

RESEARCH ARTICLE

Global Communication Part 1: the use of Apparel CAD Technology

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Abstract

Trends needed for improved communication systems, through the development of future CAD applications, is a theme that has received attention due to its perceived benefits in improving global supply chain efficiencies. This paper discusses the developments of both 2D and 3D computer aided design capabilities, found within global fashion supply chain relationships and environments. Major characteristics identified within the data suggest that CAD/CAM technology appears to be improving; however, evidence also suggest a plateau effect, which is accrediting forced profits towards information technology manufactures, and arguably compromising the industry's competitive advantage. Nevertheless 2D CAD increases communication speed; whereas 3D human interaction technology is seen to be evolving slowly and questionably with limited success. The article discusses the findings and also presents the issues regarding human interaction; technology education; and individual communication enhancements using technology processes. These are still prevalent topics for the future developments of global strategy and cultural communication amalgamation.

Keywords: communication; computer aided design; culture; fashion; information technology; supply-chain.

1. Introduction

It is important to consider that the apparel industry is one of the most globalised industries worldwide, and that international sourcing has dramatically increased over the past two decades (Park & Stoel, 2005). However, this globalisation effect has caused many internal and external conflicts for the apparel industry in terms of social and ethical responsibilities; resource costs and political interventions; making buyer-supplier relationship vulnerable to problems unless effective strategic networks can be successfully engaged, managed, communicated and upheld (Park & Stoel, 2005).

In recent years the cultural differences, language barriers, geographical proximity and misunderstandings within such communications have made the supply chain unstable and, product development with regard to problem solving, is said to be arduous (Chen *et al*, 2007). The motivation tactics for improving competitive advantage within a market sector are cited as communication, trust and functional conflict, which are considered major imperatives to any form of organisational model (Parker *et al*, 2006). Subsequently, Chen *et al* (2007) additionally suggest that an emphasis on direct communication, personal liaison and the human factor, namely an individual's abilities and encompassed functionalities; all credit the performance of the relationships and communication efficiency, necessary to complete a product's lifecycle.

Significantly, Chase (1997) suggested that no organisational aspect within the fashion industry, can avoid the adoption of computer technology. Chase (1997) states that this is due to current computer technologies having the ability to enhance the communication speed, ease its flow, and simultaneously reduce costs involved in global product development. Concurrently, other aspects found within the research literature, suggested a need for further 2D and 3D computer aided design technology (CAD) investigation under the present climate of globalised clothing retail, garment manufacturing and information technology applications. With this in mind, this empirical study aims to identify communication issues and evaluate the degree to which CAD systems can be of assistance in the management of the apparel supply chain communications. Furthermore, the study critically evaluates, analyses, and identifies the interactive relationships of clothing industry practices, identifying the trends needed for improved communication through the development of future CAD applications.

2. Background

Jana *et al* (2007) stated that the definition of the supply chain is an amalgamation of synchronised global organisations, working towards a common network, within a diverse environment. Alternatively, it has also been advised that traditional functions of the apparel business structure have previously been aligned, so that manufacturers made products and retailers bought products. However, in today's global supply chain, this distinction is generating a more varied and complex environment (Park *et al*, 2005). In effect, the buyer-supplier relationship is now considered a type of corporate strategy and an influential tactic for improving retail sourcing activities (Tam *et al*, 2007). Considering this, retailers are now required to have value-adding partnerships to achieve the same end goals; therefore, interdependent collaborators are needed to communicate effectively with management and different organisational structures (Lau *et al*, 2005).

The current worldwide supply chain, therefore, has created an antagonistic environment and has forced organisations to become more aggressive in their approach; subsequently, this has created strategic networks for buyers to sustain their competitive advantage (Lau *et al*, 2005). Numerous sourcing strategies have the ability to adopt and include, multiple, single, local, offshore, global and in/out sourcing methods (Tam *et al*,

2007). Thus, it has been said that, to achieve any of these strategies successfully, further examination is needed into the communication of local buying offices, offshore offices and should include third party import agents and suppliers (Chen *et al*, 2007).

Other problem areas that have been identified by Chen *et al* (2007) refer directly towards the corruption of speed within the product development stages, and the issuing of correct technical specifications; the buyer's ability to convey their product needs correctly; the buyer's available time; sample making instructions and the inaccuracy seen within specification translations. Additionally, it should be noted that significant changes are impacting on current supply chain product lifecycle lengths. These include impulse buying, high volatility or low predictability of demand, and the consumer requests for originality and increased product variety (Christopher *et al*, 2004). In effect, a balance between consumer responsiveness, suitable margins, product longevity, supply chain manageability, communication development and quantity of order volumes; are all therefore, recognised desires for the industry and consumer progression (Doyle *et al*, 2006).

2.1 Apparel information technology

The majority of research indicates new technologies will potentially allow retailers to move further towards the just-in-time approach desired by the industry (Mastnak, 2008). However, regardless of current information technology developments, Jankle & Morton (1984) stated that, before computer technology should be adopted, the user should consider, why is it required?; what is it for?; and how well will the end result be produced? Consequently, technology and how well a human being can communicate their ideas through computer technology, should not be underestimated, nor ignored, as an effective communication method in today's complex retail environment (Jin, 2006; Beck, 2008; Jankle & Morton, 1984).

Information technology seen within the apparel sector is extensively recognised to improve performance; not only within the supply chain entirety, but to the individual members involved (Jin, 2005). Other studies undertaken by academics have revealed that a need for exemplary information technology systems which develop both products and relationships. These are required to convey necessary information and to improve the communication link (Birtwistle & Fiorito, 2003; Hayes & Jones, 2006). However, due to relationship types that exist between both parties, I.T. systems are said not to be fully realised at present (Birtwistle & Fiorito, 2003). Furthermore, suppliers seem reluctant to invest in systems that specific retailers use, as they are unsure as to the length of time that the relationship will continue and similarly, retailers are reluctant to share information with their extended networks in order to retain their negotiation power (Birtwistle & Fiorito, 2003; Parker *et al*, 2006; Hergeth, 2008).

2.2 Apparel 2D and 3D Computer aided design (CAD) and computer aided management (CAM) technology.

Due to this revolution in medium, CAD/CAM technology has been improved over the years to progress this phenomenon, and is significant with regard to its contribution to competitive advantage (Jin, 2005). In simple terms, Jankle & Morton (1984) have stated that CAD/CAM can be seen as being a complete version of two parts; including both the *model* for storing the image created; and the perceived *view* of the on-screen rendering; which may or may not be a realistic representation depending on the *model / view* used. Early adopters of 2D CAD/CAM models are companies, such as Adobe®, Lectra® and CorelDraw®, who are innovators and leading advocates of such 2D imagery producing technology (Steuer, 2006; Corel® Corporation, 1996; Beazley & Bond, 2003).

However, one disadvantage associated with CAD/CAM technology is the use of colour within the monitors used. Steuer (2006) points out that customer-level monitors currently display colours in red, green and blue lights (RGB), and therefore cannot replicate the cyan, magenta, yellow and black (CMYK) inks that are accustomed to paper printing. Adobe's suggested response to this problem, is noted as being a partial solution only, and considers the need for monitor calibration to meet the user's requirements (Steuer, 2006).

Concurrently, since the late 1990s, 3D imagery technology has been evolving, with notable progression in the gaming, TV and film sectors (Byron *et al*, 2006). These developments have far outstretched these arenas and are now seen within the apparel industry (Devlevan, 2007; Mastnak, 2008). In today's CAD/CAM market there are currently only a few early adopters offering this combined 3D and 2D CAD technology model. One of which is Browzwear®, who launched its product in 2004 (Devlevan, 2007). Established in 1999, and said to be currently used by 150 companies, Browzwear® is one of the newest 3D CAD visualisation technology solutions, which incorporates many new useful CAD/CAM features (Devlevan, 2007). However, this approach is still to be fully explored. Regardless of this, these forms of 3D simulation are suggested to be beneficial and needed increasingly to be used by the retailer, in order to develop shorter lead times; address fit concerns; reduce material costs; enhance e-retailing progression; and develop the communication issues arising from global supply chain processes (Devlevan, 2007; Mastnak, 2008).

3. Methodology

Due to the expected values aligned with communication engagement, no single organisation was targeted, or considered more relevant from which to gather data. Therefore, a triangulation of research orientations maintained the need for the analysis of individual supply chain employment sectors, rather than a singular company evaluation through a case study. Therefore, a design lead focus group, consisting of five members; and four corporate constructed semi-structured interviews were used as the methods of qualitative data collection.

Respondents from the clothing retailers covered a range of business organisations, including director and design employment levels found within; current successful global supermarket corporations; a highly regarded high street retailer; an Indian owned footwear supplier; and a high street fashion design freelance firm. All retail companies encountered, performed apparel production techniques in various locations; although China and India were considered to be their main manufacturing bases.

The supermarket retailers were considered '*lean and mean*' in their strategic approach, whereas the high street retailers regarded quality to be paramount in their global operational philosophy. Additionally, the footwear consultant's background was addressed, which had encountered prolific involvement in the buying and supply of footwear, to the value and high street market segments. Consequently, some respondents had benefited from lengthy careers which had covered all aspects of the global apparel trade, and over a period of significant technological development. In contrast, the focus group participants had more direct involvement in apparel technology developments over the past decade. Simultaneously, a former product data management (PDM) consultant was recruited for the study. The participant had previously dealt with the USA and European countries, and had experience of technology implementation strategies. Furthermore, a managing partner within an international digital marketing agency was interviewed, which allowed the synthesis of the in-depth current technology knowledge to be collected with transparency and triangulation in mind. The participant had extensive knowledge of digital marketing; and currently advises and promotes international global brands using online technology formatting. The focus

group consisting of five retail designers, from various apparel and other relevant organisations were interviewed simultaneously, in a secure closed environment for comfort of all participants.

Feasibility, time, practicality and resources were all complex issues for the research processes, and these issues were noted when writing up the results (Bryman, 2008). However, it should also be noted that although few radical outcomes were identified, the research approach remained consistent and systematic throughout, allowing the variable forms of beliefs, views and opinions to be gathered, and which were considered of great importance to the overall qualitative, cross-sectional, empirical research design.

Six sets of variables were identified with respect to the cause and effect relationships, found within the fashion retail and technology sectors (Bryman, 2008), and these were:

- Apparel retail management
- Apparel retail buying
- Apparel retail supply
- Retail design (using CAD)
- Retail digital marketing (using internet and TV outputs)
- Corporate Information technology (PDM)

These six sets of participant variables were aligned so that potential conflicting, and/or similar opinions could be extensively evaluated and analysed using post-coding techniques, to establish the predominant themes found within the data collection. The focus group and interviews extracted informed background information regarding, behaviour and experiences, opinions and values, interviewee feelings, knowledge on the subject, sensory information and demographical perceptions (Bryman, 2008). Subsequently, the focus group and interviews were arranged for between thirty minutes and one hour, although most exceeded this. Attempts were made to avoid extensive co-participant behaviour and non-intentional bias (Bryman, 2008). All interviews were semi-structured, and both interviews and the focus group were conducted in a location and at a time suited to the participants that was also acceptable to the interviewer. Results were audio tape recorded, and participant anonymity was protected ensuring that ethical issues were upheld. Respondents were unable to see the interview questions prior to commencement, although the general subject was addressed in a previous un-recorded conversation. Participants were told that their answers needed to cover the topics underpinning their professional and own opinions and beliefs on:

- Communication concerns and benefits
- Computer aided design (CAD)
- Computer aided management systems (CAM)
- Product data and lifecycle management systems (PDM) / (PLM)
- Information technology administration operating systems
- 2D & 3D CAD technology
- Internet sites and social networks
- Global supply chain management
- Buyer-supplier relationships
- Digital marketing
- Digital presentation techniques

In doing so, this prevented participants from conducting research or formulating precise answers prior to the event (Bryman, 2008). Therefore, the direct responses were

spontaneous, and based on the participants’ own experiences, opinions and beliefs within their professional backgrounds, rather than those considered or adopted through other means. Due to the small scale of interview data collection, and the diversity within the focus group, a less formal structure was devised in order to develop the constructed semi-structured interview questions (Bryman, 2008). Lists of questions were constructed for each individual participant, in anticipation that some interviewees would not have a deep understanding within certain subject areas, due to their specific professional experiences. The focus group was conducted after the individual interviews had taken place. Thus, a list of questions was constructed for them, to reflect the entire list of questions given respectively to each of the individual interviewee, enabling the development of an arrrogate set. Participant memories towards the development cycle of technology were important, thus, the triangulated data comparisons presented herein, suggests indications of a clearer picture, of past and present behaviour towards communication technology development, found within the apparel retail and supply sector.

4. Results

The results identify current clothing industry business relationships, communication concerns, external phenomena and inherent cultural issues, with the consideration of adversarial implications on company performance. The following responses seen in Table 1 and Table 2 were noted as being the top five issues concerning the product development process:

Recorded issues of perceived importance	(Focus Group Participant Code) Recorded perceived importance values					TOTAL VALUES in rank order of most significant	
	(G1P1)	(G1P2)	(G1P3)	(G1P4)	(G1P5)		
SPEED	1 st	3 rd	3 rd	3 rd	3 rd	5	1 st
LANGUAGE		1 st	2 nd	1 st		3	1 st
TIME ZONES			1 st	2 nd		2	2 nd
CRITICAL PATHS	2 nd				2 nd	2	2 nd
PEOPLES PRIORITIES					1 st	1	3 rd
SPECIFICATIONS		2 nd				1	3 rd
TECHNOLOGY	3 rd					1	3 rd

(Table 1)

Perceived Importance Ranking Order	(Interview Participant Code) - Recorded Responses			
	(I1P1)	(I2P1)	(I3P1)	(I4P1)
1 st	MISINTERPRETATION	LACK OF INFORMATION	TRUST	MISUNDERSTANDINGS
2 nd	SPEED	MISUNDERSTANDINGS	LONGEVITY	TIMING
3 rd	EXPECTATIONS	MISINTERPRETATIONS	RESISTANCE	LEVEL OF DETAIL

(Table 2)

It should be noted in Table 2 that the design lead focus group agreed on the top five issues, but disagreed with the order of the most significant. Therefore, Table 2 indicates the mode rank order; *speed* of information and *speed* user handling, were considered the most important issues as some key design processes are seen to be configured centrally. However, *distance* and *language* in Table 2 seem to be of concern in maintaining effective

communication. From Table 1 the frequency coding analysis, finds significant issues arising from a variety of different processes; which concern product development which is evident under the numerous guises and industry procedures. However, adverse effects concluded from the interviews, suggest *misunderstandings*, *speed*, *costs* and different information *interpretations*, still appeared to be the main adverse affects on product development, for all participants involved. Furthermore, seen in Table 1, it is worth noting that I1P1 and I2P1 were apparel industry management professionals; and that I3P1 and I4P1 were technology management experts. Table 1 shows the significant disproportion of issues, that each sample set, considered most important within the product development process.

Evident in Table 3 and Table 4: the main adverse issues that occur most frequently within the product development processes were thought to be, misinterpretations, misunderstandings, trust, lack of information, speed and language barriers.

Recorded issues of perceived importance	(Focus Group Participant Code) - Recorded perceived importance value					TOTAL VALUES in rank order of most perceived significance	
	(G1P1)	(G1P2)	(G1P3)	(G1P4)	(G1P5)		
COSTS	1 st	1 st	1 st	1 st	3 rd	7	1 st
TIME	3 rd	2 nd	2 nd	2 nd	2 nd	11	2 nd
DESIGN	4 th	3 rd	4 th	3 rd	1 st	15	3 rd
COMMUNICATION	5 th	4 th	3 rd	4 th	4 th	20	4 th
SOURCING	2 nd	5 th	5 th	5 th	5 th	22	5 th

(Table 3)

Perceived Importance Ranking Order	(Interview Participant Code) - Recorded Responses			
	(I1P1)	(I2P1)	(I3P1)	(I4P1)
1 st	SPEED	CORRECT PRODUCTS	SPEED	TECHNOLOGY UNDERSTANDING
2 nd	INACCURACY	COMMUNICATION	CONSUMER DEVELOPMENT	TRANSPARENCY
3 rd	MISUNDERSTANDINGS	INTERPRETATION	RELUCTANT CONTROL	PRODUCT UNDERSTANDING
4 th	COSTS	MISUNDERSTANDINGS	CONCEPT VARIETY	CONSUMER NEEDS
5 th	INTERPRETATION	COSTS	UP-TO-DATE TECHNOLOGY	REDUCED WASTE

(Table 4)

In Table 3 the frequency coding analysis shows *misunderstandings* and *misinterpretations* to be the main adverse effect on communication. This signifies that the product development process itself relies heavily on effective communication handling. The design lead focus group however, felt unable to agree on a top three issues; therefore in Table 4 several issues were shown in the coding analysis and in numerical order revealing the issues that each participant felt were the most common adverse effects on their own communication. The rank order is shown by the value order of the most frequently occurring response.

Significantly, the data suggested that all participants strongly agreed that there were *cultural misunderstandings*, although the occurred to differing degrees. Interestingly, the term *cultural* was interpreted by participants in a variety of ways, which suggests that communication is very subjective in its own standardised forms. Nevertheless, *culture* was seen as an issue of concern for all. Interestingly, all participants agreed that language was not a current issue in India. However, for Chinese and Far Eastern countries, language translation had an influence over the effectiveness of the supply chain processes; with the main concerns being that of misunderstandings, and being based around distinguishable cultural differences. Enhanced education processes were suggested as a solution for improving technical

communication. Nevertheless, the general feeling was that human error and cultural differences are currently the main global communication downfalls.

Observed was a drive towards strengthening existing relationships; trust seemed to be an issue for all respondents, along with a concern for how professional relationship practices were conducted. However, the underlying factors suggested that relationships were more important than technology usage, though technology was still noted as being able to speeding up the relationship processes.

4.1 Apparel 2D and 3D technology

Under the investigation into current CAD technologies and 3D technology within the retail and manufacture sector, which have recognition in the globalised market place, the following responses were most significant. Interestingly the participants didn't feel that CAD/CAM technology is used to promote added competence and competitive advantage. The responses seem to signify that *user handling* and *cost implications* are the main factors which allow technology to become truly competitive. Most participants from the interviews suggested; if neither is fully considered by the obtaining party, then little competence can be achieved by the user or company adopter. Rather than suggesting specific packages that embedded a competitive advantage strategy, respondents considered that a computer is a platform in which to operate processes. Furthermore, there were indications about technology improvements, in particular to the speed of communication over a period of time, and specifically suggested that the benefits adhered to the quality of the communication technology.

A summary of similar questions posed to the focus group, generating responses representing numerous view points, and these considered the factors affecting the communication speed within the design field. CAD/CAM technology was considered to give competitive advantage and added competence, although it was noted as only doing so if the correct technology was used, and if the costs and the length of user-times were considered. Interestingly, one view was very much in line with the "*Garbage in Garbage out*" (GIGO) theory, (Pountain, 2001) and provides a reminder that technology can only be as effective as its user and organisational context. For the design led focus group, technology was seen as a place to interact, whilst simultaneously reducing the interaction time within relationship and administration cycles. As expected, both the buyers of such technology, and the creators, had open views on CAD/CAM improvements, whereas the other participants felt unable to answer those questions or had sufficient knowledge on the subject. *Time* and *speed* considerations were noted in participants' reactions, which is a significant view on the overall perceived ability and benefits of such technology utilisation.

Interestingly, seen as the best use for a 3D computer concept, the buyer of such technology had a very different point of view to the previous creator of similar technology. This is significant due to an imbalance of opinion and exaggerates the difficulties in technology development and understanding. Nevertheless, the thoughts on 3D technology by most, is that the gaming sectors are progressing the 3D Avatar quicker than the clothing industry. 3D technology was seen as not being a new concept, although was identified as being potentially essential in today's design arena. Furthermore, the participants expressed that 3D technology would be best suited to the marketing and promotional aspects of business strategy, rather than in the design stages, and this is due to product selection and garment realisation issues. All of the respondents agreed to disagree on the usefulness and effectiveness of in-house administrative, managerial and company organisational systems and therefore, each system can be described as only being of use if it is seen in that manner by the user. In addressing what was considered the most successful information technology

packages, as anticipated, the technology experts considered the pros and cons of packages rather than identifying specifics; suggesting a notion that technology consequently gives individual supply chain components competitive advantage.

With respect to the issues aligned to the benefits of connecting retail and supplier CAD/CAM systems, suppliers seemed to advocate the technology connection, whereas the retail director was concerned with security and of intellectual property issues. In contrast, the technology experts suggested that the success of this technology connectivity, would only be truly possible if all parties opened up their data; this touches on intellectual property, competitive advantage issues and the acceptable functional conflict that is already seen in the business sector. Interestingly, the computer systems that were currently used by the participants had no real effectiveness when it came to updating organisational contact details. This seemed to hinder the user's ability to communicate, and created opportunities for poor connectivity with internal and external contact sources.

Conclusively, the comparison between the primary and secondary data collected, within the focused literature review suggested that the following issues are found to be relevant for the technological development, success and longevity of future software applications. Thus there is a need for further evaluation and research understanding of:

- Language configurations
- Cultural amalgamation
- Relevant technology platforms
- Relevant technology models / views
- Dimensional interaction levels (2D and 3D)
- Iconography simplicity
- Interactive performance levels
- Human competence factor
- Visual sense factor
- Audio and oral sense factor
- Kinaesthetic sense factor
- Consumer acceptance
- Consumer trust and security
- Consumer loyalty

5. Conclusions

The findings gathered in this paper were established through the analysis of interactive clothing industry relationship practices and within global retail environments. Furthermore, an examination of current communication concerns, inherent cultural issues, and adversarial implications of company performance has also, included issues such as 2D and 3D CAD technologies, effective operating systems, presentation techniques, imagery, and sustainable consumer handling of current technologies. Therefore, the results give an indication of the practice theory and the trends needed for improved communication through the development of future CAD applications.

Prominent issues regarding misunderstandings and misinterpretation signifies that supply chain communication could be driving the retailers' needs to reduce supplier portfolios, conduct performance reviews and regain power over a trustworthy supply base (Tam *et al*, 2007). An increased relationship lifecycle through performance reviews will

inevitably allow communication management to remain essential to global industry advancement. Hence, the communication of design specifications has become of great importance to future supply chain management strategies. Connectivity software has achieved some small notable developments, yet has received little attention in its advancement. Suggestions that this may be due to inadequate supporting infrastructures and unavailable information storage space were observed by all interview and focus group participants'. Nevertheless, companies are still reluctant to combine and opening up information technology systems between suppliers and retailers (Birtwistle & Fiorito, 2003). Their main concerns are based on information sharing and inbuilt security, although many still question the actual capability of such a system.

Mastnak (2008) proposed the view that technology had advanced at an explosive rate during the last two decades. However, computer graphical outputs over the last decade have allowed for reflection on recent technological advancement (Jankle & Morton, 1984). Therefore, it can be said that, whilst during the last decade, advancement in gaming technology has progressed at an explosive rate mainly due to the 3D interactive nature of 3D information technologies; the fashion industry has resisted the full adoption of such technology. This is because 3D CAD/CAM technology usage is still not seen as being effective enough for retailer and supplier end use. Nevertheless, retailers and suppliers are currently equipped with numerous competent 2D CAD/CAM design software capabilities, such as Adobe®, CorelDraw® and Lectra® systems, which encourage designers to consider that 3D technology interaction is only useful in the marketing or design selling stages of a products lifecycle. Respondents suggested that the current CAD packages available are effective enough for 2D design realisation and specification use, whilst identifying the inherent technology need for user competence. Further data collected suggests that senior management and design levels agree that 3D CAD would be irrelevant in the designing and selection processes. Highlighting the kinaesthetic inabilities, this addresses the concerns of actual garment / product removal and pre-consumer selection assessments.

However, senior management levels noted that 3D technology could be useful for the technologist, and for education and problem solving exercises. The development of both this technology arena and of realistic imagery has mainly been due to advancements in the operating computer hardware components, and the subsequent software developments, rather than through individual user performance capabilities. Notably, individual performance in creating life-like 3D images with 2D CAD systems has been prevalent since the 1980s (Byron *et al.*, 2006), and has existed profusely with some recognised success. Consequently, the most noticeable advancements have been within computer hardware component technology developments, including screen resolution, printability, storage capacity and colour appearance. Niche programming and software developments have certainly evolved over time, although their main attribute is the ability to enable the encouragement of mass market usability and the increase of information technology company profits. Therefore, further research into improving mass market hardware technology is necessary for software development.

Information technology systems were considered to be the result of a move towards a paperless office, which was a suggested corporate move in the 1990's by Beazley & Bond, (2003). However, nearly twenty years later, primary data evidence still shows that some of the major retailers are struggling to achieve this transition to a paperless office. Therefore, this suggests three possibilities; either the information technology still has not allowed the successful changeover; that the office culture still does not want to release complete control of operations to individual information technology systems; or, as more information is becoming available and printers are becoming more capable, it is all too easy to push the

print button. Either way, progression is still necessary in both information technology developments and office culture, due to the UK Government's drive towards a greener environment, which ultimately requires less avoidable paper waste.

Nevertheless, it can be said that, technology development is based around technology capabilities, consumer acceptance and ease of integration, cultural interactions and organisational usage; with human information technology performance being the key to any technological success. However, communication misunderstandings will always occur, and as such, how best to overcome simple human errors are still a concern for organisations and subsequently also for educational bodies. However, technology can improve information sharing and thus, education, allowing many to suggest that culture and society also have to evolve concurrently. Either way, culture and technology progression are aligned, advocating that only through the correct use, refined educational techniques, and effective research and development strategies, can progress the variable contributing success factors progress. The research finds that current information technology systems do not fully cater for the needs of apparel retailers and suppliers; this highlights the need for further investigation to identify the issues necessary to develop a suitable singular modus operandi platform to improve the communication flow, reduce the language barriers, address the relationship structures and the misunderstandings experienced within the industry. 2D CAD applications have achieved an exceptional level of advancement over the past five years, whereby current design imagery has produced a photographic quality, which is now accessible to the mass market, even though it is still seen as expensive for business implementation. 2D CAD is seen to give a heightened competitive advantage for the period in which the technology is new; however, due to regular software upgrades, problems arise with compatible information sharing and thus, competitive advantage is compromised for the catch up period. Regardless of this, competitive advantage in such systems allows for increased design process speeds and is increasingly becoming an effective visual communication method. Additionally, technology development encompasses technology capabilities, cultural interactions and organisational usage, with human information technology performance being the key to any technological success. Technology adopters should therefore, maintain the need for individual specific software and consistently, identify the individual technological needs within their organisation, and apply competent users to handle relevant systems.

The conclusion for this research has similarities with much previous research, which helps to validate the reading of the data collected. Alternative readings from previous academics may therefore, be due to vested interest in specific technology developments. The research suggests that if business relationships are to become stronger, communication technologies need to adopt collaborative strategies. Data regarding organisational contact information suggests that retailers' and suppliers' do not update this area and therefore, are hindering their own collaborative performance within informational technology and business relationship functions. However, businesses are found to have numerous programs to undertake suitable individual business functions, on a simple, required level; and therefore, are currently seen as being effective in their undertaking of these specific information technology business functions. Technology is identified as being, and should be, organisation specific. This highlights the essential nature of an employee's abilities to command a variety of software packages competently to achieve corporate diversity.

As a result, further research and CAD application developments should aim to accommodate issues surrounding multiple software package connectivity, the promotion of simple 3D interactive gaming-type communication platforms; and develop a system that decreases misunderstandings through increased speed of information finding. Therefore, competent user handling and perceived user requirement still remains paramount to

information technology success. Thus, information technology systems that can ease consumer adoption, through simplification strategies will consistently be considered for an appropriate end use. All being said, how best to achieve the mass cultural adoption of CAD technologies, on an increasingly growing global scale, remains yet to be fully understood in any aggregated depth. *Global Communication Part 2: The use of Apparel PDM Technology*; will continue the theme and discuss the research findings, in accordance with the current views, on product data management systems and their communication effectiveness, found within global supply chain processes.

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References

- Beazley, A. and Bond, T., 2003. *Computer-Aided Pattern Design & Product Development*. 1st ed. Manchester, England: Blackwell Publishing.
- Beck, B., 2004. Key Strategic Issues in Online Apparel Retailing – The Need for an Online Fitting Solution [online], available from http://www.TUKATECH_Techexchange.com [Accessed 13 November 2004].
- Birtwistle, G.S.N. and Fiorito, S.S., 2003. Quick Response: perceptions of UK fashion retailers, *International Journal of Retail & Distribution Management*, 31 (2), 118-120, 122 & 127.
- Bryon, S. and Curran, S. and McCarthy, D., 2006. *Game On! From Pong to Oblivion – The 50 Greatest video games of all time*. London: Headline Publishing Group.
- Bryman, A., 2008. *Social Research Methods*. 3rd ed. New York: Oxford University Press Inc.
- Chase, R.W., 1997. *CAD for Fashion Designers*. UK: Prentice-Hall, Inc.
- Chen, Z. and Murray, R. and Jones, R.M., 2007. Fashion supply chain organisation and management between the UK and China. *Journal of Fashion Marketing and Management*, 11 (3), 380-397
- Christopher, M. and Lowson, R.H. and Peck, H., 2004. Creating agile supply chains in the fashion industry. *International Journal of Retail & Distribution Management*, 32 (8), 272 & 279
- Corel® Corporation, 1996. *CoreDRAW! Suite 6 for Power Macintosh*. America: Corel Corporation.
- Delevan, J., 2007. e-Fitting [online], available from http://www.TUKATECH_Techexchange.com [Accessed 12 June 2008].
- Doyle, A., 2006. Supplier Management in fast moving fashion retailing. *Journal of Fashion Marketing and Management*, 10 (3), 277.
- Hayes, S.G. and Jones, N., 2006. Fast Fashion: a financial snapshot. *Journal of Fashion Marketing and Management*, 10 (3), 284 & 285.
- Hergeth, H., 2008. The business of fashion visualizing the financial and competitive situation of fashion companies. *Journal of the Textile Institute*, 99 (2), 145.
- Jana, P. and Prof. Narag, A.S. and Dr. Knox, A., 2007. Measuring Efficiency of a Supply Chain [online], available from http://www.TUKATECH_Techexchange.com [Accessed 16 June 2008].

- Jankle, A. and Morton, R., 1984. *Creative Computer Graphics*. 1st ed. Ipswich, Great Britain: Book Club Associates By arrangement with Cambridge University Press.
- Jin, B., 2005. Global sourcing verses domestic sourcing: Implementation of technology, competitive advantage and performance. *Journal of the Textile Institute*, 96 (5), 278 & 284.
- Lau, M.M. and Moon K.L. and Zhang, Z.M. and To, K.M.C., 2005. The antecedents of successful buyer-supplier relationships in strategic networks of the Hong Kong clothing industry. *Journal of the Textile Institute*. 96 (5), 329-337.
- Mastnak, R., 2008. 3D Scanning and the Apparel Industry in North America – A New Business Paradigm [online], available from http://www.Style Estate Inc_Techexchange.com [Accessed 13 November 2008].
- Park, H. and Stoel, L., 2005. A model of socially responsible buying/sourcing decision-making processes. *International Journal of Retail & Distribution Management*, 33 (4), 235-237, 243-245.
- Parker, M. and Bridson, K. and Evans, J., 2006. Motivations for developing direct trade relationships. *International Journal of Retail & Distribution Management*, 34 (2), 121-124, 126-132.
- Pountain, D., 2001. *Dictionary of Computing – An A-Z of computer jargon and concepts*. London: Penguin Books Limited ©.
- Steuer, S., 2006. *The Adobe Illustrator CS2 WOW! Book, tips tricks and techniques from 100 top illustrator artists*. Berkeley, CA: Peachpit Press.
- Tam, F.Y. and Moon, K.L. and Ng, S.F. and Hui, C.L.C.L., 2007. Production sourcing strategies and buyer-supplier relationships: A study of the differences between small and large enterprises in the Hong Kong clothing industry. *Journal of Fashion Marketing and Management*, 11 (2), 297-302 & 304.