

Journal of Information Technology Management

ISSN #1042-1319

A Publication of the Association of Management

THE ADOPTION OF MULTIMEDIA OCCUPATIONAL HEALTH, SAFETY AND ENVIRONMENT INDUCTIONS

RODGER WRIGHT
MURDOCH UNIVERSITY
rodgerwright@rcwright.com

TANYA MCGILL
MURDOCH UNIVERSITY
t.mcgill@murdoch.edu.au

ABSTRACT

Occupational Health, Safety and Environment (OHSE) inductions are used to ensure that employees and stakeholders understand OHSE policies. Despite research suggesting the superiority of face-to-face communication in the transmission of vital information and contrary to the lack of productivity/profitability evidence for information technology in general and multimedia in particular, classroom style OHSE inductions are increasingly being replaced by interactive multimedia. The research described in this paper considers a number of theoretical platforms relating to innovation, marketing, adoption and the productivity-profitability paradox (PPP) and explores the influences behind the shift to multimedia OHSE inductions. Case study data was collected from 21 adopting organizations. Adoption by others, Demonstratability, Job Relevance, Image and Output Quality were identified as important change factors. The PPP was both contradicted and supported – multimedia was found to be very cost effective, but on the other hand ‘profits’ were traded away before they hit the bottom line. Major factors in influencing enterprises to adopt were transaction efficiency and the superior consistency of multimedia delivery.

Keywords: occupational health, safety and environment; multimedia; technology-push; market-pull; unique selling proposition; product positioning; technology acceptance; media richness theory; duty of care; productivity paradox; information productivity; transaction efficiency

INTRODUCTION

Occupational Health, Safety and Environment (OHSE) is a key function of corporate Human Resources (HR) departments. OHSE policy statements are prominently displayed on office walls and web sites, safe-working statistics are posted on billboards and OHSE accomplishments are given pride of place in corporate newsletters. Corporate OHSE departments are typically well funded and actively engaged in training, accident

prevention and the monitoring of safe working practices. The purpose of an OHSE induction is to ensure an employee, contractor or visitor has an understanding of the company’s OHSE policies relating to issues such as the environment, fitness for work (smoking, drug and alcohol testing), safety reporting, access authority and emergency procedures. These jointly fall under the heading of Duty of Care (DOC). Every company has a legal DOC that reaches all the way up from the workface to the boardroom to ensure the safety and welfare of its employees, the community and the environment.

Traditionally OHSE inductions have been conducted face to face in a training room. However, increasingly classroom slide shows and printed material based inductions are being supplanted by interactive multimedia systems. The research described in this paper considers a number of theoretical platforms relating to innovation, marketing, adoption and the productivity-profitability paradox and explores the influences behind the shift to multimedia OHSE inductions.

RESEARCH QUESTIONS AND ANTICIPATED OUTCOMES

The main research question addressed in this study was: *What factors, forces and influences are driv-*

ing the shift from traditional OHSE inductions to multimedia?

This section presents a series of more specific research questions that emerged from a review of the wider bodies of knowledge relevant to the research. In particular, five main categories of themes are addressed: innovation, marketing, technology acceptance, media richness, and the productivity-profitability paradox. Each of these is considered in the sections below: the relevant previous research is discussed and associated research questions and anticipated outcomes are presented. Figure 1 illustrates the framework and interconnections of the themes included in the study.

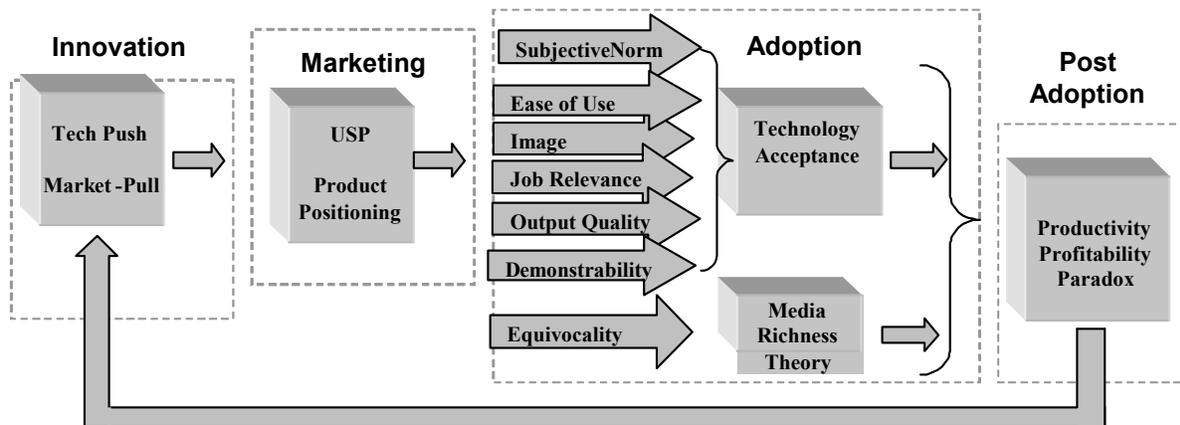


Figure 1: Theoretical Framework

Innovation

The discussion in the literature concerning provider side innovation has largely focused on the Technology-Push/Market-Pull dichotomy [45]. Technology-Push occurs when an innovative technology (without previous practical application) is presented to the market. Examples of Technology-Push include the optical laser and the personal computer. Market-Pull occurs when the market asks for a product for which no technology exists or asks that existing technology be modified to suit a market requirement. While the initial emphasis in the literature was focused on the relative importance of Market-Pull [49] versus Technology-Push [48], the later and more generally accepted picture is that technological innovation is more relevant in the initial stages of a product life-cycle with

market factors becoming more important as the product matures [43]. Carayannis and Roy [11] added the dynamics of Technology-Pull and Market-Push to the innovation landscape and support the idea that the balance between these four forces varies over time.

This research explores the role of innovation theory in the shift towards multimedia OHSE inductions by asking: *In what ways and to what extent have Technology-Push and Market-Pull forces been factors in the shift to multimedia OHSE inductions?*

Based on the literature it was anticipated that as technology is pushed to a new market, the market will in turn pull technical applications [6, 38, 58]. It was also proposed that Technology-Push would be the source of disruption with the disruption diminishing over time [6, 15, 58]. In addition, the literature suggests that a pure

Technology-Push strategy is likely to be employed where the innovating firm has no established client base and where customer resistance to new technology is seen as the major barrier to adoption [6, 38].

Marketing

Two key concepts in marketing are Unique Selling Proposition (USP) [44] and Product Positioning [46]. USP describes a proposition that is made to a prospective adopter concerning the benefits and advantages that a product offers that competitors cannot match and that is strong enough to cause adoption. Product Positioning posits that the mind is constantly being assaulted with confusing information that invokes negative emotional responses – especially fear. In order to allay these emotions, products need to position themselves against other products, trusted authorities or celebrities, the ‘herd’ or heritage. As organizations have taken the step of acquiring multimedia OHSE inductions, it is reasonable to assume that something induced them to make the change. This research considers: *In what ways and to what extent have USPs and Product Positioning arguments been influential in the adoption of multimedia OHSE inductions?*

While Reeves [44] claims many successes for the USP, there has been very little academic research into the USP proposition. It appears that the USP has been accepted into the lexicon as axiomatic, and consistent with this it might be expected that assertions concerning the unique benefits and advantages of OHSE multimedia inductions (USP) would be strong incentives to adopt.

Kaul and Rao [33, p. 320] summarized the research on Product Positioning and conclude: “The extant consumer decision theory assumes that consumers are rational utility maximizers and choose the product (from a set of available alternatives) that gives them maximum utility”. The utility gained is affected by the consumer’s perception of the product, its attributes, the alternatives and range of choices. Consistent with this, Product Positioning of OHSE multimedia inductions against other products, trusted authorities, celebrities, or the ‘herd’ should provide strong incentives to adopt.

Technology Acceptance

Availability of a technology (Technology-Push) is not enough to ensure adoption – the technology must also be accepted and used. A range of factors have been proposed to influence the acceptance and adoption of innovative technology. In Rogers’ Diffusion of Innovations Theory (DIT) [47] diffusion of technology is described as a social process. Rogers identified five categories of adopters based on their enthusiasm for adoption – innova-

tors, early adopters, early majority, late majority, and laggards. He highlighted the differing emphasis placed on influences by the chronology of adoption - for example demonstration of superiority becomes a more important factor as time progresses. The five attributes which Rogers proposed influence innovation are Relative Advantage (the degree to which the new technology’s benefits are perceived to exceed its precursor’s), Compatibility (the degree to which the new technology is perceived to meet the requirements of its precursor), Complexity (the degree to which a new technology is perceived to be difficult to implement or maintain), Observability (the degree to which the benefits of a new technology can be demonstrated) and Trialability (the degree to which a new technology can be tested prior to adoption).

Moore and Benbasat [39] re-cast Rogers’ complexity attribute to Ease of Use and expanded Rogers’ five attributes to include Image (social approval by others) and Voluntariness (the degree to which use of the innovation is seen to be mandated). They named the seven attributes the Perceived Characteristics of Innovating (PCI). They further divided Observability into the Result Demonstrability and Visibility constructs. Studies of the DIT and PCI theories in diverse fields have found that at least some of these constructs have a strong influence on adoption [e.g. 14, 31, 54].

The Technology Acceptance Model (TAM) [19, 20] has been widely used for explaining technology adoption. In contrast to the DIT, Davis proposed only two constructs as forces in determining attitude and intention: Perceived Usefulness (the degree to which a technology is considered to be utilitarian) and Perceived Ease of Use (the degree to which the use of a technology is considered to be effortless). Perceived Usefulness and Perceived Ease of Use are believed to largely mediate other influences in the intention to adopt a technology [56]. Studies have also found a strong correlation between intention to use and adoption which allows the extension of the TAM to implementation and practice [e.g. 13, 32].

An expanded version of the TAM, (TAM2), was proposed to include and integrate social influence factors such as Subjective Norm and Image [56]. Subjective Norm relates to people’s perceptions that others who are important to them think they should or should not perform behaviors [2]. The rationale of the inclusion of Subjective Norm is that people may choose the adoption of a technology if they perceive their referents as being favorable to its adoption. In an enterprise framework, this rationale may be better understood by practitioners as the notion of an ‘industry standard’ or ‘best practice’. Image is a somewhat different idea and is defined by Moore and Benbasat [39, p. 195] as “the degree to which use of an innovation

is perceived to enhance one's ... status in one's social system." TAM2 also highlights the other precursors of Perceived Usefulness. These are Job Relevance, which is the degree to which a technology is applicable to the task, Output Quality which is taken by Venkatesh and Davis [56] to have a broad meaning as a matching between a user's goals and the success or consequences of using the system and Results Demonstrability, the tangibility of the results of using the innovation. In the initial TAM2 model, Job Relevance and Output Quality were identified as two separate constructs, but in the final model, they are combined with the justification that they were found to be 'interactive' – as a technology becomes more relevant to a job, it is perceived as increasing important to job output and quality.

These theories of technology adoption highlight a number of constructs likely to influence the uptake of multimedia OHSE inductions. The precursor constructs from TAM2 were all considered of interest. This research explores their role and considers the following research questions:

- *In what ways and to what extent have Ease of Use, Subjective Norm, Image, Job Relevance, Output Quality and Demonstrability been influences in the adoption of multimedia OHSE inductions?*
- *What is the intent for future adoption of multimedia OHSE inductions?*

Consistent with the technology acceptance literature it was expected that the following constructs would be important factors in the initial adoption, current practice and future implementation of multimedia for OHSE inductions: Perceived Ease of Use; Demonstrability; Job Relevance and Output Quality; Image; Subjective Norm - directly in mandatory situations and indirectly via Perceived Usefulness [26, 39, 56]

Media Richness Theory

Organizations process data to reduce uncertainty [60]. By collecting more data, managers are able to base decisions on reduced uncertainty. Organizations train staff to reduce equivocality. In the face of equivocal or ambiguous situations, the collection of additional data alone will not help reduce uncertainty. Managers therefore create or define general solutions to equivocality and then attempt to pass them on to employees in the form of training [17]. OHSE inductions are a classic case of this solution – the inductions attempt to remove uncertainty and equivocality about certain OHSE related behaviors and actions. This leads to the issue of what media best dispels uncertainty and equivocality. Daft and Lengel [17] proposed the Me-

dia Richness Theory (MRT) to explain such decisions. This theory posits that managers select a media for communication based on the ability of the media to avoid equivocality. The perceived ability of media to overcome equivocality is based on its 'richness'. Richness is defined as the ability of a media to change understanding within a time interval [17, p. 560]. Richness factors include feedback, multiple clues, language variety and personal focus. On the richness scale, face-to-face with its ability to contain many social clues and the opportunity for immediate feedback is rated highest with numeric documents rating lowest. The hierarchy of media richness has been built up from written formats to include electronic media and is ranked highest to lowest as face-to-face, telephone, web site, email and written documents [16, 18, 57, 59]. MRT has been supported in a number of papers [e.g. 25, 35], it has received less support in laboratory studies [e.g. 22].

This research examines the choice of media made by a group of adopters who have a message to deliver where equivocality is of high, possibly life-threatening importance. Adopters are choosing multimedia over face-to-face delivery. Yet the literature suggests that face-to-face presentation is the richest media and the best method of dispelling uncertainty and reducing equivocality. This research therefore explored whether multimedia was chosen despite reduced media richness, or whether it is better able to dispel uncertainty and reduce equivocality as compared to face-to-face delivery of OHSE inductions, by answering the following research question: *Is multimedia better able to dispel uncertainty and reduce equivocality as compared to face-to-face delivery of OHSE inductions?*

Productivity-Profitability Paradox

The profitability paradox was originally posed by economist and Nobel Laureate Robert Solow who observed "You can see the computer age everywhere but in the productivity statistics." [50, p. 36]. This insight sparked what may be the world's largest and longest line of IT/economic research. Many follow-up studies have failed to find any significant productivity-profitability gains associated with investment in IT and have upheld the PPP at the international, national, industry and firm levels [e.g. 1, 10, 37, 55]. One of most appealing of the explanations of the PPP is the Redistribution explanation which speculates that 'profits' and benefits from investment in IT are often traded before reaching 'the bottom line' [7].

When examining multimedia specifically, the profitability outlook is even worse than for IT investment in general. Fahy [23] argues that: a) the total cost of own-

ership (TCO) of multimedia will constantly rise, b) no general cost savings may ever be realised by most users, c) the TCO will be well above purchase price by many times, d) the rationale for adopting multimedia is more related to issues of technical performance, flexibility, improved learning and user satisfaction than cost effectiveness.

An alternative explanation to the PPP is the Information Productivity® (transaction efficiency) theory which proposes that investment in IT is not correlated to profitability, rather investment in IT is associated with the efficiency of the enterprise's transactions [51-53]. This theory holds that transactions within a business are unique to that business and are therefore not measureable in the economic statistics. Some firms are better at employing IT to improve the efficiency of their transactions than others thus gaining a competitive advantage. This research therefore considers: *Does the adoption of multimedia OHSE inductions support or refute the PPP?*

Based on the literature the following outcomes might be expected:

- Investment in multimedia will not be cost effective [12, 23]
- Investment in multimedia may prove to be disruptive or counterproductive [23, 40]
- Investment in multimedia has no prospect of ever providing a ROI [5, 41, 61]
- Multimedia as a form of IT will improve the efficiency of inductions [51-53]
- 'Profits' from investment in IT may be traded away before they reach the bottom line [7, 27].

METHOD

A case study research method was adopted to answer the research questions. This research approach was considered appropriate given that the investigation of decisions is the major focus [62] and that data was to be captured from the practitioners in its natural environment [3].

This research has as its target of study the clients of an Australian company that creates and markets multimedia OHSE inductions. The case study contains elements of both a single and multiple-case design. The design is single-case in the sense that the study addresses the clients of a single company (the alias 'The Multimedia Company' is used in this paper), and multi-case in respect of the multiple clients. Table 1 lists the case study units that were selected.

The main body of the research data was obtained via a first person, elite interview with the responsible OHSE professional at each client firm. Areas of discussion included previous training-presentation methods, marketing propositions and their relevance, product positioning and its relevance, usage, physical constraints of training methods, justifications for expenditure on multimedia, equivocality as a factor in choice of media, DOC and other legislative requirements, productivity-profitability examples and anecdotes of multimedia use, any practice of trading away or redistribution of productivity-profitability gains, identification of additional influences in the adoption of multimedia. The interviews generally took from 35 to 45 minutes. The interview data was transcribed and coded using the initial categories identified from the literature. Thematic analysis was then carried out.

In addition to the interviews with the OHSE professionals, in investigating the innovation and marketing aspects of the study, various records of The Multimedia Company were consulted including correspondence, marketing text and graphics, multimedia presentations, web site history, and sales demonstration journals. Interviews were conducted with marketing and design staff where necessary.

Table 1: Case Study Units

Primary Industry	
Mining[1]	International, multi-billion dollar mining company with multiple sites
Mining[2]	Billion dollar Australian mining company with multiple mine sites
Mining[3]	International, multi-billion dollar mining company with multiple sites
Agriculture[1]	Billion dollar crop transport, storage and sales firm with large numbers of seasonal workers
Agriculture[2]	Billion dollar crop transport, storage and sales firm with large numbers of seasonal workers
Manufacturing	
Construction[1]	International billion dollar construction company with multiple sites
Construction[2]	One of the largest commercial/industrial builder in Australia
HeavyIndustry[1]	Integrated mining, production and manufacturing enterprise
HeavyIndustry[2]	Integrated mining, production and manufacturing enterprise
DiverseGoods[1]	International billion dollar manufacturer and supplier of branded goods
Transportation	
Airport[1]	State capital international airport
Airport[2]	State capital international airport
Seaport[1]	State capital port
Seaport[2]	Multi-commodity port
Seaport[3]	Multi-commodity port
Haulage[1]	National specialty transport firm
Haulage[2]	National furniture and removalists firm
Services	
Services[1]	Branch of an international, billion dollar service group
Services[2]	Services provider off-shore oil/gas production and exploration
Services	
Utility[1]	State Water Authority
Utility[2]	Steam and power generation utility

RESULTS AND DISCUSSION

What Roles have Technology-Push and Market-Pull Forces played in the Shift to Multimedia OHSE Inductions?

To determine the roles that Technology-Push and Market-Pull forces had played in the shift to multimedia inductions, source materials from the Multimedia Company (historical promotional material, order books and emails) and in particular historical copies of The Multimedia Company's old web sites as archived by the internet Wayback Machine (<http://www.archive.org/index.php>) were examined and are summarized in Table 2.

Table 2: The Evolution of Technology-Push/Market Pull

Year	Marketing Banner	Technology & Applications
1999-2001	'Remote Digital Outdoor Advertising'	Early 50" plasma screens in industrial and outdoor environments Digital advertising
2002	'Enter the World of Multimedia'	Video CV's Industrial 'Scoreboards' combining KPIs (key performance indicators) and digital advertising
2003	'Multimedia for Industry'	Industrial process visualisations Multimedia presentations re industrial systems First multimedia OHSE inductions and safety presentations
2004-2005	'Industrial Multimedia' 'If you can describe it we can design it'	Over 50 OHSE inductions included in client list
2007	'Site Specific Induction Specialists'	Web site intro entirely given over to OHSE inductions 99.99% of business multimedia OHSE inductions
2008-2009	'Site Specific Induction Specialists'	On-line OHSE inductions Learning management databases Expansion of OHSE multimedia packages including a risk and opportunity management system and a training resource generator package

Have USPs and Product Positioning been Influential in the Adoption of Multimedia OHSE Inductions?

A USP describes a marketing strategy where propositions are made to a prospective adopter concerning the features, benefits and advantages of a product that are (i) unique and (ii) significantly better than those offered by competing products and (iii) compelling [44]. The USP strategy does not include direct comparisons or disparagement of a competing product. In the participant interview responses, there were no instances where these three elements were present. The USP theory of marketing success was therefore not supported – adopters did not perceive any USPs that were persuasive. Being a new entry to the OHSE induction market, it wouldn't have been surprising if multimedia was seen as having USPs. However, a USP requires product competition. It is likely that the participants did not perceive multimedia as being a direct competitor to their existing approach (e.g. live classroom presentations, paper based and video movies) and therefore did not require unique and significant differences as a basis for purchase. Also, there were no competitive suppliers. In no instance did the participants obtain competitive quotations, and often committed to a purchase upon sight. USP theory arose from markets with many similar competitors (e.g. beer and washing powder) and is likely to be more applicable to similarly crowded markets. In a

future competitive market with multiple suppliers of multimedia inductions, USPs would most likely prosper.

Product Positioning theory as originally proposed by Hotelling [29] asserted that consumers assessed a product's utility by comparing its attributes to the alternatives. Ries and Trout [46] popularized the advertising concept of Product Positioning which differs in emphasis from Hotelling's construct in that products need to be positioned against other known products, trusted authorities, celebrities, heritage or the 'herd'. The majority (59%) of the participants felt that perceiving that the 'herd' - other companies not necessarily in the same industrial sector - were adopting multimedia for OHSE inductions was an incentive for them to purchase the product. This is illustrated by the following quote:

- *He showed us what the company had already done. And there is I think [another] Port Authority. There were a couple of mining companies and that actually shows us that these things were actually in place - gave a lot of credence to the sort of program. So if it's accepted by other industries, that is a big thing. SeaPort[1].*

In the interviews, 47% of the participants identified Product Positioning propositions of multimedia versus video. Of these, 75% identified the ability of multimedia to be easily updateable as compared to video as an influencing factor as illustrated by the following quotation:

- *What continually sells it, at the moment, and what is being proposed for the use on the other sites is how easy it is to use and how easy it is to modify things. That's probably the thing that's coming across. HeavyIndustry[1].*

The interviews illustrated two aspects of the effectiveness of Product Positioning – the comfort derived from seeing via sample inductions presented to them by The Multimedia Company that others (the ‘herd’) were adopting a similar product, and the highlighting of multimedia as being easier and less expensive to modify than video. The first aspect supports Ries and Trout [46] in respect of the ‘herd’ but not in the need to position products against other trusted authorities, celebrities or heritage. The second aspect more closely matches the original Product Positioning construct of Hoteling [29] in demonstrating the consumer’s evaluation of comparative product utility.

While cost and time savings may have later been used as justifications for future adoption, it is surprising that they were not initially sales sensitive issues. While none of the case study participants reported being approached or induced to purchase on the basis of reduced cost or improved efficiency, these are the same arguments that the participants later reported using to justify future adoption. This may be explained in the context of perceived usefulness. If the adopters’ primary aim was to create a better induction by reducing equivocality and providing a higher quality learning experience, then the perplexity is dispelled.

What Role do Technology Acceptance Factors play in the Adoption of Multimedia OHSE Inductions?

The research considered all of the precursor constructs from TAM2: Perceived Ease of Use, Results Demonstratability, Job Relevance and Output Quality, Image and Subjective Norm. All apart from Subjective Norm were found to be important in the adoption of multimedia OHSE inductions. Ease of use was an important factor to the participants with a high percentage (88%) of participants saying that multimedia OHSR inductions were easy to use. Participant comments included:

- *Ten times easier than what we were doing before. Services[1].*
- *Very, very easy. Agriculture[1].*

Demonstrability was also found to be an important determinant of acceptance. Over half of the participants (59%) reported that just seeing the product demon-

strated was enough to convince them to adopt it. This reaction is illustrated in the following quote:

- *Actually seeing the thing operating and having him run me through it is what sold me on that package. Seaport[3].*

Nearly half of the participants identified Job Relevance as being an important factor in adoption (47%). The following comment is typical:

- *Yes it met our needs. The fact that then after that we could use existing content that they've got and then fiddle with it a bit and produce something that we wanted. DiverseGoods[1].*

Over half of the participants identified the quality of the multimedia product as being an incentive to adopt (59%) as illustrated by the following quote:

- *The quality in terms of the cleanliness of the presentations that they put to us, they were clean, they were easy to follow, they were simple to work, they contain simple messages with good images, in fact the images and the messages danced well. They were uncomplicated and they gave us a fairly good sense of a storyline that went through it, okay, so that was pretty important. Mining[2].*

TAM2 posits a positive influence of Subjective Norm on the adoption of new technology via Perceived Usefulness if the participants perceive their referents as being favorable [56]. In an enterprise framework, this rationale may be extended to the concept of an ‘industry standard’ or ‘best practice’. From the responses in the interviews to questions concerning Subjective Norm, it appeared that the case study participants were not aware of any industry standards or best practice. Often, there were few or no peers to act as referents. Where possible referents existed, either within or outside their industry sector, the participants were generally unaware of what the possible referents were doing in the realm of multimedia for OHSE inductions. Further, when shown samples of possible referent inductions during marketing, the participants had been unconcerned with the opinions of the companies from which the samples were drawn. Subjective Norm was therefore not found to be a factor influencing adoption of multimedia OHSE inductions.

Venkatesh and Davis [56] and Hartwick and Barki [26] also identified the relationship between voluntariness and Subjective Norm. In TAM2, Subjective Norm is shown to have both a direct and indirect effect on intention to adopt. The direct effect is moderated by voluntariness and is only present when the system use is perceived

to be mandatory and diminishes with time and experience. The indirect effect via Perceived Usefulness is not moderated by voluntariness. The existence of real or implied legislative requirements to exercise a DOC includes the provision of OHSE inductions. Therefore in a mandatory situation, Subjective Norm ought to be a factor in adoption. A large proportion (77%) of the participants acknowledged that industrial legislation was involved in their decision to have OHSE inductions. However, they pointed out that industrial laws do not specify the manner of the induction. The adopters therefore viewed the requirement for the provision of inductions as mandatory but the use of multimedia as voluntary.

Venkatesh and Davis [56] have shown that Image is a significant influence in adoption but that it has only half the impact on the variance of Perceived Usefulness as Subjective Norm. As shown by the participants' comments below, the above definition of Image and its influence is shown by this study to apply equally as well to enterprises as individuals. Eleven participants voiced opinions concerning image – two said image was not a factor and nine (73%) reported image as a positive factor in adoption as illustrated by the following:

- *Multimedia set us up as a benchmark leaders in our field. Services[1].*
- *In the early days it was kind of leading edge and novel to be doing this stuff when no one else was. Selling the business and trying to get a new image, being at the lead edge of IT - which is kind of romantic' Construction[1].*

If, as Kaul and Rao [33] predicted, users select systems that provide maximum utility, then that utility is moderated by Subjective Norm, Image, Job Relevance, Quality of Output and Result Demonstratability [56]. Given the importance of all but Subjective Norm, the efficacy of TAM2 should therefore be evident in the participants' intentions for future adoption. Almost half (47.1%) of the participants indicated their intention to adopt additional multimedia OHSE inductions in the near future. The other half was either content with, or still evaluating the utility of, their current inductions. None of the participants had plans to replace their multimedia OHSE inductions with other products. Sample quotations from the interviews illustrating future plans included:

- *Now what I've been asked by the Executive General Manager is to adopt it to a national model. Services[1].*
- *That's convinced me to do more projects. We've been asked to move everything to multimedia. Mining[1].*

Thus, Perceived Ease of Use, Results Demonstratability, Output Quality, Job Relevance and Image were all found to positively contribute to adoption. Consistent with the notion that Subjective Norm will only be an influence when adoption is mandatory, it was not found to be an influential factor. Whilst there are legislative DOC requirements, they do not mandate a particular type of induction.

What role does Media Richness play in the Adoption of Multimedia OHSE Inductions?

As discussed above, MRT proposes that face-to-face presentation is the richest media and the best method of dispelling uncertainty and reducing equivocality. Yet, the adopters in this research moved away from traditional face-to-face OHSE inductions to multimedia. Face-to-face training was only retained when the amount of information was small or the subject was local. A large percentage of the adopters (73.3%) reported that they chose multimedia over face-to-face presentation because it offered the best opportunity to dispel uncertainty and reduce equivocality by delivering consistent, accurate and unequivocal information. Therefore the results are in contrast to what might be expected based on MRT: multimedia was seen as superior in dispelling uncertainty and reducing equivocality. The following quote illustrates this:

- *For the most part by having this group induction CD at least we can be assured of consistency. And by the same token, we wanted to get specific information out and we don't want it to deviate or be different. We wanted that consistency and for that reason, this was perfect. DiverseGoods[1].*

The ability to rapidly inform a large target audience, to reduce equivocality, and to provide consistency of induction content over time was therefore shown to be a strong factor in adoption. This preference appears to be in contradiction to the hierarchy of delivery modes posited by the MRT. This difference can be attributed to the nature of communication required in inductions. The lack of rapid feedback capability is balanced by the ability to change understanding within a time interval, consistent with Daft and Lengel's [17] definition of media richness.

Does the Adoption of Multimedia OHSE Inductions Support or Refute the PPP?

When examining the commercial aspects of IT in general, and multimedia as employed in OHSE inductions in particular, there are three distinct but related aspects: cost effectiveness, efficiency and profitability. The inter-

views addressed all three aspects. As the interviews progressed, it was found that while the case study participants were acutely aware of cost effectiveness and efficiency, they were far less aware of profitability. This appeared to be part of the OHSE culture – what price does one put on avoiding an accident or saving a life? The OHSE departments were not considered by the case study participants to be ‘profit centers’ because the only metrics for the performance were related to accident and death statistics (not available to the researchers). The costs of the inductions were also not available. Therefore, rather than addressing enterprise profitability, the questions concerning cost effectiveness and profitability were directed towards the section’s costs and budget. The major finding was that the PPP proposition was both refuted and supported – in this instance, multimedia, was found to be cost effective but the ‘profit’ was traded away before it hit the bottom line.

Cost effectiveness

According to the literature, the prospect for multimedia attaining cost effectiveness is bleak - many sources have claimed that multimedia is unlikely to initially, or ever, save the enterprise time or money [12, 23] and may even in the short term cause chaos, promote time-wasting and lower productivity [23, 40]. Further, it has been claimed that the total cost of ownership of multimedia may be many times the purchase price and will constantly rise with little or no prospect of recouping costs [5, 41, 61]. In contrast to this outlook, 82.4% of the participants found multimedia OHSE inductions to be cost effective. The three not reporting cost effectiveness said either that they did not know or that it was too soon to tell. None of the participants reported multimedia for OHSE inductions had a negative ROI.

Using multimedia, the participants were able to eliminate or severely reduce the basic elements of the traditional induction model – the trainer, the training material, the training room and the training schedule. None of the participants had conducted any formal cost analysis and they were content with ‘back of the envelope’ or simple time multiplied by cost calculations to support their view of cost effectiveness. This may either be interpreted as a lack of due diligence on their part or, more likely, the cost effectiveness was extremely obvious. This latter conclusion is supported by the time spans for ROI in the participant’s comments which varied from having ‘already paid for itself’ to 18-24 months. Comments related to cost effectiveness included:

- *Certainly from a cost point of view the induction is reducing the time it’s taken to do those inductions. Paying casual staff to sit around for four hours and now we’re paying*

them for one hour - yes, it has been cost effective. [How do you know?] Back of the envelope type stuff, it pays itself back quickly. If it saves two hours we induct say 800 people a year, that saves two years at \$20/hr, you know, the payback period is probably 1-2 years. Agriculture[1].

Efficiency

The Information Productivity®/efficiency alternative to the PPP [51-53] proposes that i) IT spending and profitability are unrelated, ii) profit comes from low cost transactions, iii) IT spending is directed towards reducing transaction costs, iv) transaction costs are unique to the firm and the correct level of IT spending cannot be derived from public data (hence the inability to prove/disprove the PPP from economic statistics), and v) competitive tensions of gain/loss cause firms to exploit every conceivable advantage of IT.

All of the participants reported that the use of multimedia OHSE inductions increased the induction efficiency. The pivotal factor in efficiency was time – more inductions in less time equals higher efficiency. The Multimedia Company reported using the term ‘Multimedia Time’ – meaning the reduction in time that can be achieved when converting existing slide show or video inductions into multimedia. The factor generally used is four to one – four hours of other media may be reduced to one hour of multimedia. Support for increased time efficiency has been provided by Fletcher [24] and Hemphill [28] who found large reductions in time as compared to instructor based training. Participant support for the increased efficiency provided by multimedia OHSE inductions is illustrated by the following quote:

- *It significantly reduced the time that it took to get information across. It went from four hours down to less than an hour to do the induction. So that certainly reduced the time. Agriculture[1].*

Redistribution of ‘profits’

Since the question of the productivity-profitability of IT investment was first raised by Solow [50], many efforts have failed to put this proposition to rest. Brynjolfsson and his associates were one of the few research groups during that period proposing that IT did actually provide productivity-profitability gains [7-9]. Other researchers including Osei-Bryson and Ko [42] and Lin and Shai [36] were not able to duplicate the gains detected by Brynjolfsson’s group. As the years progressed and the productivity failed to materialize, even Brynjolfsson started to steer away from absolute profitability.

The explanation that the PPP might be caused by a redistribution of the gains achieved from the use of IT was introduced by Brynjolfsson [7]. The idea was that ‘profits’ may be traded away in some manner before they hit the bottom line – for example in price reductions, lower stock levels or other customer or private benefits. A similar explanation centered around the concept that the introduction of IT created ‘organizational slack’ with the benefits going to the workload and demands upon staff [7, 21]. Supporting the PPP solution that profits are traded away before reaching the ‘bottom line’, 93% of the participants reported that significant financial benefits were realized from the use of multimedia for OHSE inductions that did not necessarily hit the ‘bottom line’. When the participants were asked if the cost savings meant that their budget for the next year would be reduced, after the initial laughter, none indicated that there would be a reduction.

The cost benefits identified by the participants were related to training resource – especially trainer time (including their own) - that could now be used for duties more aligned with their training and position statements as demonstrated by the following comment:

- *We’ve now got time to do other things and things that we’re being paid to do. We’re not taking the environmental officer, or the shipping superintendent away from what they’re doing so that they can go and spend two hours every day doing an induction. So those two hours then is gone back into the job. So it’s an investment back into the job. Seaport[3].*

CONCLUSION

The research described in this paper has explored the factors driving the shift from traditional OHSE inductions to multimedia, making use of five theoretical platforms. Table 3 provides a summary of each of the themes that were investigated, the anticipated outcomes according to theory, and the results and conclusions drawn. As can be seen from Table 3 just over half of the outcomes were consistent with what had been proposed on the basis of the literature.

In terms of the innovation literature, support was provided for the general Technology-Push/Market-Pull theory, as it was shown that the multimedia technology that was initially pushed to the market as an industrial tool for doing advertising, process visualization and education was pulled by the market towards OSHE site specific inductions. However, the argument that the technology pushed would be disruptive was not supported – the mar-

ket-pulled technology was the disruptive element. Some authors [6, 15, 58], posit the push of a new technology as being the force behind disruptive change. In this research it was shown that in contradiction The Multimedia Company was pulled to OHSE inductions. This contradiction can be reconciled by arguing that while at the time of the study, multimedia was not a new technology, it was a new technology as far as OHSE inductions were concerned. Mixed models of the push-pull duality [4, 30, 34] have appeared which aim to develop a better understanding of the innovative process. It was also shown that technological aspects decreased with time.

The results relevant to marketing were mixed. USPs appeared to play no role in the marketing phase. This may be due to the perceived lack of ‘competitors’ and/or competitive technologies. The USP was originally formulated to describe marketing approaches in highly competitive markets. With few or no perceived competitive forces, being unique is not a requirement for success. Product positioning against video and examples of what other enterprises were doing (image and the ‘herd’) was, however, pivotal in the purchase of the inductions: with no point of reference to competitors, the safest path is often to follow the lead of others.

As predicted by TAM2, Perceived Ease of Use, Demonstratability, Output Quality, and Job Relevance were all found to be relevant to adoption. Considering that inductions might be considered a rather mundane OHSE task, it was surprising that Image was an influence in adoption. Image in terms of being seen as or comparable to industry leaders, and nurturing the image of a caring and responsible employer, were both deemed to be important. Subjective Norm was not, however, found to be a factor influencing adoption. This is consistent with the notion that Subjective Norm will only be an influence when adoption is mandatory [56]. Legislative DOC requirements may at first appear to be mandatory, but the participants were vague about their responsibilities under the various Acts and did not appear to view the legislation as specifically mandating inductions - let alone, a particular type of induction.

In terms of Media Richness Theory, the preference for multimedia over face to face appears to be in contradiction to the hierarchy of delivery modes. However, inductions require a particular type of communication, and multimedia seems well placed to support this. That is, to rapidly inform a large target audience, to reduce equivocality, and to provide consistency of induction content over time. The lack of rapid feedback capability is balanced by the ability to change understanding within the required time interval.

Table 3: Summary of Anticipated Outcomes and Results

Theme Investigated	Anticipated Theoretical Outcome	Conclusion
Technology-Push Market-Pull	Technology will be pushed to a new market, the market will in turn pull technical applications	Supported – this was the path followed
Technology-Push Market-Pull	Technology-Push is the usual source of disruption	Not supported – market pull was the source
Technology-Push Market-Pull	Disruption will diminish over time	Supported
Unique Selling Proposition	Propositions concerning the unique benefits and advantages of OHSE multimedia inductions would be strong incentives to adopt	Not supported – USPs not perceived by adopters
Product Positioning	Consumers gain utility by comparing product attributes	Supported – video compared unfavorably to multimedia
Product Positioning	Products are positioned against other products, trusted authorities, celebrities, or the ‘herd’	Supported for the ‘herd’ but not trusted authorities or celebrities
Perceived Ease of Use	Perceived ease of use will be an influence in intention for future adoption	Supported – i) multimedia OHSE inductions were found to be easy to use, ii) the majority of the participants planned future adoption
Results Demonstrability	Results Demonstrability was a factor in adoption	Supported
Job Relevance and Output Quality	Job Relevance and Output Quality were factors affecting adoption	Supported
Subjective Norm	Subjective Norm via perceived usefulness was a factor in adoption	Not supported – no referents were considered
Image	Multimedia was adopted because it enhanced company image	Supported
Equivocality and Uncertainty	Face-to-face presentation is the richest media and the best method of dispelling uncertainty and reducing equivocality	Not supported – multimedia seen as superior in dispelling uncertainty and reducing equivocality
Cost Effectiveness	Investment in multimedia will not be cost effective	Not supported – found to be very cost effective
Cost Effectiveness	Investment in IT may prove to be counterproductive	Not supported – no evidence of negative usefulness in operation
Cost Effectiveness	The total cost of ownership of investment in multimedia has no prospect of ever providing a ROI	Not supported – short term ROI indicated
Transaction Efficiency	Multimedia will improve the efficiency of inductions	Supported – more inductions in less time
Profit Traded Away	Investment in IT will not improve productivity-profitability	Supported – departmental budgets not reduced
Profit Traded Away	‘Profits’ from investment in IT may be traded away before they reach the bottom line	Supported – personnel released for more other duties

The final theme considered was that of the PPP. Multimedia as employed in OHSE inductions was found by the adopters to be cost effective, and to improve induction efficiency. The adopters were able to eliminate or severely reduce the costs and time associated with trainers, the training materials, training rooms and the training schedules. However, this research supports the PPP in general by noting that when asked, not one of the participants reported a decrease in their next year's section budget based on the cost and time savings gained from the use of multimedia in OHSE inductions.

However, the Redistribution explanation of the PPP (redistributed of profits/benefits before they hit the bottom line) was supported by the research. Physical resources such as training rooms were re-used for other purposes and OHSE professionals who were tied down giving inductions could now apply that time to other duties more suited to their job description and qualifications (e.g. accident investigations, safe working practices, etc.). This indirectly (rather than directly in the production of inductions) increased the productivity of the OHSE section. The research also supports the Information Productivity® (transactional efficiency) alternative to the PPP as multimedia improved the efficiency of inductions. In many cases the participants could not have achieved the necessary number of inductions in the available time without the use of multimedia.

The results of this study demonstrate the value of considering a number of theoretical platforms when addressing complex adoption scenarios. Adoption of multimedia OHSE inductions has been shown to be influenced by a wide range of factors. These factors, although also clearly related are ordinarily considered separately.

REFERENCES

- [1] Ahituv, N. and Greenstein, G., "The Impact of Accessibility on the Value of Information and the Productivity Paradox". *European Journal of Operational Research*, Vol. 161, Number 2, 2005, pp. 505-524.
- [2] Ajzen, I. and Fishbein, M., *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research*. Addison-Wesley, Reading, MA. 1975.
- [3] Benbasat, I., Goldstein, K., and Mead, M., "The Case Research Strategy in Studies of Information Systems". *MIS Quarterly*, Vol. 11, Number 3, 1987, pp. 369-386.
- [4] Bernstein, B. and Singh, P., "An Integrated Process Model Based on Practices of Australian Biotechnical Firms". *Technovation*, Vol. 26, Number 2004, pp. 561-572.
- [5] Black, S. and Lynch, L., "Human-Capital Investments and Productivity". *American Economic Review Papers and Proceedings*, Vol. 86, Number 2, 1996, pp. 263-267.
- [6] Bower, J. and Christensen, C., "Disruptive Technologies: Catching the Wave". *Harvard Business Review*, Vol. 73, Number 1, 1995, pp. 43-53.
- [7] Brynjolfsson, E., "The Productivity Paradox of Information Technology". *Communications of the ACM*, Vol. 36, Number 12, 1993, pp. 67-77.
- [8] Brynjolfsson, E. and Hitt, L., "Paradox Lost? Firm-Level Evidence on the Returns to Information Systems Spending". *Management Science*, Vol. 42, Number 4, 1996, pp. 541-558.
- [9] Brynjolfsson, E. and Hitt, L., "Beyond the Productivity Paradox". *Communications of the ACM*, Vol. 41, Number 8, 1998, pp. 49-55.
- [10] Byrd, T., et al., "A Process-Oriented Perspective of Is Success: Examining the Impact of Is on Operational Cost". *Omega, The International Journal of Management Science*, Vol. 36, Number 2006, pp. 448-460.
- [11] Carayannis, E. and Roy, R., "David Vs. Goliaths in the Small Satellite Industry: The Role of Technological Innovation Dynamics in Firm Competitiveness". *Technovation*, Vol. 20, Number 2000, pp. 287-297.
- [12] Cassidy, J., "The Productivity Mirage", in *The New Yorker*. 2000.
- [13] Chau, P., "Influence of Computer Attitude and Self-Efficacy on It Usage Behavior". *Journal of End User Computing*, Vol. 13, Number 1, 2001, pp. 26-33.
- [14] Chen, L., Gillenson, M., and Sherrell, D., "Consumer Acceptance of Virtual Stores: A Theoretical Model and Critical Success Factors for Virtual Stores". *Database for Advances in Information Systems*, Vol. 35, Number 2, 2004, pp. 8-31.
- [15] Christensen, C., "Disruptive Innovation". *Leadership Excellence*, Vol. 24, Number 9, 2007, pp. 7-15.
- [16] D'Ambra, J., "A Field Study of Information Technology, Task Equivocality, Media Richness, and Media Preference". University of New South Wales. 1995, pp. 233.
- [17] Daft, R. and Lengel, R., "Organizational Information Requirements, Media Richness and

- Structural Design". *Management Science*, Vol. 32, Number 5, 1986, pp. 554-571.
- [18] Daft, R., Lengel, R., and Trevino, L. K., "Message Equivocality, Media Selection, and Manager Performance: Implications for Information Systems". *MIS Quarterly*, Vol. 11, Number 3, 1987, pp. 355-366.
- [19] Davis, F., "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology". *MIS Quarterly*, Vol. 13, Number 3, 1989, pp. 319-340.
- [20] Davis, F., Bagozzi, R., and Warshaw, P., "User Acceptance of Computer Technology: A Comparison of Two Theoretical Models". *Management Science*, Vol. 35, Number 8, 1989, pp. 982-1004.
- [21] Dehning, B., Dow, K., and Stratopoulos, T., "The Info-Tech "Productivity Paradox" Dissected and Tested". *Management Accounting Quarterly*, Vol. 5, Number 1, 2003, pp. 31-39.
- [22] Dennis, A. and Kinney, S., "Testing Media Richness Theory in the New Media: The Effects of Cues, Feedback, and Task Equivocality". *Information Systems Research*, Vol. 9, Number 3, 1998, pp. 256-274.
- [23] Fahy, P., "Planning for Multimedia Learning", in *Interactive Multimedia in Education and Training*, Idea Group Publishing: Hershey. 2004, pp. 1-24.
- [24] Fletcher, J., "*Effectiveness and Cost of Interactive Videodisc Instruction in Defense Training and Education*". Institute for Defense Analysis, Washington D.C.1990.
- [25] Fulk, J. and Collins-Jarvis, L., "Wired Meetings: Technological Mediation of Organizational Gatherings.", in *The New Handbook of Organizational Communication: Advances in Theory, Research, and Methods*, Sage:624-663: thousand Oaks, CA. 2001.
- [26] Hartwick, J. and Barki, H., "Explaining the Role of User Participation in Information System Use". *Management Science*, Vol. 40, Number 4, 1994, pp. 440-465.
- [27] Hayward, B., Magrassi, P., and Roberts, J., "*IT and the Economy Are Experiencing Growing Pains - Av-17-0296*". Gartner Inc.2002, pp. 4.
- [28] Hemphill, H. "The Impact of Training on Job Performance", <http://www.netg.com/research/resultsreport97.htm>, (1997).
- [29] Hoteling, H., "Stability on Competition". *Economic Journal*, Vol. 39, Number 1929, pp. 41-47.
- [30] Howells, J., "Rethinking the Market-Technology Relationship for Innovation". *Research Policy*, Vol. 25, Number 1997, pp. 1209-1219.
- [31] Hsu, C., Lu, H., and Hsu, H., "Adoption of the Mobile Internet: An Empirical Study of Multimedia Message Service (MMS)". *Omega, The International Journal of Management Science*, Vol. 35, Number 6, 2007, pp. 715-726.
- [32] Igarria, M., Guimaraes, T., and Davis, G. B., "Testing the Determinants of Microcomputer Usage Via a Structural Equation Model". *Journal of Management Information Systems*, Vol. 11, Number 4, 1995, pp. 87-116.
- [33] Kaul, A. and Rao, V., "Research for Product Positioning and Design Decisions: An Integrative Review". *International Journal of Research in Marketing*, Vol. 12, Number 4, 1995, pp. 293-320.
- [34] Klang, M., "*Disruptive Technology: Effects of Technology Regulation on Democracy*", Department of Applied Information Technology. Goteborg University, Goteborg, Sweden. 2006.
- [35] Lee, M., Cheung, C., and Chen, Z., "Understanding User Acceptance of Multimedia Messaging Services: An Empirical Study". *Journal of the American Society for Information Science and Technology*, Vol. 58, Number 13, 2007, pp. 2066-2077.
- [36] Lin, W. and Shai, B., "The Business Value of Information Technology and Inputs Substitution: The Productivity Paradox Revisited". *Decision Support Systems*, Vol. 42, Number 1, 2006, pp. 493-507.
- [37] Melville, N., Kraemer, K., and Gurbaxani, V., "Review: Information Technology and Organizational Performance: An Integrative Model of It Business Value". *MIS Quarterly*, Vol. 28, Number 2, 2004, pp. 283-322.
- [38] Moore, G., *Crossing the Chasm*. Harper Collins, NY, NY. 1991.
- [39] Moore, G. and Benbasat, I., "Development of an Instrument to Measure Perceptions of Adopting an Information Technology Innovation". *Information Systems Research*, Vol. 2, Number 3, 1991, pp. 1992-2220.
- [40] Murgatroyd, S., "Business, Education, and Business Education", in *Distance Education for Corporate and Military Training*, American Center for the Study of Distance Education: University Park, PA. 1992, pp. 50-63.
- [41] Oberlin, J., "The Financial Mythology of Information Technology". *CAUSE/EFFECT*, Vol. 19, Number 1, 1996, pp. 1-15.

- [42] Osei-Bryson, K. and Ko, M., "Exploring the Relationship between Information Technology Investments and Firm Performance Using Regression Splines Analysis". *Information & Management*, Vol. 42, Number 1, 2004, pp. 1-13.
- [43] Pavitt, K., "Sectoral Patterns of Technical Change Towards a Taxonomy and a Theory". *Research Policy*, Vol. 13, Number 1, 1984, pp. 343-373.
- [44] Reeves, R., *Reality in Advertising*. Alfred A. Knopf, New York. 1961.
- [45] Rehfeld, K., Rennings, K., and Ziegler, A., "Integrated Product Policy and Environmental Product Innovations: An Empirical Analysis". *Ecological Economics*, Vol. 61, Number 1, 2007, pp. 91-100.
- [46] Ries, A. and Trout, J., *Positioning: The Battle for Your Mind*. Barnes & Noble, NY, NY. 1986.
- [47] Rogers, E., *Diffusion of Innovations*. The Free Press, New York. 1962, 5th Ed. 2003.
- [48] Rosenberg, N., "Science, Invention and Economic Growth". *Economic Journal*, Vol. 84, Number 333, 1974, pp. 90-108.
- [49] Schmookler, J., *Invention and Economic Growth*, Cambridge, MA. 1966.
- [50] Solow, R., "We'd Better Watch Out", in *New York Times Book Review*. 1987, pp. 32-35.
- [51] Strassmann, P., "Foundations of Information Economics - Part 1". *Information Economics Journal*, Number March, 2004, pp. 15-18.
- [52] Strassmann, P., "Foundations of Information Economics - Part 2". *Information Economics Journal*, Number June 2004, pp. 50-51.
- [53] Strassmann, P., "Foundations of Information Economics - Part 3". *Information Economics Journal*, Number September 2004, pp. 14-17.
- [54] Treanor, C., *Impact of Communications Channels on Adopters' Perceptions of an Organizational Transformation*, College of Education. Georgia State University. 2002.
- [55] Triplett, J., "The Solow Productivity Paradox: What Do Computers Do to Productivity?". *Canadian Journal of Economics*, Vol. 32, Number 2, 1999, pp. 309-334.
- [56] Venkatesh, V. and Davis, F., "A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies". *Management Science*, Vol. 46, Number 2, 2000, pp. 186-204.
- [57] Vickery, S., et al., "The Performance Implications of Media Richness in a Business-to-Business Service Environment: Direct Versus Indirect Effects". *Management Science*, Vol. 50, Number 8, 2004, pp. 1106-1119.
- [58] Walsh, S., Kirchoff, A., and Newbert, S., "Differentiating Market Strategies for Disruptive Technologies". *IEEE Transactions on Engineering Management*, Vol. 49, Number 4, 2002, pp. 341-351.
- [59] Webster, J., Trevino, L., and Stein, E., "Personal Nature and Ambiguity as Sources of Message Equivocality: An Extension of Media Richness Theory", in *Proceeding of the 29th Annual Hawaii International Conference on System Sciences*. 1996, pp. 34-40.
- [60] Weick, K., "Educational Organizations as Loosely Coupled Systems". *Administration Science Quarterly*, Vol. 21, Number 1976, pp. 1-19.
- [61] Welsch, E., "Cautious Steps Ahead". *Online Learning*, Vol. 6, Number 1, 2002, pp. 20-24.
- [62] Yin, R., *Case Study Research Design and Methods (3rd Edition)*. Sage Publications Inc., Thousand Oaks, California. 2003.

AUTHOR BIOGRAPHY

Tanya McGill is an Associate Professor in the School of Engineering and Information Technology at Murdoch University in Western Australia. Her major research interests include technology adoption, e-learning, and information technology education. She is the author of over 100 journal articles, book chapters, and articles in conference proceedings. Her research has been published in various journals including *Behaviour and Information Technology*, *Decision Support Systems*, *Computers & Education*, *Journal of Computer Assisted Learning*, *ACM Transactions on Information and System Security*, *Journal of Computing in Higher Education*, and *Information Resources Management Journal*.

After many years of using multimedia to illustrate his technical IT systems in the resource sector, **Rodger Wright** formed a company to create and deliver multimedia OHSE inductions and training. In 2005, he sold his businesses and return to school to research the implementation and impact of multimedia training technology. He completed his PhD at Murdoch University in Western Australia in 2012. He currently holds the position of Senior Lecturer and IT Coordinator at ATMC/University of Ballarat in Melbourne, Victoria.