Conceptualising The Innovation Process To Fit Virtual Reality

Jeff Butler
R&D Management,
Manchester Business School and PREST,
University of Manchester.
j.butler@fs2.mbs.ac.uk

Abstract

We understand and manage innovation activities, implicitly or explicitly, using conceptual models of the ways in which knowledge is combined and resources need to be organised. These models (of the innovation process) have evolved over more than three decades as a result of innovation studies looking more deeply and carefully at the range of situations where innovation is possible, and as a result of changes in the ways in which business and other organisations must operate. We have become more sophisticated in our approaches to innovation, and the recent emphasis on 'knowledge management' is perhaps a consequence of this. We now refer to five generations of innovation and R&D management models. There are other tools and concepts to identify and plan the optimum level or type of innovation for particular circumstances and to help manage projects so as to encourage creativity, meet design specifications, control risks and maintain costs and schedules. Better knowledge management can influence the balance between these factors and the overall likelihood of success. As technology has progressed we have discovered new innovation challenges and have often needed to become more multi-disciplinary. We have also acquired new R&D and innovation management support tools such as computer-aided design, rapid-prototyping, videoconferencing and web-based tools for information retrieval. Technology has facilitated the development of virtual organisations and collaborative networks. Now virtual reality (VR) technology is emerging and is finding useful and commercially viable applications. The paper will focus on its significance for innovation management. VR has a wide variety of potential applications but many applications are not yet fully recognised. It is most obviously useful in the visualisation of proposed products and processes. It can enhance CAD and can complement or replace physical prototypes. It can extend the capability of simulation techniques and interpret and present complex data in a user-friendly format. It can create 'virtual worlds' or 'synthetic environments' which will allow innovative proposals to be tested and which will permit alternative scenarios to be generated. Thus it can significantly influence the direction of innovation as well as the efficiency and effectiveness of innovation. Less obviously, VR can be used in project management, business process engineering, market research, ergonomics, creative problem solving, education and entertainment, teleconferencing and knowledge management. VR technology is becoming less expensive and is diffusing and evolving rapidly. It will be a challenge to companies to recognise and grasp the innovation opportunities that are offered by the increasing availability of VR technologies in its various forms; there is ample scope for researchers to learn and advise managers more effectively about these opportunities. It is also a challenge to researchers to consider if and how our understanding of the innovation process might be further enhanced by VR. By studying the impact of VR on innovation activities and innovation potential we can continue to learn how knowledge is generated, accessed and combined within the innovation process and by using VR we will be able to interpret and present

more effectively our conceptual models of these processes. Hence, VR could lead to a new model of innovation management.

Extension to the abstract

We often make progress by constructing models. Conceptual models can explain scientific and technological principles or represent complex processes such as fluid dynamics and the laws of motion. Physical models can help build new structures and to design and manufacture new products. They can help us visualise improvements in production systems and anticipate environmental consequences. They can help us analyse the properties of materials, test the characteristics of those materials in context and serve as prototypes to gather user information or to prepare better instructions for manufacture and service.

Examples of models include drawings, plans, the double-helix structure of DNA, scale models for aerodynamic analysis (and the wind tunnel environment itself). The designing process has been studied via models of the relationship between client and designer, or architect. In management science 2x2 matrices are frequently used to model business situations and strategies, or project portfolio, and to educate managers and students. In early innovation management research the models used were linear; the innovation pipeline or funnel is still used by managers. Sometimes models such as the linear model of innovation influences mindsets and actions even though they are only used implictly. The evolution of innovation and R&D management has been described as progressing through five generations of models (Rothwell 1991, Rogers 1996, Bartholomew et al 1997). This understanding of the evolution is itself a model, that we might perhaps refer to as a meta-model, that is useful both to academic researchers of innovation and to managers.

Virtual models can be constructed to extend our use of physical and conceptual models. They might enable more sophisticated or detailed models to be developed, they might be easier to construct, and they might be useful when the datasets in the model are very large or when there is a highly dynamic process to be represented. Sometimes there are many more criteria than can be depicted in three dimensions and so the brain has difficulty in interpreting flat or solid models. When time is especially important a virtual model can be useful. Virtual models make it easier to visualise, explore, examine or communicate existing physical and conceptual models. This makes them useful in knowledge management. Data-mining generates a model of patents and publications that can be structured and accessed more easily via a virtual model that acts as a gateway. We can show the contours of a knowledge domain and walk through the resulting landscape, or fly over it to gain a quicker impression of its topology. We can immerse ourselves in a virtual vault or economic model and experience around us the simulated fluctuations in gold bullion reserves, money supply or share prices. We can model ourselves, or even crowds of people, and operate within the virtual model rather than observe it from outside.

Thus virtual models can become much more advanced versions of the business spreadsheets that facilitated easier ‘what-if?’ analysis. They can represent much more than financial criteria and incorporate the complexity of innovation processes. ‘Suppose we innovated in this strategic direction? What would be the effects of that innovation?’ etc. ‘Where is the scope for innovation? – show me!’ They can be the basis of multimedia educational programmes

which might relate to business change programmes or technological progress. They can easily emphasise learning modes rather than teaching modes since they can incorporate or provide access to vast bodies of knowledge that needs to be navigated. The computer adventure game provides a good model of the benefits of navigating a virtual model. Interactivity is a key to learning and a key to comprehending complex worlds. Virtual reality technologies facilitate interactivity and involvement with what already exists in the real world or with what might be proposed. They allow for 'time travel' in the sense of restoring heritage or appreciating historical events and cultural interpretations, which has environmental implications in technology management. They allow future scenarios to be generated and to be evaluated more enthusiastically and vividly. Much of this hype might also, of course be claimed for television, but relatively little has happened in television over several decades compared with what can now be imagined possible in just a few years applications of VR.

In innovation and knowledge management virtual models can be used directly rather than to illustrate or communicate an existing model. Where there is much data, for example, and appropriate statistical or mathematical models are not emerging readily, we can experience and navigate that data more intuitively, perhaps in the search for meaning or simple models. By being immersed we might learn enough without the need for verbal or conceptual description. This seems to be a potential benefit in innovation strategy and concurrent engineering and product data management systems are moving in that direction. There is a suggestion that society can in fact now begin to progress, after thousands of years from a literate world, which superceded the oral tradition, to a computerate world. In the transition that we currently experience, paper is a constraint on the design of computerate systems, even though it is also a wonderful material with significant ergonomic advantages.

We can begin to apply virtual models to an understanding of innovation management in a 'post-internet' paradigm. The effects of the internet phenomenon on business innovation have stimulated imaginations and turned perceptions of innovation potential inside-out. We can envisage 'innovation space' and the need for innovation space more readily. Knowledge domains and business innovation space can be combined in a virtual model. Our understanding of innovation processes and especially the behavioural and environmental influences on innovation can progress simultaneously, unconstrained by the conventional physical and verbal limitations of how we might describe or diagrammatically represent them. In other words we can enter into a virtual model of the innovation process, or we can enter into a virtual innovation space, like we can enter into a large food larder, and choose an option on our meal preparation without recourse to a book of recipes.

This speculation is far removed from the perception of the immediate applications of VR technologies as an enhancement to computer aided design or simulation, or as a platform for entertainment. But the range of potential applications is so wide that it is difficult for a busy manager to scan the potential of VR and identify its relevance to his/her own organisation. Vendors might not want to venture too far into these kinds of speculation with ordinary industrial users; they will naturally focus on justifying immediate sales opportunities. But bold applications can become viable if new business relationships and networks can be formed to exploit the vision. VR can be much more than a visualisation or prototyping tool with efficiency improvement advantages just as the internet is much more than a mechanism for communication

and wordprocessing became more than computerised typing. Truly innovative but commercially viable VR applications might need to be induced by strategic interventions. By trying to evaluate the impact of VR on the innovation potential of organisations we might therefore make progress in innovation research.

The original abstract for this proposed presentation, as shown above, was a model of the presentation. The text that follows – the extension to the abstract -is a second or revised model. As virtual reality becomes increasingly embedded in applications we can expect higher levels of change than we have been used to, just as web pages might be more transient than book publications. The conference presentation will facilitate some interaction and hence the text has been written provocatively and very concisely to attract participants to learn and discuss the potential of VR in an innovation and knowledge management context.

Grant support from the ESRC Virtual Society? Programme is acknowledged, for a project entitled ‘The impact of virtual reality on the innovative potential of organisations’. The team of investigators is Peter Swann, Tim Watts, Alan Pearson and Jeff Butler.