The Impact of Visual Communication Innovations on the Film Industry[1]

ANNMARIE CHANDLER, ELLEN BAKER & TOM FISHER

ABSTRACT *This paper examines the impact of visual networking technologies and communication innovations within the film industry. The researchers investigated companies designing and implementing uses for the new systems within the manufacturing cycles of film production. The project selected two case studies, one from the advertising industry and one from a large scale Hollywood feature film, to examine emerging benefits and issues for companies innovating in this area. The research found that this new area of technological change is impacting on international divisions of cultural labour by affecting decisions concerning facility location, collaborative work practices, and the scheduling of production activities. The findings identified a number of economic and social advantages for companies who adopt the systems. However, they also revealed characteristics about the industry and innovation which would act to inhibit the rate of adoption.*

Keywords: communication technologies, visual transactions, film industry, work practices.

Media as Manufacturing and Innovations in Visual Communications

Filmmaking is a manufacturing process. Film projects can be deconstructed into three core production phases. Pre-production is the planning period prior to filming, when meetings are held between the director, producers and crew to make decisions about the creative and financial aspects of the project; the script and budget is finalised; visual elements designed; locations and cast selected. During the second or production stage, the film is shot, processed and assembled (edited). In the third stage, post-production, there is more editing and sound track work, leading to cinema quality release prints for distribution and exhibition.

During these three production stages, a large number of collaborations occur, utilising visual material (photos, videos, models and film clips) for the design and approval of work in progress. Traditionally, most transactions take place either in person or through the use of the post and courier. On international projects, travel is often required for decisions between major stakeholders about such things as casting, locations, costumes, wardrobe and set designs, as well as the approval of progressive edits and special effects sequences. When it is not possible to meet in person, videotapes of material, or prints of the film, are couriered between remotely located businesses and creative teams. By 1994, technologies displaying suitable features for the storage and transferral of moving images of acceptable quality, between business locations, were beginning to become available to production companies. Throughout 1994 and 1995, for

0810-9028/99/020139-13

example, reports began appearing on television, the World Wide Web, and in media industry trade journals and conferences about the experimental use of electronic networks that could support images and motion video, enabling remote creative collaboration on media productions.[2] The use of electronic networking technologies to carry out creative production work was thus a new idea to the industry, beginning to be communicated through a number of its information sources. The attributes associated with the technologies fit Rogers' description of an innovation in its preliminary stages of diffusion and these elements will be developed further in the case studies.[3]

The emergence of these technologies coincided with changing economic and social features in the production industries, with moves towards stronger internationalisation of the advertising, commercial television and feature-film production sectors.[4] Our research objectives were to improve understanding of the requirements for technological change in these areas of the industry by examining the motives that promoted the communication innovations and their effects on the film-making manufacturing process and creative work practices.

During 1993–94, 1200 Australian businesses were listed as active in the film and video production industry.[5] The actual production structure of the industry can be further broken down into companies who produce commercial and corporate material (200), post-production companies who service the industry (195) and general production businesses (742). This information was taken from a leading industry directory and gives a total of 1137 businesses active in 1995.[6] The directory sources were used by the researchers to contact businesses and are probably more accurate than the Australian Bureau of Statistics' figures in terms of providing information on regular business units, as some businesses are 'one-off', that is, only brought together to work on specific projects. All of the businesses listed in the trade directory were contacted to ascertain if they were aware of the innovations and whether any Australian companies were using new electronic networks for international collaborations. From this initial survey, the majority of companies contacted in 1995 responded that they were either unaware of the innovations or considered them too speculative, in relation to traditional work practices, to consider seriously as a business proposition. Eleven companies, from both the producer and post-production area involved in making television commercials, however, were identified as experimenting with network technologies of one sort or another for visual communications. Some companies were trialing video conference systems, others were using computer-based technologies linked to networks that could transmit moving images. The group identified in 1995 represented 1.01% of the overall number of business units from this production sector and thus falls within the classification of 'innovating' business, 'willing and eager to try out new ideas'. This group, according to diffusion theorists, may ultimately influence more conservative and respectable sections of their industry to adopt a new idea or technology.[7]

The 1995 survey revealed that only one Australian feature-film company had used visual networking technologies, and only in a one-off, experimental basis on a single project, but the company refused to give any details of their work. The search for a feature film case study was then extended to the international arena where a number of trade publications and exhibitions were speculating on the advantages of new visual communication systems to the industry. From these sources of information, 15 innovating film production companies were identified in the UK and USA. A survey of these companies, similar to that conducted in Australia, revealed that most international innovators were in early research and development programmes within their own companies, and some were associated with university funded projects but generally were not using the systems for actual or ongoing communication activities. One company,

with offices in the UK and Hollywood, however, emerged as a leading innovator, actively using the systems in production work, and this company agreed to be studied as part of our research.

A re-survey of the Australian industry, conducted in early 1998, revealed that the businesses using the innovations had expanded from 11 to 20, and that they were now using visual networking technologies and communications regularly as part of international work. This takes the usage up to 1.83% of the overall production sector but still places it within the innovator category of diffusion within the overall industry. Data was not collected on the size of each business, however, information gathered from the innovator category revealed that all the companies using visual communications in this band were employing over 20 people and were mainly involved in the production of television commercials. Also, by 1998 three major companies in the feature-film sector in Australia could be identified as moving into this area to conduct business. A new large multinational film production company located in Sydney in 1998 (Fox Studios) has installed optical fibre networks for this purpose, and an animation company (Animal Logic) and a visual effects firm (D Films) are now using the innovations both for links to this studio and for other international work.

The technologies are thus still within the innovator's adopter category and it is too early to say whether electronic visual communications will penetrate the entire industry, and what their ultimate significance will be on production organisations and work practices. The findings, however, reveal relative advantages experienced by the innovators and other characteristics of the innovation which are likely to be favourable to ongoing diffusion and adoption by particular sectors of the industry. They also reveal characteristics about the industry and the innovation which would act to inhibit the rate of adoption.

Selecting Case Studies

Production case studies were selected on the basis of interviews with the innovating companies. The interviews were informed by literature on Computer Supported Co-operative Work,[8] and work published on managing communications in different time zones.[9] The reason for designing these perspectives into the interviews was to expose work practices of which the companies may have been unaware, where the new communication technology was prompting different methods of working, or of managing time, in the manufacturing cycles of film-making. Two members of each organisation were interviewed. The highest-ranking person in the organisation, usually the chief executive officer (CEO), was sought for interview to ascertain their knowledge and understanding of the technology and the company's reasons for implementing the innovation. Senior members of the production teams, such as the director of technology or the creative directors, were also interviewed to gain information on any changes to creative work practices.

A standard questionnaire was prepared, and responses were taped, to topics covering five broad areas:

- the reasons for the use or experimentation with the visual communication technology or service;
- the role of place and time in traditional workflows and how the technology may be affecting this area;
- the people, places and roles involved in the workflows and any changes occurring with the adoption of the technology;

- the costs involved in using the technology and any savings within the production cycles; and
- examples of recent and specific applications that might be suitable for a production case study.

Advertising Case Study

Responses from the CEOs in the innovating sector of the Australian commercial television production industry confirmed many of the characteristics that diffusion theorists describe of those willing to take venturesome risks with new technologies.[10] All the people interviewed in this category were, for example, eager to try new ideas on the basis of gaining advantage over competitors. All of them were also sufficiently profitable to be able to invest in experiments with visual communications, and absorb possible losses.

Changes to regulations in the Australian advertising industry, removing protection of local content in 1992, saw a significant rise in the international demand for Australian creative expertise and labour. While the Australian industry had been cautious about the changes and predicted a decline in local production, examination of its impact in 1995 described a balancing effect, with $50 million cut from local production, while the export of advertising services raised $48 million.[11] Attractive export features of the Australian advertising industry include access to low cost local crews, trained to meet high levels of quality delivery in their technical roles, often because of their interface with the feature-film industry; the availability of reputable creative directors and talent; diverse locations; and being able to shoot material during the European winter.[12]

The motives prompting innovation amongst CEOs were therefore not technological progress for its own sake. Most CEOs interviewed were looking to find substitutes for the use of the post and international couriers in their business communications, so as to make these transactions faster, more personal and more effective. They saw investment in visual communications as a step towards creating competitive advantage for developing export markets for their services.

Film Graphics Productions, located in Sydney, was selected as the case study from the television commercial production sector, as the company was the first to be identified as using visual communications regularly throughout the making of an entire project. They incorporated the use of a 'Videofax' in a successful tender to the Bates Dorland advertising agency in London in 1994.

This was an experiment for Film Graphics as they had not used the Videofax for production purposes previously. The decision to use the innovation was an organisational one rather than one made by any particular individual. Rogers suggests that most innovative organisations engage in various forms of 'opportunistic surveillance by scanning the environment for new ideas' and require awareness of an innovation before the process of adopting it commences.[13] The impetus that drove the use of the innovation for this company was the fact that the company had some knowledge of its effectiveness in transmitting moving images and a desire to display a competitive edge in their tendering process. At that stage about 10% of Film Graphics' work was from overseas and they were eager to extend their profile here. Interviews with the CEO and the production supervisor revealed that, by including the Videofax in their pre- and post-production work, they predicted that they might overcome some of the obstacles that were associated with using the post and courier in international transactions. Obstacles cited at that stage were the barriers to intimacy in business and creative communications through the geographical separation of companies.

The Videofax is a technology developed in Australia. It operates like a paper fax, except that it transmits moving video images over an ISDN network. The transmissions are only designed for short clips, and in 1994–95 it was seen as an ideal visual technology for the advertising industry, where the length of most commercials ranges from 15 seconds up to a minute. Three levels of resolution in image quality were developed by the manufacturer to suit different transmission and pricing requirements. The higher the resolution selected, the longer the transmission time and consequently the greater the cost of the transaction. Like the paper fax, the Videofax is also what is known as an asynchronous communication technology, in that it allows only one-way communication, unlike say a teleconference set-up, which allows two-way communication in real-time. In its earliest forms, in 1994–95, it was being promoted as a system to transmit copies of commercials to the regulatory bodies for broadcasting approvals. It was thus not being promoted as a production technology, but as an electronic courier that would allow producers of commercials to work to longer deadlines and still be able to get their work to the broadcast regulator's office overnight. It had been purchased by four companies in Australia for transmitting work to the Australian Federation of Commercial Television Stations (FACTS) and had also been set up internationally in the United States, Singapore, Malaysia, Hong Kong, The United Kingdom, France, Germany and New Zealand for similar work with their respective regulators.

The technology was available to Film Graphics through an adjoining production company, operating it as a bureau service. Their London Agent, Bates Dorland, also possessed a unit, making this form of communication practical. Film Graphics' idea to use it as a visual communication device in creative production occurred when their production manager overheard an anecdotal conversation at one of the bureaux that one company was successfully using the system to transmit short video clips for casting approvals with international clients.

To examine the impact of visual communications on the production process, Film Graphics' production activities and workflows were translated onto a flow chart, to compare the Videofax communications with what the traditional processes would have been, in the absence of the fax.

The communication requirements between the client and agency in the UK and the production company in Australia were extensive and spanned a production period of approximately 14 weeks. The commercial required a complex combination of location and visual effects filmmaking to promote the services of the Halifax Building Society. The sequence, shot and edited in Australia, entailed the construction of a 'clock' made from the skating skill of 250 roller bladers, merged with the skill of specialised visual effects designers.

During the pre-production activities, which lasted 8 weeks, Film Graphics used the low resolution mode on the Videofax for casting decisions concerning the employment of Australian actors, approvals of costume designs, and approvals of storyboarded segments (drawings) of the advertisement. In every transaction, a couriered videotape of the faxed material was also sent, although this arrived later than the Videofax and was only sent for safety reasons. This was the company's response to the uncertainty that often surrounds innovations. In reality they were using both the innovation and the conventional systems of communication concurrently, as they were not willing to lose the client's business if the innovation failed, and they were in a financial position to invest in both forms of communication and thus absorb the extra financial outlays the experiment required. In all cases, however, the Videofaxes proved suitable for the desired transactions.

In the post-production stages, with a restricted schedule of only 2.5 weeks, it was

necessary to transmit high-resolution images, as the agency and client wanted to see edited material, close to the final televised look of the programme. This involved progressive transmissions of sequences, for approval purposes, as well as clips which displayed how the special effects sequences would look.

Findings

Benefits. Discussions, held with the CEO and the Production Manager, before the flow charting was completed, revealed that the producers were generally unaware of the benefits of asynchronous communications and ways that they might manipulate their scheduling and work practices by using the Videofax. Some of these benefits to scheduling had already been discovered in some international production work with electronic networks, however, there were no publications available at the time of the research on the outcomes of these projects and information gathered from Australian CEOs during the interviews revealed that they were unfamiliar with these particular applications. As innovators, their concerns were not focused on the impact of the new technology on their creative labour, rather they were focused on the notion of 'customer intimacy' and being able to communicate in a more direct way with international clients. The producers in fact expressed doubts to the researchers about the effectiveness of the Videofax compared to more expensive systems of real-time video conferencing, where they might hold two-way face-to-face interactions over material. The benefits of the use of asynchronous time that were identified from the flow charting, however, revealed that videoconferencing systems, alone, which require people to collaborate in real-time in different time zones, would not have provided the benefits to their communication workflows that were achieved with the Videofax.

Thus, it was after the first experimental use of visual communications on an entire production that the company became more aware of its benefits to their work practices. They noted, for example, that it is a practice on international projects to have the physical presence of key client/agency representatives at the production base, due to the remoteness created by geographical separations. While this was still necessary during periods of actual development of the project, to check sites and meet with the production company and creative personnel, it was eliminated during the post-production phase, where the Videofax substituted the need for this type of physical collaboration. This allowed personnel to work in their own environments, on alternative projects, instead of being tied up in Australia on only one project.

Secondly, it was revealed that the use of the Videofax produced benefits to the scheduling process, as material could be transmitted during the evening in Australian time and received in the morning British time. On reflection, real-time communications, like those supplied by video conferencing, were not considered appropriate for such activities as the agency needed time to evaluate their comments on the material, which happened while the Australian team slept. On the following morning the Australians phone-conferenced with the British end for approvals, and production work proceeded without more than a normal overnight delay. This workflow pattern was regarded as particularly useful during the special effects post-production work which, due to the use of the Videofax, was able to proceed continuously during the day with the necessary approvals. The flow charting technique, used in the research, revealed that the traditional process, of using and relying on international couriers, would have added an extra day to each transaction, creating hold-ups in the editing, pending approvals.

Disadvantages. A cost analysis performed on the budget items revealed that on a project basis alone, the net costs of the Videofax added expenditures of the order of approximately $2000 in a project budgeted at over $1m.[14] However, the producers considered that the non-financial benefits, of experimenting with greater intimacy in communications, outweighed these extra costs. Transmission costs were, however, highlighted by other innovating companies as providing significant barriers to regular use of the systems.

Hurdles with telecommunications suppliers was another factor given as a disadvantage, strong enough to dissuade some other innovators, as well as companies who were aware of the systems but hadn't used them, of the overall effectiveness of the new technologies. Film Graphics noted problems with telecommunications suppliers during some transactions and periods when losing network connections made business difficult. This resulted in extra pressure on production co-ordinators to problem solve with network suppliers. This task usually fell to the production manager. In the interview with Film Graphics this was not seen as a major problem, but as an expected outcome of becoming familiar with the requirements of the innovation.

This innovation in visual communications has now become standard production practice for Film Graphics and the emphasis on asynchronous communications was clear in the company's 1998 decision to invest in its own facilities. The use of a Videofax bureau has been replaced with a customised video transfer system to send work in progress to international agencies overnight. The customised video system allows creative personnel to receive material on their own computers and uses more compression for the transmission of larger files of material. It has allowed creative labour to relocate from the production facility and still have access to work on a project. For example, directors can be in another town on another project while still receiving material for approval. Also, some of Film Graphics' visual designers can live and work remotely from the office in this way. The company has now increased its overseas work from 10% to between 30 and 40% of all its commercial television work.

Feature Film Case Study

In contrast to the innovators using the Videofax in Australia, Cinesite, the company selected for the feature film case study, had progressed beyond the notion of electronic visual communications being a substitute technology for the post and courier, through their intra-company trials and use of these systems in 1994. In their production work on the animated film, *Space Jam*,[15] conducted throughout 1995, they consciously selected the deployment of three different visual communication systems, to effect changes to creative work practices and create a competitive budget for remote work with the Los Angeles studios.

The company was approached for a case study because it appeared, from the research available, to be the only innovator at the time using visual communications throughout the entire manufacturing cycles of film production and for actual business purposes. The cost of the systems was identified by other innovators in this sector as the major barrier to wider adoption and trials of the systems.

Unlike the commercial advertising sector, feature-film making is a more risk driven enterprise, where the significance of story over costs, at the box office, often produces high investments that can be complete failures financially.[16] The sector is therefore usually controlled and led by financial companies, like the major Hollywood studios, who can afford to spread their risks over a number of projects.

Since late 1960, these companies have restructured themselves, moving away from being large vertically integrated studios, to centres who primarily control the financing

and distribution of projects. Most of the studios now outsource and contract many of their former production activities, selecting their requirements from smaller, specialist production service companies.[17] This strategy ensures their access to the highest quality of creative labour. Production companies negotiate their involvement with the studios on a project by project basis, where collaborations tend to be formed on the basis of long-term relationships combined with production profiles that suit the style of film being made. A number of different production companies may be employed by a studio on one film, to cater for different production needs such as set designs, costume designs, visual and special effects, animation and titles, and sound and picture post-production.

In the Hollywood industry, most outsourcing has traditionally been allocated to companies geographically clustered around the major studios, due to the ease of doing business this way. A changing factor within the industry emerging during the 1990s, however, is the evolution of digital imaging into filmmaking. This area is known as digital visual effects and involves the combination of digitally produced images with camera originated material. These changes in the design of the moving image were quickly adopted by Hollywood in the form of the 'blockbuster' or special effects 'event' movie, as a way of keeping their product popular with audiences and hence maintaining their box office dominance.

The new digital imaging techniques have, however, increased the material processing involved in manufacturing film product by increasing the amount of image work that needs to be done (i.e. photochemical filming, as well as digital designs). The techniques also demand the highest levels of creative labour to achieve results, as well as creating additional stages for quality approvals and consultations within the production process.

This need for very specialised expertise in the digital image design areas has extended the search for creative labour beyond the local arena to the international. The increases to material processing have added new pressures on both the studios and their production service companies, to maximise their use of time and scheduling in order to minimise costs and ensure effective turnaround on projects.

These two factors were the driving force behind the decision made by Warner Bros. to trial and use visual communication systems in their work on the making of *Space Jam*, one of the largest animation and visual effects films in recent history. Warner Bros. contracted Cinesite to provide their digital-imaging and post-production services. The work essentially involved creating the *Space Jam* storyline, through combining Warner Bros. own animated cartoon characters and action footage of the star, Michael Jordan, with Cinesite's three-dimensional animation of the sets.

Inside the Cinesite company structure, the creative specialists, skilled in composing three-dimensional drawings, were located at the UK end of the company, while the compositing team (those that married the images to the film) were located in Hollywood—thus spreading the creative labour fairly evenly between both locations of Cinesite in the UK and Los Angeles.

A basic ISDN system was used to transfer 3D wire frame drawings of the sets and the occasional image and texture maps from the UK to the USA. In tandem with these transfers, the company utilised e-mail on their Intranet system for messages between the distributed offices. A more sophisticated ISDN system, with greater memory capacity, was used to transfer proxies (short video clips) of the animation sequences for approval by the studio. These two processes utilised asynchronous transmissions (not in real-time or face-to-face). Cinesite also used a video conference system to hold regular meetings between people from both ends of the company and, on this project, to hold meetings between the directors and producers in the US with the animators in the UK.

Findings

Advantages and cautions. Asynchronous communications were used for purposes similar to the findings in the use of the Videofax study, to allow creative labour the flexibility to rest or get on with other work, without having to be in a set place, at an inconvenient time, to receive and respond to a transmission. The transmissions also had similar time savings over the international courier systems, in that they arrived approximately a day earlier.

Cinesite noted that their creative workforce was generally better off by having the systems available, as not only could they manage their projects more flexibly, but they could also choose to live in the environment they felt happiest in.

Production managers at Cinesite voiced some cautions, however, about these advantages compared to traditional communications. They indicated that without careful planning, the speed of the systems can encourage increases in the choices available to directors and visual effects producers. Hence it becomes possible to compose a piece of material, say, six different times in the same amount of time it would take to courier a copy of the one-shot version. As the feature-film industry has a high level of uncertainty with its box office there is always a tendency to try and improve things. While this can advantage the final product, it can also increase people's workloads, perhaps unnecessarily. For these reasons, Cinesite saw the development of effective production management skills as essential to the use of remote transaction systems. This generally means that someone needs to supervise the transactions ensuring effective decision-making is proceeding within the schedule, and overall project requirements are being met.

Feature films require the production of large amounts of visual material, with the final cut of a film running between 1.5 to 2.5 hours in screen length, compared to the final length of a commercial advertisement which may run for 15–60 seconds of screen time. Due to this increased material processing, Cinesite concluded that even with the aid of electronic visual communication systems, they would require travel and face-to-face meetings in the production process. This was managed with the aid of the teleconferencing system; however, the system was not regarded as a total replacement for travel.

Cinesite argued that the need for actual, physical, face-to-face contact will always be an essential element of feature-film work, for ensuring the confidence of clients, like the Hollywood studios, where very large financial investments are made in films (between $100m and $200m), and where the risk factors with the box office are high.

The need for a physical presence, in collaborations, is both socially and technically motivated. Technically, producers and some of their key creative teams need to see the result of their work in progress on the 'big' (cinema) screen. This is the viewing environment of the audience and certain visual details, or overall reactions to an edit, can often only be evaluated under these conditions. The theatrical setting also provides an environment where creative teams feel comfortable in giving each other critical feedback about work in progress. Cinesite, being aware of these needs, therefore planned the use of the video conferencing system as a supplement, but not a replacement, to physical meetings. Their evaluation was that the conferencing system reduced the need for some travel and allowed people to meet more frequently than they would have otherwise, thus also facilitating intimacy between the team.

The company also emphasised that, regardless of developments or improvements in the systems, they would always have an office in the US for business purposes. This reasoning supports research previously conducted on the US film industry, where it was found that a physical presence by companies is essential to maximise the deal making

opportunities for setting up projects and future contractual work.[18] In the current studio environment, where work is essentially won project by project, establishing a presence in these centres assists companies to maintain their contacts.

The work Cinesite completed in London on the *Space Jam* project was able to be conducted with a number of other projects happening at the same time and the company attributed this achievement to the availability of visual communication systems. Utilising new electronic networks into its schedule, the film went from conception to finished product in an estimated one third of the time it would have taken using traditional communications for the animation transactions.

Conclusions

Companies willing to try visual communications cited the need to establish wider export markets for services and also to gain access to the highest quality creative labour as driving their desire for using the new technologies. The internationalisation of the film industry is thus providing the incentive for the adoption of visual communication innovations. These economic and social forces are creating the predisposition for adoption that diffusion theorists, like Rogers, argue are essential for recognition of a need for an innovation.[19]

Our research revealed that the major applications emerging from the new communication innovations, within the manufacturing cycles of filmmaking, were design and approval work associated with pre- and post-production tasks.

The two case studies provided information on emerging benefits for innovators within the film industry:

- achieving greater levels of customer intimacy for production companies by providing greater degrees of control of the production process through increased connectivity between creative labour, even though work is happening on the other side of the world;
- producing time savings in production schedules, compared to the use of traditional communications such as the telephone, post or courier, especially in the post-production phases of work, thus allowing greater turnaround on projects;
- the ability to take advantage of the use of asynchronous transactions where companies are located in different global time zones. The use of asynchronous electronic communications means that the production work can be scheduled across the 24-hour day, without breaks in the schedule. It also creates more flexibility for creative labour, by allowing them to work on a number of projects simultaneously, if need be, from one location;
- asynchronous transactions are also improving the quality of life for some creative labour, by allowing their work to be performed from the location of their choice, rather than at the client's base;
- the conscious choice of systems, matched to particular creative tasks, is facilitating better management of travel schedules for creative teams. The systems are also facilitating increased access to the best international creative labour, especially for animation and visual effects work.

The case studies, however, also identified some dysfunctional attributes of the innovation that may act to inhibit adoption.

On large scale productions, the visual communication systems brought new challenges to production co-ordination tasks, as illustrated in the *Space Jam* study, where their availability was seen as a possible problem to be managed, if they accelerated the

need for superfluous transactions or decision-making. The Cinesite company study also revealed the need to consider and match different forms of visual communication systems to the task required. For example, asynchronous communications were effective for design work, but the use of the video conferencing system was more effective for collaborations where major team members needed to report on events in a face-to-face environment (i.e. in larger projects like feature length films). These factors would indicate requirements for new skills in production and communication management roles within creative teams.

The feature film case study also dispelled speculation, often accompanying trade promotions, that adoption of the systems would put an end to the need for physical meetings or the location of business within the major film centres. The availability of remote visual communications was not replacing the need for travel, as people still wanted to meet and solve problems in person. Nor were they replacing the need for businesses to be located in major centres, Hollywood for example, to build and maintain business contacts and negotiate contractual work.

The findings indicate which sectors of the industry may lead the diffusion, or have most benefit from it. The innovating companies studied, for example, had moved from experimental to normative adoption of the innovation within the 4-year time-span from 1994 to 1998. The benefits of using the system are thus supplying strong relative advantages to these companies over traditional means of communications, for conducting international business. This would suggest that the next category within the diffusion model, that of early adopters,[20] may come from companies involved in the production of television commercials and those specialising in animation and special effects for feature films, where the knowledge produced by the innovators will have most relevant significance.

The adoption of new visual communication technologies has not, however, moved beyond the innovation stage in the period 1994–98. It is too early to conclude, therefore, how successful its diffusion will be within the film industry. Lamberton identifies a number of forces that strongly influence diffusion and would have application to this innovation: decline in costs of the technologies and costs of substitution; the requirement for new skills; a critical mass of users being attained; and 'dissemination of information about experience with the new technology: its operating characteristics and profitability'.[21]

The current telecommunication and network costs, the variety of transmission systems available, and the diverse range of 'image qualities' associated with digital imaging, were cited by the innovator category as problems, preventing wider uptake of visual communication innovations. The period 1994–98 has seen rapid advances in the compression capabilities of digital technologies and therefore improved image transfer systems to meet telecommunication and communication needs. Thus network costs and changing technologies are possibly prompting uncertainty amongst more conventional and sceptical companies about 'the right time' to buy into the innovation, without incurring either increased communication costs or having continual replacement costs associated with their investment. The companies adopting the systems were the larger ones who could afford the financial risks and outlays within this period of uncertainty. It could be predicted, therefore, that if technological standards stabilise and network charges decrease, the conditions may be created for more rapid diffusion of the innovation and the attainment of a critical mass of users which is essential for effective diffusion.[22]

This predication, however, needs to be balanced within the other considerations raised by Lamberton in the diffusion process. A comparison with the adoption of digital

editing in the industry supports the assertion that the dissemination of knowledge and information about new systems and work practices is a crucial element, determining the adoption of new technologies in this industry. The film industry came into the area of digitisation relatively later than other areas of manufacturing. It was not until the very early 1990s, for example, that computers were able to handle large files of visual material which led to the digitisation of imaging and editing. The first digital editing systems began appearing around 1990. Although the diffusion process has not been mapped formally, the Australian industry as a whole resisted widespread adoption of the innovation until 1997, despite their popular promotion in trade journals, conferences and reports from a number of eager and converted innovating companies. The advantages of the systems over the traditional technologies included: reductions in the physical handling of large amounts of film material; easier and more reliable cataloguing and editing management systems; increases in the speed of producing edited work for approval. Critical industry forums, however, cited a lack of compatibility of the systems with traditional analogue editing processes and work practices as a major industrial block to their adoption. Editors resisted changes to their creative role brought about through having to acquire new computing skills and uncertainty about the increased speed and flexibility of the new technologies for creative decision making. Companies cited increased budget elements in post-production as blocks to adoption.[23] The critical forums and publications that resulted from them, however, also allowed industry workers to share mutual concerns and make decisions within a more considered framework than the trade arena. Changeover to digital editing occurred rapidly between 1997 and 1998, as prices for the systems tumbled and producers and editors become more knowledgeable about integrating the benefits of the system into their traditional work practices and production values. People still using the analogue systems are now regarded as laggards.

This experience would indicate that a critical framework for disseminating knowledge and experience with visual communication technologies will also need to take place within this industry, for wider understanding and acceptance of the innovations to occur.

Notes and References

1. The authors wish to thank the management and staff of Film Graphics Productions, Bates Dorland, Halifax Building Society, Warner Bros. L.A. and Cinesite US for their willing participation in this study and their permission to publish these results. The study was supported by the Australian Research Council, the Australian Film Television and Radio School and the Faculty of Business, University of Technology, Sydney.

2. For selected reports on the emergence of visual communication technologies see D. Kaufman, 'Digital post-production: Hollywood dials into distance networking', *American Cinematographer*, September 1995, pp. 30–3; K. Mills, 'Video on the run–eliminating geography as an obstacle to production', *Millimeter*, March 1995, pp. 131–40; and R. Mizer, 'From post-production to the cinema of the future', *Society of Motion Picture and Television Engineers Journal*, December 1994, pp. 801–4.
3. For a description of the innovation-development process of diffusion and classifying adopter categories see E. Rogers, *Diffusion of Innovations*, The Free Press, Collier MacMillan Publishers, London, 1983, pp. 135–9 and 242–51.
4. For an analysis of regulatory changes governing advertising on Australian commercial television stations see the report to the Media and Communications Industries, M. Smythe, *Trends in the Use of Standardised Advertising Material Across National Borders*, Mervyn Smythe and Associates, November 1994. For an examination on the impacts of internationalisation on national screen industries see S. Cunningham and E. Jacka, 'Global mediascapes: theory and industry', *Australian Television and International Mediascapes*, Cambridge University Press, Cambridge, 1996, pp. 3–38; and T. Miller,

'Hollywood and the world', in J. Hill and P. Church Gibson (eds), *The Oxford Guide to Film Studies*, Oxford University Press, Oxford, 1998, pp. 371–9.

5. The most recent data on the industry, supplied from the Australian Bureau of Statistics for Film and Video Production in Australia, 1993–94.
6. Data supplied from *Encore, the Production Bible, Directory,* Reed Business Publishing, New South Wales, 1995.
7. E. Rogers, *op. cit.*, pp. 246–7.
8. Setrag Khoshafian and Mark Buckiewicz, *Introduction to Groupware, Workflow and Workgroup Computing,* John Wiley and Sons, New York, 1995.
9. Mary O'Hara and Robert Johansen, *Global Work–Bridging Distance, Culture and Time*, Jossey-Bass, San Francisco, 1994.
10. E. Rogers, *op. cit.*, p. 248.
11. K. Strickland, 'Moving pictures', *The Australian*, 16 January 1995, p. 30.
12. *Ibid*, p. 30.
13. E. Rogers, *op. cit.*, p. 362.
14. E. Baker, A. Chandler, T. Fisher and R. Moss, 'Moving pictures: a case study of the Videofax', *Media International Australia*, 80, 1996, pp. 66–74.
15. *Space Jam*, 35 mm. Feature Animation Film, Dir. Joe Pytka, Warner Bros., 1996.
16. T. Miller, *op. cit.*
17. S. Christopherson and M. Storper, 'Flexible specialisation and regional industrial agglomerations: the case of the U.S. motion picture industry', *Annals of the Association of American Geographers*, 77, 1, 1987, pp. 104–17.
18. *Ibid.*
19. E. Rogers, *op. cit.*, p. 106.
20. *Ibid*, pp. 246–50.
21. D. Lamberton, 'Diffusion of new information technologies and products', Attachment 1 to Communications Futures Project, Work in Progress, *Diffusion of Communications, Entertainment and Information Services*, Bureau of Transport and Economics, Canberra, 1994, pp. 5–29.
22. *Ibid*, p. 15.
23. For information on film industry responses to digital editing and other new digital technologies see, K. Aisbett, C. Griff and E. Jonker, *Talking Digital: Impact of Digital Technology on Film and Television Creative Teams*, Australian Film, Television and Radio School Research Department, 1997, pp. 4–12; and S. McGuire, *Crossing the Digital Threshold, Screen Industry, Culture and Policy Research Series*, Australian Key Centre for Cultural and Media Policy, 1997.