A network of innovations

A team of organisational communication researchers based at Chapman University in California and led by Dr Kerk Kee has made inroads towards understanding how big data innovations and cyberinfrastructure become widespread and ultimately dominant in virtual communities.

THE HISTORY OF technology is filled with innovations that have made their competitors redundant or obsolete. It is not always the actual merit of an idea that governs its success, however; bad innovations can thrive and good ones fail, simply because of how they are adopted by consumers. A prime example of this was the so-called ‘videotape format war’ between Betamax and VHS that occurred in the early 1980s. Though Betamax was first on the market, and superior in resolution, sound and image stability, VHS ultimately became more popular while Betamax faded into obscurity. The prevalence of any innovation is subject to the patterns by which it is spread.

The formal recognition and study of these patterns began in 1962, with the publication of sociologist Everett Rogers’ seminal book Diffusion of Innovations. It was Rogers who first recognised that innovations are transmitted between individuals via certain channels, noting that time, social structure and the characteristics of the innovation itself have an influence on the uptake of the idea. There are many barriers to the widespread adoption of a beneficial innovation; one concept that Rogers drew on was the pre-existing notion of homophily – the tendency of people to interact with other people with whom they share traits. For example, since unhealthy people are likely to form friendship circles with other unhealthy people, there is an innate barrier to disseminating the good health practices of healthy communities among them. The same tendency can be found in circles of scientists and engineering researchers based on the technologies and tools they use.

GENERATION NEXT

Tracking and predicting innovation diffusion was difficult even at the time of Rogers’ writing, when the latest technologies came unpackaged, tested and fully developed, and could be bought straight off the shelf. Today, a new generation of open source technologies, web 2.0 platforms and computational tools presides; with regard to big data and cyberinfrastructure for e-science, technological modernisations tend to be dynamic in that they are user-driven, custom-made and in a permanent state of beta testing. This means that they are being developed at the same time as they are being disseminated and used, and since they are also often diffusing through virtual rather than physical networks, tracking the spread of innovation today requires a smart approach.

One group of organisational communication researchers at Chapman University in California, USA, is taking just such an approach to the issue of innovation diffusion in the field of e-science with big data and cyberinfrastructure. Dr Kerk Kee is Assistant Professor in the Wilkinson College of Arts, Humanities, and Social Sciences’ Department of Communication Studies at the University, and his focus for the last five years has been on applying diffusion theory to the spread of computational tools, cyberinfrastructure and big data through scientific collaborations and virtual organisations in e-science. The main vehicles for this work are two National Science Foundation (NSF)-funded projects: the Computational Tools, Virtual Organizing, and Dynamic Innovation Diffusion (CID) project – supported by the Virtual Organizations as Sociotechnical Systems (VOSS) Program; and the Organizational Capacity and Capacity Building for Cyberinfrastructure Diffusion (CID) project under the Faculty Early Career Development (CAREER) Program.

GOING VIRAL

“The exciting aspect of applying diffusion theory to the study of scientific virtual organisations is the opportunity to identify the pathways and mechanisms through which dynamic innovations spread and evolve in today’s wired society,” Kee enthuses. His work suggests that the success of a dynamic innovation is dictated to a large extent by its reaching a critical mass of users and developers; in general, people will adopt an innovation once it is used and constantly updated by an active community of colleagues across universities and fields. So, early adopters can ultimately push uptake to a tipping point and initiate a domino effect that will lead to the innovation becoming prominent in a marketplace. By gaining a better understanding of how this process is achieved in and across scientific virtual organisations, Kee and his student research team may also be able to shed light on how ideas and technologies achieve viral status, and their findings will certainly light the way for future visionaries hoping to achieve maximal impact with their innovations.

The prospect of probing virtual networks can be daunting, but according to Kee, there are patterns to be found in those that he works with. Innovations disperse through personal connections between individuals within and across organisations. Many scientists are involved in multiple collaborations, and scientific virtual organisations therefore
The success of a dynamic innovation is dictated to a large extent by its reaching a critical mass of users and developers; in general, people will adopt an innovation once it is used and constantly updated by an active community of colleagues across universities and fields.

Science & Engineering, for what is essentially an organisational science project with a solo young PI. Because of its promise, however, a second project – CID, funded by the NSF’s most prestigious programme, CAREER, in the same directorate – has already followed in its wake; the scope of this sequel is even greater. With a five-year timeframe and more than $500,000 in funding, CID will complement and expand on DID by taking a more complete view of cyberinfrastructure as a multidimensional phenomenon incorporating material, behavioural and philosophical aspects. Based on this new understanding, Kee and his students will also develop theoretical frameworks for measuring the organisational capacity associated with cyberinfrastructure diffusion, and identify strategies for maximising capacity towards successful innovation diffusion.

As the sole PI on both projects, Kee is causing a stir in the field; as well as achieving high levels of funding for his unique and interdisciplinary work, in just over six years he has built up a portfolio of highly cited published papers. One paper concerning the impacts of web 2.0 platforms on social capital published in 2009 has been cited almost 1,000 times. Kee’s work is helping science to gain a greater understanding of innovation – which is appropriate, since it is innovative in itself.