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Conceptual Synthesis 1

Learning from the Diffusion of Innovations

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Conceptual Synthesis 1: Learning from the Diffusion of Innovations

Introduction

A major concern for policy makers and managers is how to ensure that research evidence has greater impact on the policy making process, the organisation of service delivery and the patterns of professional practice. Such research impact can take many forms and has various facets; for example it may focus on the utilisation of specific research findings or be concerned with the redesign of the policy process and service delivery practices so that they are routinely informed by best evidence. Reflecting this complexity, throughout this review we will use the term ‘research utilisation and evidence based policy and practice implementation’ (or RU/EBPP implementation for short) to refer to those diverse sets of activities which seek to enable more and better use of research findings.

This is the first of a series of reviews that aim to synthesise areas of conceptual knowledge that can contribute to a better understanding of these issues. The objectives of these syntheses are:

- To provide an overview of the literature in a given field, including the main ideas, models and debates;
- To tease-out the implications of these ideas, models and debates for the RU/EBPP implementation agenda;
- To consider whether the ideas from the field have already been applied to understanding RU/EBPP implementation issues and, if so, to assess the conclusions that have been drawn.

Using the literature in developing a conceptual synthesis

A common approach to literature search, review and reporting processes is being adopted for each of the conceptual syntheses (see Nutley et al., 2002a). Importantly, the intention of each conceptual synthesis is not to provide an exhaustive search and review of all the literature published in a field (in this case, the diffusion of innovations). Instead the aim is to identify the key ideas, models and debates, and review the significance of these for developing a better understanding of RU/EBPP implementation. The primary approach employed for this synthesis was a network search of the literature. This deployed a branching search method starting from a small number of key studies seminal in the field (e.g., Wolfe, 1994; Rogers, 1995; Van de Ven et al., 1999). Searches then used reference lists, following key authors, trace citations and personal contacts to identify further relevant studies.

Following from this, a search of RURU’s developing database was undertaken to identify whether the ideas from the field had already been applied to understand RU/EBPP implementation issues. Searches were conducted in the title, keyword and abstract fields of the database using search terms such as innovat*, disseminat* and diffusion. Titles and

abstracts were reviewed for all references so identified, full texts being obtained for all texts categorised as potentially useful by one or more of the reviewers.

Relevance of the literature on diffusion

Diffusion theories have their origins in the explanation of the adoption of technological change by farmers (Rogers, 1958). Since then the scope of diffusion theories and associated empirical research has broadened. While the literature largely covers innovations in industrial and service settings, a good deal of attention has now also been paid to public service and public policy innovations, with considerable emphasis on the diffusion of innovations in the health care and educational fields (Nutley & Davies, 2000).

Given the interests of the Research Unit for Research Utilisation (RURU), there are good reasons for choosing the literature on the diffusion of innovations (DoI) for synthesis. These arise from the marked parallels between understanding the process of innovation diffusion and similar concerns over making sense of RU/EBPP implementation. We cover these only briefly here, as we shall revisit them in more detail later in the paper when drawing the lessons from the diffusion of innovations for RU/EBPP implementation.

The doyen of diffusion research, Everett Rogers, describes diffusion as '*the process by which an innovation is communicated through certain channels over time among the members of a social system*' (Rogers, 1995 p 5). This definition highlights some important features: innovation, communication, and a dynamic process happening in a social context. More than this, much of the writing in this area embodies the notion not just of communication, but also of adoption (or rejection) of innovations by members of the social system. The parallels, at least on the surface, are obvious: much of RU/EBPP implementation is also concerned with new products, practices or ideas, the communication of these, and the uptake, utilisation or changes in behaviour that result.

Conventional conceptions of research utilisation have characterised it as a linear process, plotting the course of research from creation through dissemination to utilisation. Such conceptions tend to assume that well-developed, research-based innovations will spread within populations of users, thereby reducing the gap between what we know and what we do (Cousins and Simon, 1996). The Diffusion of Innovations (DoI) literature not only serves to illuminate certain aspects of this process but it also offers insights into why the process of utilisation is likely to be more complex than this.

The focus of this review then is on what the DoI literature can tell us about RU/EBPP implementation. However, it can be argued that the flow of insight and influence also operates in the opposite direction. For example, the Evidence Based Medicine Movement (Sackett et al., 1996) is seen as an attempt to introduce more rationality into how innovations get diffused (Denis and Langley, 2001).

The paper proceeds firstly by providing a brief overview of the literature on the diffusion of innovations. This is followed by an analytical review of that literature, which considers: the types of knowledge at issue, the forms of utilisation that are envisaged, how the process has been modelled, the ‘ways of seeing’ that underpin analyses within the field, and finally the lessons to emerge from the DoI literature. The final section of the paper draws out the implications of the DoI literature for RU/ EBPP implementation, and considers to what extent these ideas have already been applied in the field.

Diffusion of Innovation (DoI) research: a brief overview

There is a vast literature on innovation generally and on the diffusion of innovations more specifically. A review of the literature on organisational innovation (Wolfe, 1994) identified some 6,240 articles on innovation published in the five years up to 1994. Using the same search strategy as Wolfe (1994), a follow-up search was conducted for this paper which identified some 14,600 articles over the period 1990 – 2002. This suggests that interest in this topic has remained relatively constant over the decade.

The first edition of Rogers’ seminal text on the diffusion of innovations was published in 1962. In this, and later editions, Rogers reviews existing ideas and summarises the research findings on the DoI. By the fourth edition (Rogers, 1995), Rogers had articulated a typology of diffusion research based around the aspect of the innovation process that was the focus of study. Eight categories of research were identified:

1. *Earliness of knowing about innovations*: Addressing the means by which initial knowledge of an innovation is communicated within social systems.
2. *Rate of adoption of different innovations in a social system*: The classic studies aiming to explain patterns of diffusion focused on the nature of the innovation (e.g. seminal studies on the uptake of new agricultural practices).
3. *Innovativeness*: Empirical research that examines the characteristics of individuals or organisations perceived as being innovative.
4. *Opinion leadership*: Research focusing on the role of opinion leaders and change agents in ensuring diffusion.
5. *Diffusion networks*: Work exploring the social interconnectedness of the actors in the social system where diffusion is being examined.
6. *Rate of adoption in different social systems*: An extension of the work in the previous category, attempting to explain differing rates of uptake by the characteristics of the social system and the context within which it is embedded.
7. *Communication channels*: The focus here is on the various communication channels which seem to be most effective either at different times in the diffusion process, or with different categories of potential adopters.
8. *Consequences of innovation*: Research attempting to assess the potential impacts as innovations diffuse through social systems.

Rogers' eight categories are differentiated by the topic of study. A second, simpler but subtler, typography by Wolfe (1994) argues that it is important to distinguish between three streams of innovation research based more on a conceptual differentiation:

- *Patterns of diffusion*: Here, research is concerned with the patterns of uptake of new ideas through a population of potential adopters. Cumulative adoption over time is often depicted by an S-shaped curve – slow initial uptake, then more rapid, before tailing off (Fischer and Carroll, 1988) – although relatively little is known about when or why the curve applies (Mohr, 1987). *The central unit of analysis in this stream of work is the innovation*. In explaining the diffusion process, research has focused on the identification of those innovation attributes that are said to influence diffusion (Rogers, 1983; Stocking, 1985), and/or on the classification of adopters who are presumed to have different characteristics and tendencies to adopt (Rogers, 1962; Tornatzky and Fleischer, 1990).
- *Organisational innovativeness*: This strand of work focuses on the determinants of organisational innovativeness. *The central unit of analysis is the organisation whose innovative behaviour is under scrutiny*. Much of the research is concerned with how the structure of organisations affects their ability and willingness to innovate (e.g. Damanpour, 1988, 1991). Despite this focus, no definitive set of characteristics for differentiating more from less innovative organisations has yet emerged from the research. Perhaps because of these generally disappointing findings the approach has been criticised for the static orientation inherent in its methods (Mohr, 1987). Changes in an innovation during the adoption and innovation process are often ignored and attention is focused on the adoption decision rather than on its implementation *per se* (Downs and Mohr, 1976).
- *Process theory*: Work in this area is concerned with the processes individuals and organisations go through in implementing innovations. *The unit of analysis here is the innovation process itself*. Much of this research seeks to label and order identifiable stages in the process of innovation (Zaltman et al., 1973; Cooper and Zmud, 1990). Studies have tended to use qualitative, in-depth, longitudinal methods, and some have shed doubt as to whether the trajectory of an innovation can or should be seen as either predictable or stable (Van de Ven et al., 1999).

Each of these streams conceptualises innovation and the diffusion process in different ways; each has its own insights and drawbacks. For the purposes of this paper we will continue to use the term *diffusion of innovation* (DoI) as an umbrella term for all three streams of research, drawing out different insights from particular work as appropriate.

Analysis of the DoI literature

The intention is to provide an initial analysis of the DoI literature before synthesising insights for the RU/EBPP implementation agenda. This section uses an adaptation of a framework that has been developed for mapping the broad field of RU/EBPP implementation (see Nutley et al., 2002b). Readers may wish to refer to this paper for a fuller understanding of the ideas underpinning the framework for this conceptual

synthesis. The same approach will be adopted in subsequent conceptual syntheses. In brief, the framework pays particular attention to the following issues:

- *Types of knowledge* – what types of knowledge is the field concerned with? What forms of explicit knowledge are considered to be important and what attention, if any, is paid to the role of tacit knowledge in understanding knowledge transfer and utilisation?
- *Types of utilisation* – what forms of knowledge utilisation are envisaged? Are we concerned primarily with direct and instrumental use (for example, adoption of new technologies), or are we also concerned with less obvious shifts in basic attitudes and values? How far is utilisation conceived in terms of replication as opposed to reinvention?
- *Models of process* – how has the process of knowledge utilisation been modelled by key authors within the field? What are the key concepts employed, and how are their interrelationships portrayed?
- *Ways of seeing* – what intellectual traditions and schools of thought underpin the literature in the field? How do researchers and commentators in this area of enquiry tend to see the world? These concerns involve considerations of ontology, epistemology, theory and, most especially, methodology.
- *Key findings* – what are the key findings to emerge from empirical studies within the field? How do these findings provide either insight into diffusion processes or guidance on how such processes might be improved?

Each of these questions is addressed in turn below. In doing so we identify what has been gleaned across the diverse strands of DoI research. While some of the parallels with the concerns of RU/EBPP implementation will be apparent as we go through, these insights are drawn out and explicated more fully in the final section of this review.

Types of knowledge

The knowledge that is the focal concern of the DoI literature is new knowledge. Rogers' definition of an innovation as '*an idea, practice, or object perceived as new by an individual or other unit of adoption*' (Rogers, 1995 p 35) highlights that such knowledge need only be *perceived* as new by those whose behaviour is of interest (the potential adopters). Just as the predominant concern of the research utilisation literature can be summarised as '*how can we improve the uptake and impact of research evidence?*', so the issue dominating the DoI literature is encapsulated by the phrase '*how can we increase the adoption of innovations?*'. Thus the DoI literature also highlights a preoccupation with knowledge that is actionable: specific explicit knowledge about products, processes and actions, rather than knowledge about values, or the development of skills and tacit knowledge. While DoI is concerned with explicit (rather than tacit) knowledge, this can take many forms: knowledge about ways of practice for example

(process innovation), or knowledge embodied in specific technologies and products (product innovation).

In the DoI literature ‘types of knowledge’ most commonly equates to an understanding of the nature of the innovation. Following from this, many attempts to classify innovation types have been developed in the literature – ranging from the relatively simple (for example technical *versus* administrative innovations, or product *versus* process innovations, Damanpour and Evan, 1984) to the more complex (Wolfe, 1994, for example identifies 17 attributes of innovations). The predominant focus in the literature however has been on technical innovations (e.g. new products and practices) and this may be one of the reasons why there is a tendency for researchers to treat innovations (and thus new knowledge) as a discrete phenomenon (Damanpour, 1987).

Moving away from an exclusive focus on technology innovation is the classification of social policy innovations provided by Osborne (1998a). He argues that while a distinction between product and process innovations can be helpful, in public services these are often inter-related. He therefore develops a four-fold typology based on whether an innovation involves new or existing services being delivered to new or existing customers. Hence the concept of innovation can be interpreted in at least four ways:

- *Developmental innovations*: Existing services to an existing user group are modified or improved. For example: *the introduction of new classes of drugs for existing patients with chronic diseases such as gastric ulcers, depression or hypertension.*
- *Expansionary innovations*: Existing services are offered to new user groups. For example: *the provision of contraceptive services to younger people in an attempt to reduce teenage pregnancies.*
- *Evolutionary innovations*: New services are provided to existing users. For example: *the development of new supervision programmes in probation services for existing offender groups.*
- *Total innovations*: New services are provided to new user groups. For example: *repeat victimisation research led to new services being offered by the police to a new client group (victims of crime).*

Knowledge encapsulated in the description of an innovation is not the sole knowledge of interest in DoI. The process of adoption can be characterised as a decision-making process, where three other distinct types of knowledge may be important (Rogers, 1995):

1. *Awareness* knowledge – the awareness that an innovation exists, knowledge of its key properties, and understanding of how the innovation relates to current practices.
2. *How-to* knowledge – the information necessary to use an innovation properly.
3. *Principles*-knowledge – information dealing with the functioning principles underlying how the innovation works.

All three types of knowledge are important in moving potential adopters from ignorance through awareness and on to adoption. While it is usually possible for adoption to occur without principles-knowledge, the danger of misusing new ideas is considered to be greater, and discontinuance may result (Rogers, 1995).

Thus the knowledge at issue in DoI research is both that which defines the nature of the innovation as well as that held by potential adopters during the adoption (or rejection) process. The communication of this knowledge, and its utilisation are central to diffusion models and are considered in subsequent sections.

Types of utilisation

The key aim of the DoI literature is to understand when and why innovations are adopted or rejected. As innovations are usually conceptualised in fairly concrete terms, the concern is then to map the direct or instrumental use of knowledge about an innovation, rather than to try to grasp the ways in which such knowledge might impact on broader conceptual understandings about practice (Huberman, 1992).

Innovation tends to be regarded as a ‘good thing’ despite evidence of negative and unanticipated consequences (Osborne, 1998b). Given this pro-innovation bias, the assumption often made is that a good diffusion system is one that results in swift and widespread adoption of an innovation. The literature has less to say about discontinuing ineffective practice, or slowing the uptake of inappropriate technologies (Downs and Mohr, 1976; Van de Ven, 1986).

Possible reasons for the inappropriate spread of an innovation have, however, been explored by those authors who have sought to build a bridge between the DoI literature and that on institutional theory. This literature emphasises that it is naïve to assume that adopters make rational and technically efficient choices about whether to adopt or not (Abrahamson, 1991, 1996). Instead they seem to be more influenced by fads and fashions, and the desire for institutional respectability (O’Neill et al., 1998; Westphal et al., 1997).

The nature of the utilisation of knowledge in DoI is further complicated by contrasting straightforward adoption (replication) *versus* reinvention (adaptation). Early diffusion studies assumed that adoption of an innovation meant the exact copying or imitation of how the innovation had been used previously in a different setting. However, following the work of Charters and Pellegrin (1972) the accepted wisdom now recognises the concept of reinvention – defined as the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation (Rogers, 1995). Some of the drivers of reinvention are listed below, much of which occurs at the implementation stage of the innovation-decision process (Rogers, 1995):

1. Reinvention can occur because of adopters’ lack of full knowledge about the innovation.
2. Relatively complex innovations are more likely to be reinvented and simplified.

3. An innovation that is an abstract concept or a tool with many possible applications is more likely to be reinvented.
4. When an innovation is implemented in order to solve a wide range of problems, reinvention is more likely to occur.
5. Local pride of ownership may be a cause of reinvention.
6. Reinvention may be encouraged by a change agency.

In some cases, the process of reinvention reflects a partial utilisation of knowledge, in others innovation knowledge is changed or augmented. Thus the utilisation of knowledge, even when considered in quite instrumental terms, may be more subtle and more complex as adopters adapt and integrate external knowledge with their own pre-existing knowledge-base, both tacit and explicit.

Models of process

The process of diffusion is considered to revolve around four key elements: an idea or innovation, channels of communication to spread knowledge of the innovation, time during which diffusion takes place, and a social system of potential adopters in which this occurs (Rogers, 1995). There are a variety of models that seek to represent how these elements interact with one another. Four generations of models have been identified (Williams and Gibson, 1990) to characterise the technology transfer process:

- The appropriability model, which emphasises the importance of quality research and competitive market pressures to promote the use of research findings.
- The dissemination model, where experts inform potential users of the new technology.
- The knowledge utilisation model, which stresses the importance of interpersonal communication between researchers and users and the role of organisational barriers and facilitators in promoting research use.
- The communication and feedback model, which characterises technology transfer as an interactive process where individuals exchange ideas simultaneously and continuously.

In the early models the emphasis is on the innovation itself, and on the channels of communication through which knowledge passes. Later models incorporate not only 'science push' but also 'demand pull', where research is called to for to meet problem solving needs amongst users. In later models the process of interaction between the innovation and a group of potential adopters becomes the focus of attention. These interactions are usually brought together in some form of model of the various stages of the diffusion process.

There are a wide variety of staged models, with the numbers of stages described being as high as ten (Wolfe, 1994). However there is substantial overlap between most of the

models, and that most frequently cited is Rogers' (1983, 1995) five-stage representation of the innovation-decision process. Within this model the process of adoption is said to pass through the following five stages:

1. *Knowledge* – the individual (or decision-making unit) is exposed to the innovation's existence and gains some understanding of how it functions.
2. *Persuasion* – the individual (or unit) forms a favourable or unfavourable attitude toward the innovation. This may involve, for example, a matching of the innovation to a perceived problem, and some kind of appraisal of the costs and benefits of adoption.
3. *Decision* – the individual (or unit) engages in activities that lead to a choice to adopt or reject the innovation. This may include interaction with forces of support or opposition that influence the process.
4. *Implementation* – the individual (or unit) puts an innovation into use.
5. *Confirmation* – the individual (or unit) seeks reinforcement for an innovation-decision already made, but may reverse this decision if exposed to conflicting messages about the innovation (Rogers, 1995 p 202).

Most of the staged models proposed by other authors are variations on the above, with greater or lesser gradations between stages. Some (e.g. Cooper and Zmud, 1990) extend the stages to include considerations of the routinisation of the innovation (so that its adoption no longer seems innovative) and issues of infusion (when the innovation is applied to its full potential). Passage through individual stages is postulated as being influenced by prior conditions (such as previous practice and innovativeness) and mediated by characteristics of the decision-making unit, the perceived characteristics of the innovation, the communication channels involved, and the role of change agents and opinion leaders in promoting an innovation. Some of these sets of influences are briefly discussed below.

Adopter categories have been developed, which are classifications of members of a social system on the basis of their innovativeness – that is, the extent to which an individual or other unit of adoption is relatively early in adopting new ideas. The S-shaped curve is reproduced in many descriptive accounts of diffusion, although the time over which the innovation diffuses varies, as does the percentage of the population who ultimately adopt the innovation. The S-shaped curve becomes a normal curve when plotted as the incidence of people adopting at various points in time rather than the prevalence of people who have adopted up to that point (see Figures 1 and 2). The normal curve is used to delineate five different categories of adopters according to where they fall under the curve: innovators, early adopters, early majority, late majority, and laggards (Rogers, 1995).

In addition to the characteristics of the adopters, the perceived characteristics of an innovation are also considered to affect its adoption. Five innovation attributes are typically identified as being important for rapid diffusion (Rogers, 1995):

- *Relative advantage* – the extent to which the innovation is perceived to have significant advantages over current alternatives.
- *Compatibility* – the degree to which the innovation is seen as being consistent with past practices, current values and existing needs.
- *Complexity* – the extent to which the innovation can readily be understood and easily implemented.
- *Trialability* – new ideas that can be tried out at low costs before wholesale adoption are more likely to be taken up.
- *Observability* – the degree to which the use and benefits of the innovation are visible to others, and therefore act as a further stimulus to uptake by others.

In addition to these classic innovation characteristics identified in early work, other attributes have also been identified as being potentially important, such as: adaptability, centrality to the day-to-day work of the organisation, and little requirement for additional visible resources (Wolfe, 1994).

The rate of adoption is also said to be influenced by the communication channels involved – that is, the means by which messages get from one individual to another. A distinction is generally made between interpersonal (where messages originate from local sources) and mass media channels (where messages originate from cosmopolitan sources) (Rogers, 1995).

Finally, intermediaries are considered to play an important role in convincing others to adopt an innovation. They are considered to be crucial because innovators (such as academics) are usually dissimilar to the broad mass of potential adopters and therefore have communication and credibility problems. Two categories of intermediary are identified:

1. *Opinion leaders* – who are characterised as being of higher status and somewhat more innovative than their near peers. They have a vital role in persuading the unconvinced majority of their peers (the middle and late adopters of an innovation). By taking up the innovation themselves they help to overcome caution about the risks and costs of adoption (Rogers, 1995).
2. *Change agents* – who work proactively to expedite and widen innovation. They create demand for the innovation by reducing barriers to adoption, persuading adopters and supporting adoption decisions. The literature emphasises that since change agents act as bridges between technical experts and their clients, without being a member of either group, their ability to work effectively with both is critical. It is argued that they are most effective when they work in partnership with opinion leaders (Rogers, 1995).

In terms of the actual process of diffusion, the classical model is a relatively centralised one. It proposes that decisions about which innovations to diffuse, to whom and by what means should be made centrally. Diffusion flows from the top down, from experts to users. Schon (1967, 1971) challenged the adequacy of this centre-periphery model. He

argued that, in practice, there is often no clear centre and that the diffusion process is frequently more decentralised and iterative in nature (innovations evolve as they are diffused).

It is now recognised that the process of diffusion can range on a continuum from highly centralised to highly decentralised (Rogers, 1995). In a highly centralised system there is: central (often government) control of decisions about which innovations should be diffused; a top down diffusion of the innovation, from expert to users; and a low degree of adaptation of the innovation when adopted by users. In comparison, in a highly decentralised system there is: wide sharing of power and control among members of the diffusion system; peer diffusion of innovations through horizontal networks; and a high degree of local adaptation as innovations diffuse among adopters.

Further, many of the early models of the diffusion process were criticised for presenting an overly rational view of how change is achieved (Legge, 1984). However, Rogers has responded to such criticisms by arguing that when a simple innovation is borrowed or adapted from an external source, the stages tend to occur in the expected order, while when innovations are complex and/or originate within an organisation, stages tend to be more muddled and overlapping (Rogers, 1983). However, a linear stage model still remains at the heart of his work and that of many others.

The limitations of linear models are become clear in more recent work, such as that of the Minnesota Innovation Research Programme (MIRP). Their longitudinal case studies of the innovation process in organisations have resulted in the conceptualisation of the process as an ‘innovation journey’ (Van de Ven et al., 1999). This uncertain journey is said to reflect a non-linear dynamic system, which is neither stable and predictable nor stochastic and random (see Box 1). This is argued to be the case whether or not the innovation is initially developed within the organisation or introduced from elsewhere. In relation to technological and industrial innovations, the MIRP studies found it important to consider the contextual infrastructure for innovations. These include: conducive institutional norms, a sufficient level of basic scientific knowledge, the availability of both financing mechanisms and a pool of competent human resources, and a ready market of educated and informed consumers (Van de Ven et al., 1999). While there are no simple representations of the process and no ‘quick fixes’ to ensure that it is successful, participants who learn from their past experience can increase the odds of their success.

<<Box 1 about here>>

In sum, while insights from classical studies of the diffusion of innovation (such as Rogers’ own work and the majority of the research that he reviews) have proved popular, there has been increasing interest in whether the models of process to emerge from these studies are as appropriate as they might first appear. More recent studies have characterised innovation as a journey that is not sequential or orderly, but messy and unpredictable. Such changes in describing the process have been underpinned by shifts in the basic ways of understanding diffusion phenomena.

Ways of seeing

The DoI literature draws together evidence and ideas from a wide range of underpinning disciplines. These include anthropology, education, geography and sociology. These underpinning disciplines provide a range of perspectives on the diffusion of innovations (see Box 2). Although different, the perspectives and emphases of many of these research traditions are said to complement one another: *'the unexplained residue of one is often a major preoccupation of another'* (Kelly, 1978 p 120).

<<Box 2 about here>>

Each of the three streams of research identified by Wolfe (1994) – differentiated by the unit of analysis being the innovation, the organisation, or the innovation process – also has different ontological presumptions and methodological preoccupations. In the first two areas (exploring patterns of diffusion and organisational innovativeness) there has been a dominant emphasis on the use of quantitative methods to explore the strength of connection between a range of dependent and independent variables. In the third area (exploring the innovation process itself) there has been an over-concentration on depicting a (largely successful) linear adoption process, with the concomitant downplaying of the iterative and messy nature of much innovation. This reflects a general view in the literature that the diffusion of innovation is a problem to be addressed, resulting in a pro-innovation bias (Van de Ven, 1986). Early research on the diffusion of innovations also concentrated on the adoption behaviour of individuals. This has been criticised for over-simplifying what is often a complex *organisational* change process. Over time attention has shifted towards the organisation as the main unit of adoption, but there is still a tendency in much of the literature to treat the organisation as if it were an individual (Yin, 1978).

Early research was also heavily rationalistic – adopting positions that are largely deterministic and objective. More recently, research has adopted orientations that are more voluntaristic, subjective and political. For the future, an interpretative orientation is said to hold great promise (Denis and Langley, 2001). Whereas classical theories of innovation have tended to define innovations, evidence and organisations in fixed and unproblematic ways, newer perspectives, focusing on the innovation process, have begun to recognise the fluidity of boundaries between social contexts, objects and knowledge (Van de Ven and Rogers, 1988; Denis and Langley, 2001).

There has been a presumption that several models of innovation, each based on different perspectives, are equally valid but that each applies under different conditions (Wolfe, 1994): for example, a rational decision making process for early adopters and a process of seeking legitimacy for later adopters (Palmer et al., 1993; Westphal et al., 1997). However, resolving differences in perspectives by specifying the contingent conditions applying to each is not necessarily the best way forward. An alternative is paradox exploitation, which *'does not assume that different perspectives simply apply to certain innovations of contexts and not to others. It assumes instead that each perspective*

captures some aspect of every innovation and diffusion context' (Abrahamson, 1991 p 601). In this sense, both the diversity of models of process, and the variety of underpinning ways of seeing, have the potential to generate useful insights from empirical study.

Key findings from DoI research

Empirical research on the diffusion of innovations has generated a wide array of propositions and generalisations about the nature of the diffusion process and the factors that encourage and inhibit the rate of adoption. For example, Rogers' review of the literature results in 88 generalisations relating to the following areas: the innovation-decision process (16), attributes of innovations and their rate of adoption (5), innovativeness and adopter categories (26), diffusion networks (18), change agents (12), innovation in organisations (4), and the consequences of innovations (7). While another review of the literature (Wolfe, 1994) concludes that the only consistent theme to emerge from the research is the inconsistency of research results we believe such a view to be overly pessimistic. With care, it is possible to present a fairly coherent picture based on some of the more prominent findings. Box 3 gives specific examples of research findings. In the remainder of this section we draw together some key conclusions to emerge from across the literature.

<<Box 3 about here>>

Adopter reactions to innovations appear to be shaped by the nature of these innovations. However, the strength of evidence (on whether adoption will lead to improved effectiveness) does not seem to be the main factor influencing adoption decisions (Stocking, 1985; Westphal et al., 1997). The extent to which an innovation is perceived to be central, radical, compatible, complex, trialable and observable all appear to be more important in influencing uptake. Adopters can be individuals or organisations. When referring to individuals, earlier adopters are said to have higher socio-economic status than later adopters; they are also characterised by different personality variables and employ different forms of communication behaviour (Green and Johnson, 1996).

The organisational context within which adoption decisions are made also shapes the rate of adoption – particularly an organisation's structure, culture and resources, and its wider institutional setting. Diffusion strategies need to recognise that adoption decisions are frequently made in order to seek legitimacy. Studies by Abrahamson and colleagues (Abrahamson, 1991, 1996; Abrahamson and Rosenkopf, 1993; Abrahamson and Fombrun, 1994) have broadened our understanding of how administrative innovations are adopted or rejected by organisational groups. They argue that the choice about whether to adopt or not can relate more to the institutional pressures associated with certain fads or fashions rather than evidence in support of their use. While adoption of an innovation may at first relate to the prospect of improved performance, as the innovation gains acceptance others may adopt more in order to seek legitimacy (DiMaggio and Powell, 1983; O'Neill et al., 1998; Westphal et al., 1997). This pattern of behaviour is heightened during times of high uncertainty, when organisations are more likely to

imitate other organisations, especially those deemed to be norm setters (DiMaggio and Powell, 1983).

The characteristics of those promoting the innovation and the communication channels that they use also affect the likelihood that an innovation will be adopted. The use of opinion leaders, who are ‘near-peers’, appears to be particularly important in persuading others to adopt. The most effective communication channels seem to vary depending on the nature of the innovation and the size of the potential audience. Mass media communication channels are usually more effective when there are large numbers of potential adopters and low levels of complexity. Mass media and cosmopolitan channels are also relatively more important at the knowledge stage, particularly for earlier rather than for later adopters. In contrast, interpersonal and local channels are relatively more important at the persuasion stage.

Rogers (1995) considers the overall advantages and disadvantages of centralised and decentralised systems of diffusion and his conclusions are summarised in Box 4. These are reasonably speculative findings because ‘*our understanding of decentralised diffusion systems is still limited owing to the general lack of investigations of such user-dominated diffusion*’ (Rogers, 1995 p 365). His tentative conclusion is that decentralised systems are most appropriate when innovations do not require a high level of newly acquired technical expertise and when users are relatively heterogeneous. He adds that the potential for users to run their own diffusion system is greatest when the users are highly educated and technically competent practitioners. It seems that a decentralised approach to diffusing innovations is likely to encounter less user resistance than a centralised approach. It is also likely to result in a greater level of reinvention – although whether this is desirable will in turn depend on both the nature of the innovation and the knowledge/capabilities of the re-inventors.

<<Box 4 about here>>

In general, reinvention is not favoured by research and development agencies, who tend to consider reinvention as a distortion of their original technologies (Kanefsky, 2001). In addition, reinvention is resisted by those promoting an innovation because it makes it more difficult to measure the impact of that innovation. On the other hand, adopters tend to think that reinvention is a desirable quality and studies in education have shown that reinvention not only increases the likelihood of adoption but also reduces the likelihood of discontinuance (Berman and Pauley, 1975). However, these same educational studies also suggest that when the level of reinvention is quite high, then the outcome is that the service changes very little and the innovation changes substantially (see Berman and Pauley, 1975; Berman and McLaughlin, 1978).

Diffusion of innovation research dates back around a century, with some 50 years of more intensive activity. From such a wealth and diversity of activity comes the key findings outlined here. It is to the application of these findings in RU/EBPP implementation that we now turn.

Implications and applications of ideas emergent from DoI

The definition of an innovation as an idea or practice that is perceived as new, highlights the potential relevance of the DoI literature to RU/EBPP implementation. For example, promoting evidence-based practice involves a wide range of changes that will be perceived as novel by practitioners – such changes can thus be viewed as innovations. In seeking to complete this conceptual synthesis of DoI research we ask: *what are the implications of DoI research for RU/EBPP implementation, and to what extent have these ideas already been applied in this field?*

The changes involved in developing evidence-based services are far from homogeneous but are readily seen as innovations. Most readily identified as traditional innovations are specific technologies, such as new research based drugs, devices or techniques. More broadly however, innovations can be specific ‘packages of practice’ – such as the most appropriate form of homework for a particular age group of pupils, or the best supervision programme for young offenders. Broader still, innovations may also arise from different ways of organising service delivery (such as the *Technology Schools Initiative*, or the benefits of *NHS Direct*). In addition, in promoting evidence-based services, we are interested in what organisational structures, strategies and cultures foster or impede attention to evidence and learning as part of day-to-day practice. Lessons learned about such organisational configurations can also be seen as innovations that may need to be diffused. Furthermore, insofar as an innovation can be defined as merely ‘*an idea ... that is perceived as new*’ (Rogers, 1995), we might consider evidence-based practice itself to be an *ideological* innovation. Certainly advocates of evidence-based practice *are* interested in diffusing an ideology: the objective is to win over the hearts and minds of practitioners, to get them to adopt a frame of reference that values research evidence. Thus when talking about diffusing innovations in support of evidence-based practice, we need to maintain an awareness of the extraordinary range of innovations: specific technologies, broader patterns of practice, service configurations, and even ideologies.

Using the DoI literature to make sense of RU/EBPP implementation issues is not new. For example, Rogers’ model of the process of adoption has been used by several researchers to understand the process of research utilisation (e.g. Sobell 1996; Pearcey and Draper 1996) and the uptake of evidence-based guidelines (e.g. Lia-Hoagberg et al., 1999). However, these studies use ideas from the DoI literature to conduct *post hoc* analyses of initiatives to increase research utilisation. Studies that have designed and evaluated implementation strategies based upon DoI models and findings are far fewer, and most of these have examined the role of opinion leaders in influencing the uptake of guidelines (e.g. Lomas et al., 1991). Yet there are some ready lessons transferable from the DoI literature that can inform RU/EBPP implementation strategies.

If we focus on ‘treatment’ innovations (taken broadly to encompass both discrete technologies and broader patterns of practice), the mainstream DoI literature highlights the need to tailor diffusion strategies to the nature of the innovation and the characteristics of the target audience. This suggests that different diffusion strategies are likely to be appropriate when dealing with research evidence relating to technologies that

vary in their relative advantage, compatibility, complexity, trialability and so on. We should not be surprised at varying degrees and speed of uptake, but should use anticipations about these variations to plan more directed and effective strategies.

Similarly, decisions over the most appropriate channels of communication, and whether the system of diffusion is to be centralised or decentralised, need to pay heed not only to the nature of the intervention but also the heterogeneity and technical competence of the target audience. The key question this raises for evidence-based practice is whether evidence-based innovations should be channelled or controlled by central regimes (such as the *National Institute for Clinical Excellence*), or left to organically organised professional networks. If the answer is that what is needed is a judicious balance of both approaches, the findings from DoI research outlined in Box 4 can help in shaping that balance.

An increasingly common recommendation within the research utilisation literature is that interventions to promote RU/EBPP implementation need to be based on a diagnostic analysis of the task in hand (e.g. NHSCRD, 1999; Halladay and Bero, 2000). The DoI literature again provides the basis for designing a set of diagnostic tools, based on the findings outlined in Box 3. Specifically, such an analysis needs to focus on adopter characteristics, the social networks to which these adopters belong, and the institutional context within which they are located.

Notwithstanding these useful insights, there are clearly limitations to the transferability of DoI models and findings. We have already commented upon the pro-innovation bias within the field. This means that the literature so far has had little to say about discontinuing ineffective practice or slowing the uptake of inappropriate technologies – both important considerations for many public services.

Similarly, we need to recognise the limitations of the predominant focus on rationality and linear stage models of decision making within the DoI literature. Such models may not necessarily provide accurate maps of an empirical reality or the most effective prescriptions for improving RU/EBPP implementation. However, more recent research on DoI has drawn upon institutional theory to counter the rationalist tendencies (Abrahamson 1991, 1996) and has moved towards thinking in terms of non-linear dynamic processes. RU/EBPP implementation would appear to have much to gain from also looking in both these new directions. The first highlights the need to pay more attention than hitherto to the institutional context and norms. The second cautions against simplistic models and moderates expectations that diffusion process can have a high degree of controllability. However, such ‘problematizing’ aids understanding but does not as yet offer much guidance to those seeking to promote appropriate research utilisation (except perhaps to moderate over-optimistic expectations).

Research on RU/EBPP implementation issues (sorely needed) also has much to learn from the methodological challenges facing DoI researchers. The limitations of innovation research to date have been summarised as (Wolfe, 1994):

1. Lack of specificity concerning the innovation stage upon which investigations focus.
2. Insufficient consideration given to innovation characteristics and how these change over time.
3. Research being limited to single-organisational-type studies.
4. Researchers limiting their scope of inquiry by working within single theoretical perspectives.

Similar challenges face RU/EBPP implementation research:

1. How can/should research utilisation be measured? As with DoI research there are limitations to focusing solely on the adoption decision (Mohr, 1987).
2. What characteristics of research findings (for example, their timeliness and the methodologies that underpin them) influence their utilisation? Do the important characteristics vary over time and according to different types of impact (for example, awareness as opposed to behaviour change)?
3. What research methods are needed to explore research utilisation? Are experimental methods feasible and appropriate? Are methods based on multiple case studies a productive way forward?
4. How can multiple perspectives be brought to bear on RU/ EBPP implementation research, and what are the advantages of such an eclectic approach?

This paper has sought to begin to address the last of these challenges by highlighting the insights to be gained from the DoI literature. Subsequent papers in this series will seek to complement these insights by drawing upon other, equally important, perspectives.

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Box 1: The innovation journey

A non-linear dynamic process in which the following is commonly observed:

1. The innovation journey consists of the accretion of numerous events performed by many people over an extended time. Innovation cannot be attributed to the discrete acts of a single person on a particular date and at a particular time.
2. Concentrated actions to allocate resources and initiate innovation development are triggered by 'shocks', not mere persuasion. When people reach a threshold of sufficient dissatisfaction with existing conditions, they initiate action to resolve their dissatisfaction.
3. When innovation development work begins, the process does not unfold in a simple linear sequence of stages and sub-stages. Instead, it proliferates into complex bundles of innovation ideas and divergent paths of activities by different organisational units.
4. Setbacks are frequently encountered during the innovation process because plans go awry or unanticipated environment events significantly alter the ground assumptions of the innovation. These setbacks signal rejection of the innovation or opportunities for learning through reinvention.
5. Innovation receptiveness, learning, and adoption speed are facilitated when the innovation is initially developed within the user organisation and inhibited when end users are provided no opportunities to reinvent, or modify, innovations developed elsewhere.
6. Management cannot ensure innovation success but can influence its odds. The odds of success increase with experience and learning from past trials at innovation and decrease with the novelty, size, and temporal duration of an innovation venture.

Abstracted from Van de Ven et al., 1999, pp10-11

Box 2: Selected disciplinary contributions to the field of innovation diffusion

Discipline	Central focus as it applies to the diffusion and utilisation of knowledge
Philosophy	The study of the nature of knowledge and how knowledge is used in practices (epistemology). The study of whether certain innovations or technologies should be used (ethics).
Anthropology	The study of how cultures have evolved and have influenced each other, including how knowledge and technologies have diffused within and across cultures.
Sociology	The study of interpersonal and intergroup behaviours, including the influence of social structures and norms on behaviours and practices.
Library Science	The study of how knowledge dissemination can be facilitated, specifically how knowledge and information can be stored and catalogued so that it can be easily accessed.
Psychology	The study of human behaviour and the factors that influence individuals to act, particularly cognitive and emotional states.
Economics	The study of market forces that influence innovation diffusion, including how diffusion influences pricing strategies, and vice versa.
Education	The study of how knowledge can be shared so that it is understood, used and valued.
Geography	The study of how knowledge is spread and adopted spatially, particularly how geographical structures and land structures influence the spread and use of knowledge.
Business Studies	The study of the organisational characteristics that enhance the innovativeness of organisations as well as the ways in which innovations can be effectively marketed.
Political Science	The study of how policies are implemented, including how centralised and decentralised governmental structures influence the implementation of policy.
Technology Transfer	The study of how technology can be used and adapted for use in various practices.
Communications Theory	The study of how various communications, including mass media campaigns, can affect dissemination, diffusion and knowledge utilisation.

Source: Abstracted from Green and Johnson (1996 p 13)

Box 3: Factors affecting the likelihood that a particular innovation will be adopted

<i>Factors</i>	<i>Examples of research findings</i>
1. Innovation attributes	<ul style="list-style-type: none"> • Rogers (1995) argues that there are five attributes of an innovation which influence its rate of adoption: relative advantage, compatibility, complexity, trialability and observability. • Wolfe (1994) highlights six key attributes found to influence adoption: adaptability, centrality to the day-to-day work of the organisation, technical vs. administrative focus, pervasiveness (the proportion of total behaviours expected to be affected by the innovation), radicalness, and uncertainty about outcome. • Characteristics identified by Stocking (1985) include appeal to local power holders and little requirement for visible resources.
2. Adopter characteristics	<ul style="list-style-type: none"> • Adopters can be categorised according to their tendencies to adopt – innovators, early adopters, early majority, late majority and laggards (Rogers, 1983). Each group is ideally targeted with a different diffusion strategy (Green and Johnson, 1996). • Organisations with a long history of success are less likely to adopt new approaches (Sitkin, 1992; Levinthal and March, 1993; O'Neill, et al., 1998). • The organisational factors that are important in explaining the rate and process of adoption include: strategy, structure, resources and politics (Dean, 1987; Dyer and Page, 1988; Schroeder, et al. 1989).
3. Environmental/ context characteristics	<ul style="list-style-type: none"> • Low environmental uncertainty increases the tendency of organisations to remain stable or to avoid change (O'Neill, et al., 1998). • High uncertainty or need for legitimacy may encourage imitation in the adoption of innovations (DiMaggio and Powell, 1983). • Choices about whether to adopt or not can relate to the existence of fads and fashions amongst members of a social network (Abrahamson, 1991, 1996).
4. The characteristics of those promoting the innovation	<ul style="list-style-type: none"> • The level of change agent contact with potential adopters is positively related to the decision to adopt (Rogers, et al., 1970).

	<ul style="list-style-type: none"> • Change agent credibility in the client’s eyes is positively related to the decision to adopt (Coleman, et al., 1966). • Change agents may or may not be members of the target social system, whereas opinion leaders are. The most effective persuaders are similar in status and outlook to potential users. ‘Near-peers’ are thus seen as key in bridging the gap between innovators and adopters (Rogers, 1995). • Opinion leaders are especially important for interpersonal networks whose members differ in many respects (Rogers, 1983; Kautz and Larsen, 2000).
5. Communication channels	<ul style="list-style-type: none"> • Mass media communication channels are more effective when there are large numbers of potential adopters and low levels of complexity, and when the goal is awareness raising (Rogers, 1995). • Interpersonal and local channels are important in persuading adopters to act upon their awareness and adopt (Rogers, 1995).

Box 4: Centralised versus decentralised diffusion systems

Centralised systems

- Provide central quality control over which innovations to diffuse
- Can diffuse innovations for which there is as yet no felt need

but

- Can encounter user resistance to central control
- May result in inappropriate adoption because of low adaptation to local circumstances.

Decentralised systems

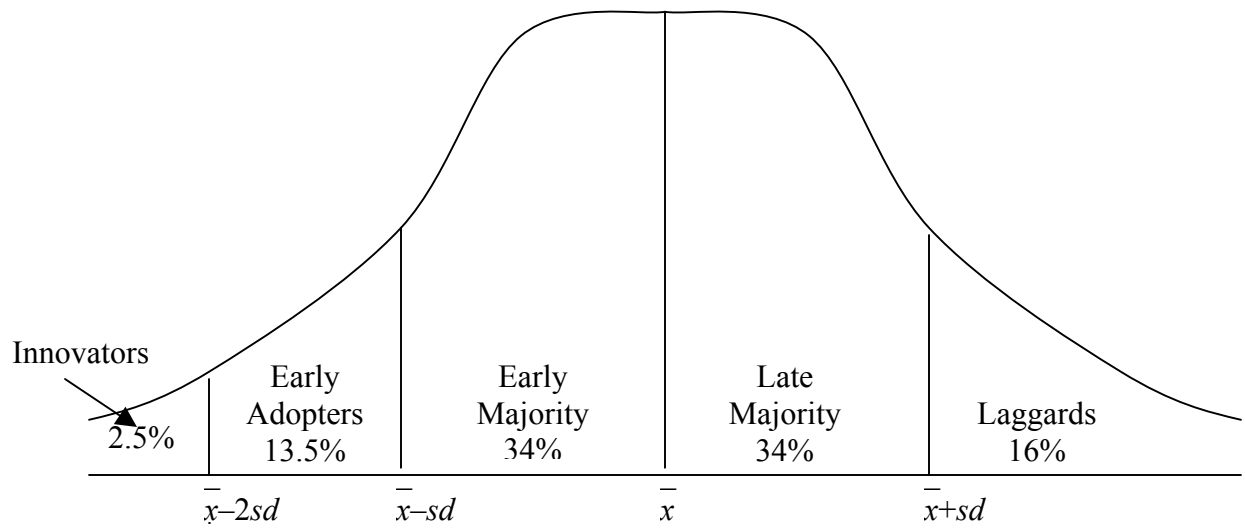
- Users tend to like such a system
- Promotes closer fit between innovations and user needs and problems

but

- Ineffective innovations may be diffused due to lack of quality control
- Depends on local users, who control the system, having knowledge about other users' problems and about the innovations available that could solve them.

(Based on Rogers, 1995)

Figure 1: Adopter Categorisation on the Basis of Innovativeness



Five adopter categories measured by the time at which an individual adopts an innovation or innovations.

Figure 2: The Rate of Adoption for a Usual Innovation

