the process. These reflections are not intended to offer a formal comparison of interpretive and critical realist research, but simply to provide some personal thoughts on the considerations a researcher may have if considering the adoption of a critical realist approach in their research.

Philosophical Assumptions

A critical realist approach requires the researcher to accept both realist ontology and epistemic relativity. The nature of truth in critical realism may present significant issues for researchers in the positivist tradition, in particular the retroductive process, which involves the intuitive activity of postulating the existence of generative mechanisms and the creative activity of eliminating competing explanations without recourse to empiricist arguments about the objective truth of statistical correlations of variables. From an interpretivist perspective, issues relate to the extent to which the researcher can accept some form of objective reality. Such acceptance may be feasible for many since it does not count on the extreme position that natural and social phenomena are inherently similar and should be studied in the same way. In particular, Bhaskar (1979) accepts some ontological differences between the natural and social worlds. Social structures, he argues, are unlike natural structures because they are neither independent of the activities they govern nor of agents’ conceptions of what they are doing in those activities; furthermore, social structures are only relatively enduring in both space and time. Many of the social theories adopted in interpretive research are consistent with such assumptions, in other words, critical realism acts as a ‘philosophical under-labourer’ for such theories about the world.

Use of Theory

Gregor (2006) identifies five types of theory which serve different purposes in information systems research. Importantly, in the context of the current paper, she provides a way of thinking about theory in terms of how it engages with the key issues of causality, explanation, prediction and generalization.

Critical realist research

Theories consistent with a critical realist approach will have a certain minimal level of generality, that is, they will be substantive in the sense that they are developed to address a well-delineated phenomenon of interest, such as electronic auctions, outsourcing, or social computing. Moreover, the retroductive approach requires that a number of candidate explanations are considered and that further empirical work is undertaken to eliminate competing accounts so that the best possible explanation at a given time is provided. Given the central role of generative mechanisms in critical realist accounts, causality is a central feature of such explanations; thus, part of the research effort involves establishing the causal chain which gives rise to observed outcomes and the processes which trigger (or not) particular combinations of generative mechanisms. This sets very high demands for a single study which not only presents challenges for reporting it in a single manuscript but also requires a significant investment of research effort to produce the initial 'best possible' explanation. Some illustration of these arguments is provided next by referencing a number of recently published studies which present mechanism based accounts of IS phenomena.

Henfridsson and Bygstad (2013) employ a multimethod research design to explain digital infrastructure evolution in terms of three generative mechanisms: adoption (A), innovation (I) and scaling (S). The work involved an in-depth case study conducted over 19 months (Bygstad 2010) – where successful evolution was hypothesized in terms of the three mechanisms – followed by case survey research of a further 41 cases of digital infrastructure evolution to analyse the applicability of the initial findings in other settings. The survey involved analyzing the 41 cases in terms of both evolution outcome (success or failure) and the actualization (or not) of the three generative mechanisms (AIS). Much of the paper is devoted to establishing the methodological rigour used to substantiate the initial findings. Thus the limitations of a single manuscript leave limited space for unpacking the adoption, innovation and scaling mechanisms themselves, although each of these entities may be seen as a complex combination of mechanisms in its own right with further explanatory potential for the outcomes from digital infrastructure evolution.

The paper by Zachariadis et al (2013) – discussed earlier – focuses on the methodological implications of critical realism. Their 5-step retroductive approach is a mixed methods research effort in which they developed and substantiated their initial findings about SWIFT adoption on bank performance through a combination of 70 exploratory and follow-up interviews, historical archive analysis, a single case study, a small-scale econometric modeling exercise and a large-scale econometric analysis of a dataset of 6,848 adopter and non-adopter banks covering 10 years of financial performance data and 30 years of SWIFT adoption data. In short, their study started with sampling a small number of personal narratives and was revised in scope to include statistical research on the entire SWIFT membership.

Avgerou (2013a) traces the social mechanisms explaining trust in e-voting. Although not a study informed by a critical realist perspective, I have already argued that generative mechanisms may be seen as one type of social mechanism, and therefore this work shares a concern with those studies outlined above to identify causal explanations which then need to be subject to further empirical testing to refine initial findings. The focus of Avgerou's paper is on the first of these concerns, and therefore she concentrates her effort on unpacking the social mechanism of trust into constituent mechanisms that explain both the development and continuation of citizens' trust in e-voting. Her research approach is a longitudinal case study which involved data collection over a two-year period. In outlining the limitations of her research, she not only points out the need to conduct comparative work in other settings, but also observes that the mechanisms she has identified could be unpacked further, highlighting both the tentative nature of her causal explanations and the high demands of a research effort aiming to develop middle range theory.

Interpretive research

Gregor identifies two subtypes of 'theory for explaining' that are consistent with views of theory in the interpretivist tradition: use of theory as a sensitizing device to provide rich insight and use of theory to analyse how and why things happened in a real-world situation, typically in a case study setting. Such narratives are more cautious about their claims to both explanatory potential and the level of generality of the findings than critical realist accounts.

In the case of using theory to provide rich insight, much important work has been done within the interpretivist tradition to highlight the significance of context, not least within ISDC research. However, after more than two decades of interpretive research, we still have a poor understanding of how context comes into play beyond the specific setting of a particular study. Having gained very many important insights, further research has been reluctant to generalize beyond a claim that insights derived from a particular study may inform other settings (Walsham 1995). Thus, research questions concerned with why some organizations/countries have poor records with introducing ICTs while others do not, or how government policies influence such experience are still underexplored areas of research.

On the one hand, this may represent a philosophical stance on the part of the researchers who would specifically exclude causal explanations from their accounts. Where such research provides the kind of 'artful and exciting insights' referred to earlier in this paper, it will continue to make a very important contribution. On the other hand, we also need the type of research that will follow on from such insightful work and endeavour to develop substantive theory with a certain minimum level of generality.

Writing Up and Publishing

Following on from the previous point, it is easy to see why researchers under pressure to publish might be reluctant to engage in the type of retroductive process that not only requires an intensive case study but also demands further empirical observations to test and refine the original hypothesized explanations. As it stands, journal editors and reviewers raise a common concern about the limited number of longitudinal case studies that are submitted for publication. Setting even higher demands for empirical work seems unlikely to increase the submission rate. One may argue that this issue could be addressed by more IS research involving cross-paradigm collaboration. Within the dominant traditions of IS research, there is limited evidence that this approach is attractive to researchers. Critical realism with its unique take on the assumptions and concerns of the dominant paradigms has potential to address this issue. Nevertheless, until very recently, critical realist research in IS has focused on interesting philosophical debates rather than findings from empirical studies. Thus, some consideration needs to be given to the demands of conducting and reporting empirical work in this tradition if it is to be reported within the limitations of a journal article.

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