Solutions to Problems Encountered During the Adoption and Management of New Colour Measuring and Control Technology in the Textile Industry

by

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Contents

SYNOPSIS

This research identifies the key factors involved in the successful adoption of a computerised match prediction system in the textile industry. The adoption of this technology has created big problems for many companies and few have succeeded without difficulty.

Five companies adopting the technology were investigated to identify common problem areas. These areas were compared with the results of a literature review. A case study format was used to study in greater detail two companies in the carpet industry regarding their adoption of this system. One company was remarkably successful whilst the other company succeeded after much delay and difficulty.

The literature relating to technological change and its effects on employees indicates the problems involve management, environmental, technical and social factors. Hence four research questions concerning prescriptive and contextual factors are tested by case study research and a cultural survey of all involved at both sites. Factors like the importance of strategy, management support and training are examined. The impact of culture, management style and fear of change are closely investigated.

The results, whilst not conclusive, do give a good indication of the areas for special attention and the key factors, should the adoption of a computerised match prediction system be contemplated. The key factors form the basis of the conclusions that training, management support and the presence of a knowledgeable champion to drive the implementation were crucial whereas there was very little evidence of fear of the technology. Culture and management style were found to have an impact in so far as they direct the companies' approach to adopting the technology and influence how decisions are made and problems solved.

INTRODUCTORY SECTION

Introduction

The business environment today is very competitive in many areas. This is particularly true in the textile industry in Australia where a previously well protected sector must restructure and modernise rapidly in order to protect their home market share and expand into the world export market or else downsize significantly. To have any hope of realising these goals the industry must develop successful strategies in key areas of its business, ie. marketing, research and development and manufacturing.

This thesis looks at colouration, a very important and costly area of manufacture in textiles. Colouration is a key factor in the production of all textile products due to the importance of colour in the eyes of the customer. Hence the management and control of colour is a vital consideration in the production of most textiles. This research investigates a computerised measuring system that changes colour management from a subjective visual expertise to a rigorous scientific measurement. This study closely examines the adoption of such a technology in two Australian carpet manufacturers.

As companies focus their operations they are increasingly looking to new technology as part of their manufacturing strategy to increase their competitiveness (Kirk 1994). The main strategic implication of acquiring this technology is its ability to cut costs, reduce lead times and facilitate quality and quality assurance. The achievement of these goals will create greater competitiveness in the market. It is imperative for industry to choose the right technology and to carefully manage its adoption and implementation to ensure optimal use in order to reap the strategic benefits. Whilst this technology is largely a manufacturing aid it also helps research and development, marketing and effluent control.

The decision to adopt new technology and the factors affecting its optimal use are often very complex. Because new technology is often very expensive it is importrant to use it successfully. Its use must also be mastered in a reasonable period to be cost effective and to fulfil its other strategic objectives. In today's world economy the successful companies are those that can rapidly absorb new technologies (Gilmour and Hunt 1993). Impacts of the new technology must be appreciated in order to avoid the pitfalls that usually exist and achieve the projected benefits. These pitfalls are related to peoples' perceptions of the technology and the need for it, the impact on the organisation and the people, the readiness of the organisation to change and the approach of management to this change.

The traditional view of new technology replacing an old link in the chain of production must be avoided because it restricts the potential of the new technology and encourages a control mentality on the part of management. Available literature demonstrates that the adoption of significant new technology is less promising if this approach predominates, particularly in a competitive market.

This research confirms that the management of new technology is just as important as selection of the appropriate technology. Whilst outright failure is not common, the full potential of a new technology is rarely realised without appropriate strategic planning management and employee support and the presence of innovative processes and climate. The above view is well supported by this research and suboptimal use is fairly widespread with this particular technology.

In order to ensure that all key areas are included in the investigation and to select two suitable companies for close examination, five organisations are initially researched briefly. The results of this preliminary investigation are also used to support conclusions and recommendations (refer Appendix IX) arrived at from the main research undertaken at Brintons Carpets and Godfrey Hirst, both located in Geelong.

Because of the traditional profile of this industry and the importance of factors like management style and culture, a historical and environmental (business) background is provided in the introductory section. A description of the technology is also included in order to appreciate its key impacts - hence the technology profile.

Technology Profile - Background and Description

The technology implementation that is being investigated is a colour measurement and match prediction system. The system has the ability to scientifically measure any standard substrate (eg. fabric, carpet, plastic, etc) or liquid and then prescribe the required additions or alterations of dye to the raw material in order to match the colour of this standard. It is used largely in textile applications but is also successfully used in paper, paint, motor spraying and any other application where colour control is deemed important.

The system was developed as an objective scientific method of measuring colours which improves on the subjective visual approach which was practised for so long. The system measures reflected light rays by using a spectrophotometer and these measurements are mathematically converted by a computer using several equations to arrive at a reliable measuring unit.

The equations themselves are derived from studies of thousands of expert colour matchers observing numerous colour charts in all colours and registering their opinions in order to establish a consensus of measurement. This consensus forms the basis of the whole system.

This technology eliminates or helps resolve the following problems:

1. disagreements between experts on the suitability or closeness of a colour match to a standard;
2. inability to standardise measures (opinions) important in the case of quality assurance schemes and commercial conflicts;
3. colour variations under different lights;
4. customer claims;
5. expert colour matchers monopoly subjective control of colour match discrimination;
6. delays in product development;
7. delays in accurate price quotations;
8. optimal selection of dyes from thousands of products - reduction of stock;
9. measurement of effluent liquors and recycling of dye liquors.

The system has the capacity to do and has achieved all of these things with varying success on different substrates. Even on the most difficult substrates success has been achieved but it requires great precision and consistency in application. In the case of sculptured pile fabrics, eg. carpets, the most scientific presentation of substrate is necessary to give an adequate degree of accuracy. This technology can communicate with an MRP system or CAD/CAM technology but this option is rarely used (refer Profile of Usage Charts Appendix II and Appendix IV).

This technology's objective control of colour allows marketing people to promote products with confidence and to liaise with manufacturing more effectively. It is widely used even by small companies and research has shown that whilst some progressive companies have widely adopted it, very many use it only as a tool in a few applications within a single department. With the increasing demand in the shorter product run contract end of the market and the pressures on quality, lead times and competitiveness, the benefits of this technology are becoming clearer each year. Retail giants such as Target, Marks & Spencers are increasingly demanding higher standards and will deal exclusively with suppliers whose products achieve scientific specifications as measured by this technology. Because some textile industry users show a strong negative reaction towards the introduction of this technology, the causes of this reaction and its best preventative measures are investigated in this research.

Points of Clarification

1. Computerised colour matching technology is difficult to master because it requires much effort, commitment and exactitude from users.

2. It can be viewed as a threat to the status and importance of skilled professionals who protect their area of expertise.

3. It gives a new control tool to top management in an area where they previously were ill equipped and lacking in power.

4. Colour matching technology has been overwhelmingly accepted by quality assurance personnel who previously had to contend with subjective rather than scientific measurement.

5. Generally, it is strongly marketed to Chief Executives as the answer to their colour problems - this has in many cases created a very high expectation.

6. This technology is now universally accepted as the best practice method for the measurement of colour and 85% of the market is serviced by one conglomerate world leader, ie. Data Colour (Whyte 1991). This ensures that selection of technology type is almost uniform and management of its adoption is the main key to its optimal use.

The Carpet Industry in Australia

Carpet manufacture is a major part of the Australian textile industry. It has remained largely in private ownership. It is characterised by traditional management structures and style and has only lately signalled major change in that regard. Due to ample tariff protection there has been no great motivation for major change. From the early seventies the industry increasingly invested in new technology and succeeded in reducing its profile as a very labour intensive industry. While today it is still a relatively labour intensive industry, those companies that succeeded in adopting new technology have achieved great efficiency in their use of labour. The business realities are as follows:

Basic Facts

There are basically three types of carpets manufactured in Australia, woven, tufted and carpet tiles. These supply two end user markets, residential (75%) and contract (25%). Tufted production represents 92% by volume of the total market whilst woven or carpet tiles share the balance (Fox I 1994). Total retail point of sale value of the Australian carpet market is estimated to be $1.4billion (Fox 1994). The impact of imports, 12% by volume is small largely due to tariffs policy.

Industry Policy - Tariffs

Historically the carpet industry has been well protected from outside competition through tariff policy. Government statements in 1988 and 1991 signalled the end of protection for the carpet industry. Carpet tariff protection will be reduced to 15% by the year 2000. Currently Australia imports about 12% of its end use carpet. This is set to rise to about 20% by the year 2000 with the reduction in tariffs (Fox I 1994).

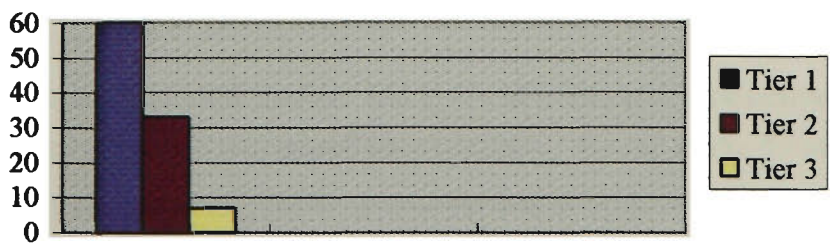
Australia currently (1993) exports 5.3% of its production value. The encouraging sign is that exports have risen by 20% over the past 3-4 years. This growth has been strongly contributed to by both Godfrey Hirst and Brintons. The main focus has been the contract market in Asia. The minimum performance of exports is expected to be circa 15% of value by the turn of the century.

Structure

Tariff realities, overcapacity, recession, low profitability, the interest of a large international manufacturer and government assistance towards orderly restructure all combined to convince the industry that the time for major restructure had arrived. The main result was that the four large players were reduced to two equally sized, more competitive organisations employing over 2000 employees. The resultant structure is illustrated below.

Structure of Australian Carpet Industry

% of market share



Tier 1	2 large companies - 60%
Tier 2	17 medium companies - 33%
Tier 3	25 small companies - 7%

Tier 1 is equally shared by Godfrey Hirst and the new American player, Shaws Carpets which is the world's largest carpet producer. Brintons Carpets occupy Tier 2 with 16 other medium sized companies. Their interest in 1994 represents 11% of the total manufacturing value of the Australian industry.

Godfrey Hirst Profile

Historical (Refer Appendix I)

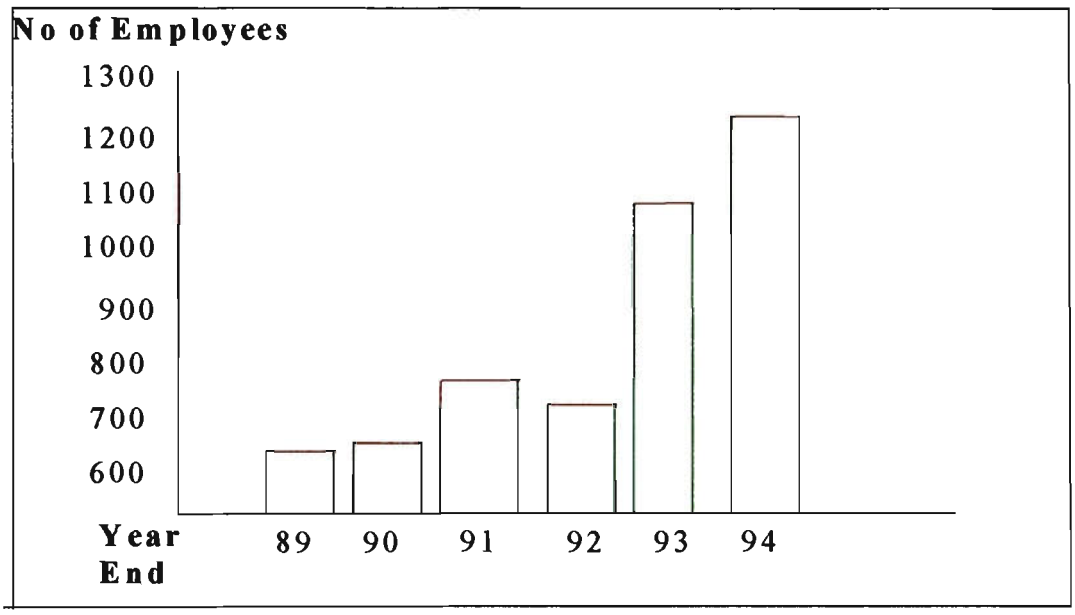
Godfrey Hirst was born, the son of a spinner, in Meltham England in 1857. A fugitive from the English climate he arrived in Australia in 1885 hoping to make a better life in Australia's healthier climate. Unhappy with the low standards of manufacturing in the Geelong textile industry he started his own weaving business. This culminated in 1895 in the purchase of the Barwon Woollen Mills followed in 1899 with the purchase of Victoria's oldest mill - the Victorian Woollen Mills. Godfrey concentrated on producing fabrics of very high quality and succeeded with this philosophy whilst others failed. Godfrey created a family atmosphere in his factories where concern for his workers' welfare and quality of product dominated the environment. This easy going family atmosphere survived long after his death in 1917, right up to the arrival of the second entrepreneur George McKendrick in 1966.

George McKendrick turned Godfrey Hirst upside down. Within a short few years he changed the product from cloth to carpet, created a proactive vital culture, removed buildings, purchased modern new machinery and generally transformed Godfrey Hirst into a commercial vehicle more suited to survival in the modern era. Sadly much of the family atmosphere had to be sacrificed along with many old hands who could not cope with the approach. Many employees were not motivated by the new dynamic climate and they adopted a passive role which still lingers on today. The last member of the Godfrey Hirst family severed his family's connection in 1970 (De Fries 1992).

Buoyed by a rapidly expanding local market and more efficient and productive manufacturing techniques the company grew and prospered spectacularly. It was at the forefront of carpet technology and developed a state-of-the-art computerised continuous dyeing plant - TITAN in 1973.

The world's biggest textile organisations purchased this technology which was followed in 1992 by the development of a revolutionary tufting technique which reduces raw material input dramatically. This technology has since been purchased by a large Japanese engineering company.

The new Godfrey Hirst, just like the original company, is driven by the persona of the owner. His very close involvement has shaped the organisation exactly as he wants it. Customer service is paramount and nothing gets in its way. Flexibility and growth are the means to this end and the company's profile and performance reflect this. The company services all sections of the market with an extremely flexible manufacturing structure which is the envy of its competitors. Its growth recently has been very impressive.



Godfrey Hirst Growth 1989 - 1994

The company is rapidly adopting a best practice approach towards quality, manufacturing and its workforce. This new approach is some comfort to those who feared that the retirement of its energetic owner in the future may expose the company to a damaging leadership vacuum.

In 1993/94 the whole Australian carpet industry was restructured with Godfrey Hirst sharing the leadership with the large American international company, Shaws Carpets. Each now holds about 30% market share. Godfrey Hirst's prosperity seems assured, particularly if it learns to prosper with less reliance on its owner.

Management Style

The owner of Godfrey Hirst is directly involved in the day to day running of the company. In spite of the size of the company and the presence of a dedicated professional management team, his personality and authority pervades the whole operation. His successful entrepreneurial approach lends much weight to the decisions he regularly makes.

These decisions often complicate the strategies employed by his management team and result in a certain fluidity in long term plans and initiatives. This has led to an expectation that plans can easily and often be changed. This approach has spawned a very flexible attitude by all at Godfrey Hirst. This flexibility typifies Godfrey Hirst's approach to customer service and has proved to be a main plank in the success of the company's manufacturing strategy. Whilst the management style is fairly autocratic, it is not a very regulated plant and access to information is restricted. The fact that the main plant under research is poorly integrated and very departmentalised proved to be an obstruction to the latest best practice approach mandated by management. This departmentalised approach is very much reflected by middle management's traditional narrow focus.

Up to recently there was not a great deal of encouragement to the workforce to be involved in committees etc. Good communication has not been widely practiced or workforce input sought. This management climate prevailed at Godfrey Hirst when computerised match prediction technology was first adopted. This traditional style of management is changing now and is demonstrated by a very recent management drive to increase organisation knowledge, integrate departments and educate the workforce particularly supervisors both formally and informally.

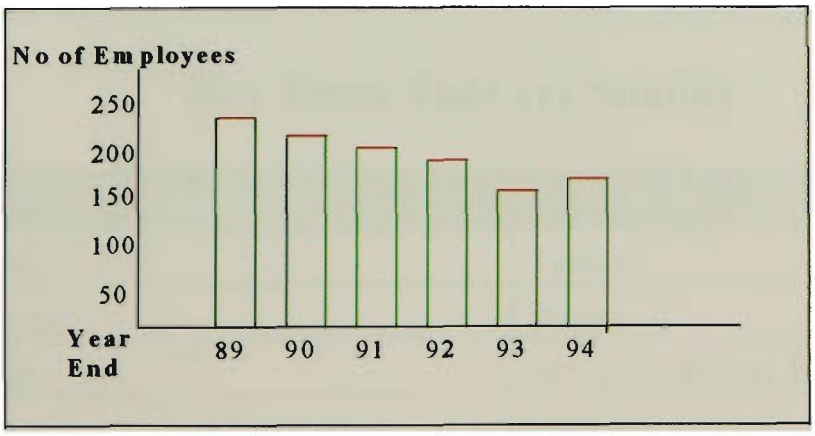
The company has acquired accreditation to AS3901 and is currently implementing TQM and driving a major safety awareness programme. This accreditation has been achieved in the remarkably short period of 13 months. Given the recent changes in this company (particularly its growth) this achievement augurs well for its future success and its ability to manage change. A newsletter is now regularly circulated. The demands of this new approach are putting pressure on the old style of management and will require change on the part of all including the owner. With the advent of the modern competitive environment, relaxation of the autocratic management style needs to be accelerated in order to release the shackles on contribution and cope with the new climate.

Brintons Company Profile

Historical - Refer Appendix III)

This proud family owned carpet company can trace its origins back to the end of the 14th century in Kidderminster, England. The strategies for consolidation of small size, family atmosphere and concentration on the top end of the market have paid off handsomely for this company in terms of quality, reputation and its phenomenal longevity. This century it has concentrated solely on carpet manufacture. This is supported by its engineering subsidiary which produces most of the machinery used in its plants. Brintons also has a reputation for innovation and excellence for its engineering exploits.

In the sixties Brintons opened a new plant in Geelong. This was the first expansion outside the UK and was a major break with tradition. Such was its pride in its roots that it continued for 30 years to import raw wool from New Zealand, convert it to yarn in England and ship it back to Australia. This logistical nightmare was only addressed in 1994 when a spinning plant was purchased in New Zealand to supply Geelong. This new departure coincided with the arrival of a new Chief Executive in Geelong and an accountant based approach to business. Time alone will show the impact of this dramatic change. The approach of the mid nineties sees Brintons perched at the top of medium sized specialist carpet manufacturers supplying contract and residential markets both at home and overseas (Fox 1994). The company has traded profitably over the past 10 years in spite of many traumas in the marketplace. Industrial relations have been excellent and union involvement merely token. Its growth over the past 5 years is illustrated in the following graph.



Brintons Growth 1989 - 1994

The atmosphere at Brintons is harmonious and employees appear focussed on their tasks giving the impression of a successful manufacturer assured of its success into the next century.

Management Style

Brintons management appear to be very democratic since employees' views are sought and employee involvement is encouraged and expected. The workforce typically outnumber management in committees, eg. safety, consultative and equal opportunity. Employee problems are generally addressed within the company structure rather than through the union. The company induction programme is very thorough and includes career path orientation. Promising employees are encouraged to improve their career opportunities and as far as possible are rewarded for their progress. However, due to Brintons' growth strategy and low turnover of staff, opportunities for promotions do not arise too often. Management in general are aware of the need to ensure that the traditional values of the company, eg. family type environment do not fall victim to the new cost effective approach. Brintons has not embraced a philosophy of rapid change in its management style, marketing or its product range. On the contrary its success has been based largely on its conservative approach, in contrast to Godfrey Hirst.

In terms of social welfare there is an irregular issue of a newsletter but no social club exists, which management considers to be a problem. Management style is one of the areas of major difference to Godfrey Hirst and some of those differences relate directly to the optimal use of this new technology.

Key Similarities and Differences

The main similarities and differences in both companies are highlighted below working from indepth interviewing of staff at all levels in both companies and from company records and documents, eg. minutes of meetings.

Key Items That are Similar

Parameter	Value
Industry	Textile
Ownership	Private
Markets	Home and Recent Export Focus
Location	Geelong
Best practice programme	Quality assurance
Union Involvement	Minimal
Remuneration	Slightly above award
Innovation	Historically Innovative

Key Differences

Parameter	Godfrey Hirst	Brintons
Size	Large	Small - Medium
Size Strategy	Growth through acquisition	Remain small - medium
Market focus	All areas	Top end
Management style	Autocratic	Participative
Communications	Poor	Good
Culture	Weak	Strong
Staff Turnover	Medium to High	Very low

Comment

The above tables show that both companies have a great deal in common. The key differences that potentially input on their use of the same technology are a matter of subjective judgement. It is clear that whilst Brintons had a relatively smooth adoption of this technology, Godfrey Hirst struggled and even though eventually both had reasonable success, the paths to success varied markedly. The main differences that arose, ie. culture, management style and prescriptive implementation factors are being addressed in this research.

However, the key difference of size that is not directly researched for its impact is briefly commented on here.

Godfrey Hirst, because it is much larger and has a much wider use requirement for the technology faced a more daunting task. It had more people to train and motivate, some of whom were fairly remote geographically from the technology. This factor had a nuisance impact and probably contributed to one production stream's abandonment of the technology. Ultimately the technology was mastered in two main areas - each of which had easy access to this technology. Noori and Radford (1990) claim that gaining commitment inside small companies is relatively straightforward if management champions the project.

The size factor also has an impact on culture. Brintons being smaller found it easier to focus on cultural aspects. Culture is an area where small companies have an advantage over their larger counterparts because it is easier to create bonding and encourage teamwork and communication lines are clear. Robbins and Barnwell (1989) conclude that the larger the organisation the smaller the role the technology is likely to play resulting in less top management input. There is clearly a greater management focus on adopting new technology in a small organisation. Whilst it is believed that large companies need to input greater resources in new technology adoption this research assumes that a similar result can be achieved if these resources are adequate and properly managed.

Comparison/Summary

This research investigates the adoption of an appropriate new technology for colour management and control by two companies in the carpet industry. Whilst there are numerous similarities, the experiences of both companies, the dynamics and approach are different within each. One company is large, without a strong culture, very flexible and very much driven by its entrepreneurial leader and his autocratic style. The other company is much smaller, is very focussed on its market niche and has a different participative management style and an apparently strong culture.

This research shows that these differences impact on the results and experiences of both companies in their adoption of computerised match prediction technology.

LITERATURE REVIEW

Introduction

The suboptimal use of new technology is widely reported in the literature and much research has taken place into its causes. The research over many years has covered just about every angle in relation to new technology. Areas covered include strategy, decision making processes, political impacts, structural imperatives, integration, training, social inpact, management of change, evaluation and development plus many more.

Many authors concentrate heavily in some areas of suboptimal use, for example Beatty (1988), Naik and Chakravarty (1992) examine closely the more prescriptive topics like training, management, support etc. They do not seem to put much value on the impact that technology has on the labour process, deskilling and other social areas. These areas are covered in depth by authors such as Braverman (1974), Matthews (1989) and Schon (1992) almost to the exclusion of the more prescriptive topics. There have been many studies done that deal with the subject of new technology with a more balanced approach, eg. Clarke McLoughlin Rose and King (1988). There appears to be a wider progression towards this more balanced approach. Pursuance of state-of-the-art technology for its own sake is a common mistake. A thorough participative examination of current needs and new technology assist in the acceptance of new technology should it be required. Poor management of new technology is usually the cause of suboptimal use rather than the technology itself (Jaikumar 1986).

Problems can arise in numerous areas from the initial decision process to the actual implementation of the new technology. Having adequate technology information and deep organisational knowledge is a good starting point for decision makers and managers to make the right decisions and plan for a successful, timely adoption of new technology. This knowledge will help anticipate problems and direct solutions. The particular culture and management style will either lubricate or obstruct these solutions. As previously explained, selection of the appropriate new technology in this particular research is not an issue because the technology under research is universally accepted as appropriate to the task. Therefore, management of the adoption and implementation as well as the environmental factors like culture are the key areas for attention.

In spite of the widespread use of this technology, very little if any has been written concerning the management and implementation problems encountered. An exhaustive data search at Geelong's CSIRO textile complex library failed to find any reference to the key elements of this topic (refer Appendix VIII). It is assumed that for the purposes of this Literature Review that problems generally encountered with this technology will be similar to those encountered with other technology implementations.

The approach of the following writers is considered valuable. Schon (1992) emphasises the importance of understanding the impact new technology can have on the individuals feeling of worth. Knowledge of potential negative perceptions on the part of employees will direct management to a more considered introduction. Child (1987) promotes a socio technical approach as far superior to a strictly technology determinist strategy.
Noori and Radford (1990), Klein (1989) highlight that deep knowledge of the technology and its potential impact can be significant factors in its effective adoption. Of particular interest is the approach of Pugh (1991) in which he suggests that management must create interest and excitement in the new technology as a means of reducing resistance and increasing commitment. This approach coupled with that of Drucker (1993) Boddy and Buchanan (1986) in which they encourage managers to view themselves in a supportive role rather than in a controlling role is shown to create an environment conducive to positive reactions to new technology.

Agrawal (1992) developed an explanatory model (Appendix X) for the process of organisational implementation of technology. This model describes how certain basic conditions must be present in order to successfully adopt new technology. These conditions are presented in two indices, the readiness for technological change index and the technical progressive index. Whilst this model is an excellent reference, many organisations would probably baulk at the prospect of having to achieve the levels suggested. Agrawal does conclude that less than 5% of Australian companies are in a satisfactory condition to adopt new technology.

Having read widely on the subject, three general conclusions arose.

1. Suboptimal use of new technology appears to be widespread.
2. Suboptimisation appears to be a management problem.

3. The authors' tendencies are divided generally into the following areas:

(a) The Rationalists
(b) The Contextualists
(c) Management and cultural aspects

This review examined the topic under these headings. All relevant factors have been listed and the alleged key factors have been expanded and supported.

The Rationalists

The Rationalist point of view accepts the present context into which new technology is introduced as given and concentrates on operational factors without much recourse to underlying factors, eg. the labour process.

The following is a list of many of the "rationalist type" factors thrown up in this literature review that impact on the successful use of new technology. All these factors could potentially impact on the adoption of computerised match prediction systems albeit some to a very minor degree.

Perceived need - performance gaps
Organisation knowledge and goals
Time scale, planning and preparation
Purchaser and vendor compatibility
Technology understanding
Project teams - knowledge demarcation
Champion
Training
Continual assessment and feedback
Management knowledge of new technology and conviction
Management style (scientific or democratic)
Employee type
Strategic awareness
Management support
Resource impact
Impact on jobs and job enrichment
Strategic connection
Trade Union Involvement
Management competencies

The 6 key factors deemed the most important by the literature follow

(i) need and understanding
(ii) strategic connection and awareness
(iii) management support and conviction
(iv) training
(v) cross functional project teams
(vi) champion

Key Factors Identified

(i) Need and Understanding

The changes involved with adopting new technology can be fairly daunting and a clear understanding of the need for this change is necessary for all involved (Mirvis and Sales 1991 p.113]. This understanding comes from well researched reasons and a consultative approach. The reasons to purchase new technology must reflect a business approach, not just a matter of having state-of-the-art technology or an attempt to impress peers (Sohal A.S. and Singh M. 1992 p.40). Performance gaps must be identified and understood in order to establish a real need and to direct attention to the appropriate technological solution (Mirvis and Sales 1991 p.117). Failure to identify and broadcast the performance gaps will lessen the perceived need and hence can reduce the commitment of users.

If the need or understanding does not stand up, then commitment to the technology will wane as soon as implementation gets difficult and the required resources will probably not be made available.

(ii) Strategic Connection and Awareness

The technology acquired must be in line with the organisation's overall strategy and assist achievement of its goals. As this may not always be the case in practice, particularly with line management, then executives must be aware of the business consequences of their technological decisions and their impact on competitiveness (Burgelman R.A. and Maidique M.A. 1988. p.233).

Naik and Chakravarty (1992 p.185) maintain that strategic evaluation of new technology is one of the three key factors to consider but they warn that sometimes organisational constraints may make it infeasible to acquire the type of technology that is most desirable strategically and a different approach may be more successful. These factors must be considered before choice is made and any "trade offs" required need to be understood.

It is the responsibility of management to be aware of the factors involved and to plan accordingly to achieve a successful implementation with minimum disruption. Management's prime objective must be to get commitment to the strategy from all involved [Pugh 1991]. This commitment can be more easily achieved if the strategic implications are widely understood by all involved.

(iii) Management Support and Conviction

This factor is a pre-requisite to all successful adoptions. Comparable with any major change in any organisation *"Implementation must begin with management and top down commitment.... It requires a resolute commitment to change and an unwavering patience to see it through"* (Conn 1987, p.58). Problems must be seriously dealt with by management and resolved. *"The role of management is critical to the successful implementation, the higher the organisational level at which a problem is "defined" the greater probability of successful implementation"* (Grant et al 1991. p.50).

(iv) Training

Training at all levels is necessary and must reflect the needs of the technology and respond to the status quo of the organisation. This will flow from management's knowledge of its organisation, people and the technology itself and it must ensure that everybody involved is appropriately prepared. It is management's responsibility to ensure its workers are prepared physically, mentally and culturally (Klein 1989, p.60). The more complex the technology the greater the need for indepth training in order to dilute the effect of remoteness from the technology on the part of the user. Colour technology is highly technical and labour intensive (Whyte 1991) and hence falls into this category.

Lockeed found success using the following formula "*Training included an overview of the entire package followed by in depth hands on instruction. Simultaneously with the system implementation and testing, training sessions were developed and conducted for all employees affected by the new system"* (Howery, Bennett and Reid 1991, p.27). The importance of training is highlighted by the OECD report on technology and the economy (Gilchrist 1991, p.87), which states that the massive investment in technology world wide failed to supply the expected outcomes in productivity because people were not adequately trained to use it.

(v) *Cross Functional Project Teams*

Such teams are widely regarded as necessary because new technology demands a more integrated approach in modern organisations (Beatty 1990, p.49) considers them vital in all types of organisations for the successful implementation of new technology (Robert H Waterman 1992, p.16) cites project teams as the most powerful tools available to effect change if they are properly managed.

(vi) *Champion*

Beatty (1990 p.46) describes the impact of an effective champion as essential. In her study she established that a knowledgeable, effective and enthusiastic champion was the only essential factor for a successful implementation of advanced manufacturing technology. This view is also strongly supported by Boddy & Buchanan (1986 p.11) and by Babbar and Rai (1989. p.49) who claim the champion's deep knowledge and past experience during the implemenation to be a major benefit.

Comment

All the factors highlighted here are considered to have an impact on the successful adoption of new technology. They are all fairly easily described and understood and generally relate to the management functions of planning, organising and control. Many companies have implemented new technology using these guidelines and large resources and yet have not achieved anything like the success expected. This whole topic has been researched and written on for decades by many renowned authors all of whom generally come up with the same answers (above) yet no complete solution to the problem appears. This research poses the question why?

Are we looking at the right area?
Are we looking at only part of the problem?
Is poor management the only reason why new technology creates such problems?

Proponents of the other school of thought believe that a more fundamental approach to the labour process and a greater understanding of the impact of change is required to identify the real problems and to arrive at a better solution. These writers are dealt with under the title The Contextualists.

The Contextualists

Labour Process

Many writers concentrate on fundamental issues as the cause of sub-optimal use of new technology, eg. the nature of the work process and the control needs of the owners of the means of production. It is claimed by many writers that the labour process is greatly affected by new technology. The best known of this school, Harry Braverman (1974) is used as a benchmark against whom many of the writers define their stance. His Marxist views strongly assert that technology is another tool used by capital to reduce the power and control that workers have over their own labour.

He claims technology ("machinery") has two functions in the hands of capitalists:

(i) *"the technical function of increasing the productivity of labour"; ....*

(ii) *"the function of divesting the mass of workers of their control over their own labour". (1974, p193).*

He believes that these functions devalue human work and, this being obvious to workers, alienates them from that technology. Child (1987, p.256) refers to the tendency to use technology to replace human work rather than to enhance it as very damaging to the potential of the technology and declares this approach to be very prevalent. Cooley (1980, p.15-17) is also very critical concerning the use of new technology and sees a more socially responsible application as the key to successful implementation.

The overriding approach from the viewpoint of these writers is that technology must be implemented from a human aspect rather than from a technological aspect. They strongly argue that this approach in the end is more effective and that technology must be designed to incorporate human factors. Sankar (1991, p.5) agrees and states that *"what is good industrial engineering for work is often exceedingly poor human engineering for workers".*
He resurrects Druckers (1974) five dimensions necessary for human achievement to be truly productive, ie physiological, psychological, social, economic, power. The impact of technology on all these factors must be understood and dealt with.

De-Skilling

A claim regularly made is that new technology deskills workers and some (Braverman 1974) indicate it is the means used by management to reduce workers control or input.
In many cases of new technology adoption, workers are de-skilled and often jobs are lost. In other cases claims are made that skills are replaced or enhanced. Braverman's thesis "that new technology will be used in a Tayloristic fashion to de-skill workers" (Child, 1987 p10) highlights a potential for management to increase its control. John Mathews draws attention to this philosophy in the Taylorist school of thought towards the use of new technology and issues a warning of the consequences. This "de-skilling design philosophy which is repugnant not only in human and social terms but also a disservice to the industry it is supposed to be promoting. It is taking industry down the road to oblivion". (1989, p.126). He bases this warning on many studies including Sorge et al on NC and CNC machines in Germany and Britain and Adler's Bank research studies in which they found that "economic success was clearly linked with a skills upgrading strategy". (1989, p.127).

However despite a greater understanding created by experience and studies, even today technology is often used to lower the status of jobs and hence the job holders. If it is obvious that this is management policy, the resistance to the technology soars. Child refers to this policy as "a policy of using technology to replace rather than enhance human capital" (1987, p.250). If, however, an organisation is seen to use technology to genuinely enhance employee work life, then acceptance of technology will be more likely. Unfortunately "the alternative philosophy which regards new technology as a means for downgrading and replacing labour is nevertheless more frequently encountered in practice". Child (1987, p.256).

A management approach towards deskilling that blatantly reduces workers' power or further excludes the worker from the process will clearly create problems for the new technology adopted. Noori & Radford (1990, p.409) identify the existence of both positive and negative impacts of new technologies and propose a course of action which minimises the negative impacts as the best way forward.

Impact of Change

The prospect of major change has an upsetting effect on many people and this can result in resistance to the change. This is often reflected in organisations in relation to technological change. Technological change often produces unintentional and unanticipated effects - it sometimes sets out its own conditions and imposes its own values (Schon 1992, p.11) . This often results in fear of the technology because it appears to offer a threat to self identity (Schon 1992, p.14).

Technological change usually involves much more than equipment change. It can often cause fear, resentment and frustration (Boddy & Buchanan 1986 P.2-3). In order to allay those fears, managers first of all need to understand them and then move to make the changes more acceptable by consultation and involvement with the workers concerned. Problems like remote monitoring, loss of operation control, social isolation (Mirvis and Sales 1991, p.115) need not cause fear if the implementation is wisely planned. Pugh (1991, p.37) strongly recommends management to create interest and excitement in the change and suggests that resistance is the result of management's failure to motivate staff, rather than an inherent fear of change on the part of users.

Management and Cultural Aspects

Management Style

Successful managers have had to change and change at an increasing rate. Where once managers were considered the experts and attained their status due to their expertise, today due to change, very often in many areas they don't have expertise and must have the confidence to rely on consultation rather than control only. Bailey (1993) suggests that management who think they know it all will be neither open nor adaptive to new ideas and hence will find change very difficult. New technology has forced this change and unfortunately some managers have chosen to use new technology to increase their traditional control instead of using new technology's full potential (Drucker 1993, p.115).

Duck (1993, p.109) believes that managers must be encouraged to "change their management style to manage the dynamic not the change". Nohria and Berkely want managers to take a more pragmatic approach to change, to ignore all the management fads and get down to basics and create urgency (1994, p.137). Management must respond to new technology with confidence and ability to integrate workers and technology to achieve optimum results and realise at the same time this may require them operating in support of the worker and the system rather than vice versa (Boddy and Buchanan 1986, p.4).

This is a fundamental change that managers must make. It is important for a manager to realise that understanding the technology, the workforce and the culture is part of a key success formula.

General Motors, despite its huge resources, failed in its attempt to absorb new technology successfully because due attention was not paid to these "softer" issues (Hamel and Prahalad 1993, p.78). Traditional boundaries between blue and white collar work is highlighted by Bailey (1993, p.7) as an area where conflict can occur due to the introduction of new technology into a traditional environment. He also suggests that an environment where management believe in the importance of peoples' involvement and job satisfaction coupled with a value of the concepts of participation, innovation, quality and customer service is an environment suitable to adopting new technology successfully.

It must also be stressed that the change required may be considerable and the time required for learning can be long. Even successful implementations take years to make significant progress (Bessent and Buckingham 1989, p.324). This fact has proven very disconcerting to many managers whose understanding of new technologies imperatives are limited to short term problem solving or quick profit generation. It is strongly advised that management should be aware of potential changes to structure, job design, management and organisation with the adoption of new technology (Wall 1984; Bailey 1993).

Strategy Dilution

Some managers with their own agendas may impact on technology adoption whereby their operational decisions, systems and attitudes may conflict with corporate strategies, (Clark, McLoughlin, Rose and King, 1988, p.211; Boddy and Buchanan 1986, p.4).

Culture

The current culture of the organisation is highlighted as a key factor. Parker suggests that a chief executive fails if he does not establish a supportive culture to adopt technological change as it will result in sub-optimal use (1989, p.115). Mirvis and Sales (1993, p.115) claim that cultures marked by adversarial labour - management relations or a tradition of top down control will probably increase conflict or at best achieve unenthusiastic compliance of users when new technology is introduced. Reyes & Kleiner (1990, p.51) suggests the right culture is very important in striving for success and developing a purpose. They believe that a 'support oriented' culture is the optimal culture to achieve employee commitment but warn that it must be balanced with other key success constituents such as power, regulation and goal achievement or else the culture support will drain profits.

Robins & Barnwell (1989, p.325) suggest that weak cultures tend to be more amenable to change. On the other hand they propose a strong culture to be a better environment for directing individuals toward key company goals. They propose that the more a company moves from a routine technology to more complex technology, the more it needs a culture that will free up individual initiative.

Comment

There is a subtle suggestion that optimal use does not exist at all - probably true for something evolving as rapidly as new technology is today. The point at issue, however is that the level of usage can be so far from the promised level that some very fundamental issues need to be addressed. It is interesting to note the difference in emphasis by both the rationalists and contextualists. It is hard to argue with almost all the issues raised by the rationalist approach. It is logical, comprehensive and markedly prescriptive, yet it does not appear to be enough.

The key issues raised by the rationalist school of thought in this literature review dictate by their logic and their frequency of comment that they must be addressed in any adoption of new technology. In this research these key issues have been tested for their presence and importance.

The second school of thought, the contextualists, raises some relevant points for this research. Fears of job loss and de-skilling can appear very real particularly for those potential users who have been valued for their skills and who also have developed a deep sense of pride in their judgement and skills. The prospect of technology replacing such highly valued skills and removing acquired status can lead to exaggerated fears. This and other problems highlighted, eg. fear of change, can all lead to alienation and create problems for the optimal use of new technology. The feeling gathered, however, is that these reactions can be managed and understood and with good planning and a wise response to the problems as they arise their negative effects can be minimised. This better approach is closely connected and dependant on the issues commented on in the third category, ie. management and cultural aspects.

In the last category, management and cultural aspects, the environment into which the new technology is adopted is examined. The preferred management style identified is one that is more democratic and trusting than the traditional style and managers must be prepared to play a more supporting role rather than use the technology to increase their control. Many new technologies offer the opportunity to exercise either approach and hence management decisions can impact directly on the outcome.

These decisions are presented in the adoption of computer match prediction systems and this writer feels that they can be important decisions. This review suggests that management style and culture are very inter-dependant and that both impact on the success of this new technology.

It is worthwhile considering the positive approach suggested by Pugh (1991, p.37) whereby management encourage excitement and enthusiasm within the user group towards the new technology in order to create a climate whereby successful implementation and use is in their own interest and a consequence of their own efforts - in other words that ownership of the success is theirs and is recognised as such.

Importance of Study

The current research is considered important to the textile industry because:

1. it will help identify adoption/implementation problems and direct solutions to them;

2. it will help expedite return on investment by directing a timely adoption programme;

3. it may help lay the foundation to exploit the advanced applications promised by this technology as described above in Technology Profile.

4. it identifies a best practice approach and hence the avoidance of morale sapping failure.

Key Factor Discussion

Need and understanding

It would appear that for any difficult or expensive technology to be effectively used there ought to be a need for it and a certain amount of understanding of how this technology can help. This need, be it in the form of identified performance gaps or some well described strategic approach must be explained to all involved in order to create commitment. With regard to this particular technology, need and understanding would seem to be important.

Strategic connection and awareness

The strategic importance of this technology in so far as it relates to manufacturing strategy to improve quality, consistency, cost effectiveness and productively would be tested when the implementation gets difficult and commitment and extra effort is demanded. A widely understood strategy keeps the effort on track and smooths the progress. The absence of such understanding often facilitates temporary shelving of the implementation program in order to attend to more pressing day to day problems. A driven strategy is a useful tool for management when faced with uncompromising resistance.

Management Support and Conviction

It has rarely been sufficient for management to say "take this technology and make it work". Where big change is required as in this case, understanding peoples' problems and helping with solutions is crucial. The message must get through that users are not on their own and that management really do believe in the technology. Management commitment in its various forms will be closely watched and users will tend to react accordingly.

Training

Must be chosen to meet the change and complexity in this technology adoption. The importance of training, including induction training, cannot be underestimated and must respond to the needs of the users.

Cross-functional project teams

Particularly important in a company (eg. Godfrey Hirst) where different and remote departments are adopting the technology and team work has not been a practiced art. In small companies (eg. Brintons) where the technology is localised, much of the function of project teams can reasonably be handled by the champion. However, their existence is very likely to be a bonus.

Champion

The existence of a multi-talented knowledgeable champion armed with patience and understanding appears to be a shortcut to successfully adopting a computerised match prediction system particularly in a climate of apprehension and ignorance. As this is a crucial role, support from top management for this individual is very important. More often than not it is a thankless job where blame is often laid at ones doorstep and credit for success must politically be seen to be due to users or planners. This is a crucial role.

Fears of change

It is claimed that fear of change is basic to people. Others protest this is just the result of poor management practice in the past which crystallises in poor communication and lack of commitment in employees. The contextualists would claim that change leads to insecurity due to a potential loss of control. Whatever the cause, the existence of fears and reasons for them have been tested in this research.

Workplace culture

The two case study companies have been surveyed in order to classify their cultures in the hope of drawing conclusions that will clarify other work in the literature. A cultural survey developed by Deshpende et al (1993) has been conducted in each company. The two companies will be classified for culture type and results compared to the literature review conclusions and expectations, in relation to their propensity to cope with technological change, eg the literature suggests that a support oriented, innovative culture is better able to cope with change.

Management style

As with culture, management style will be examined to ascertain what impact it has had and if it is the most suitable.

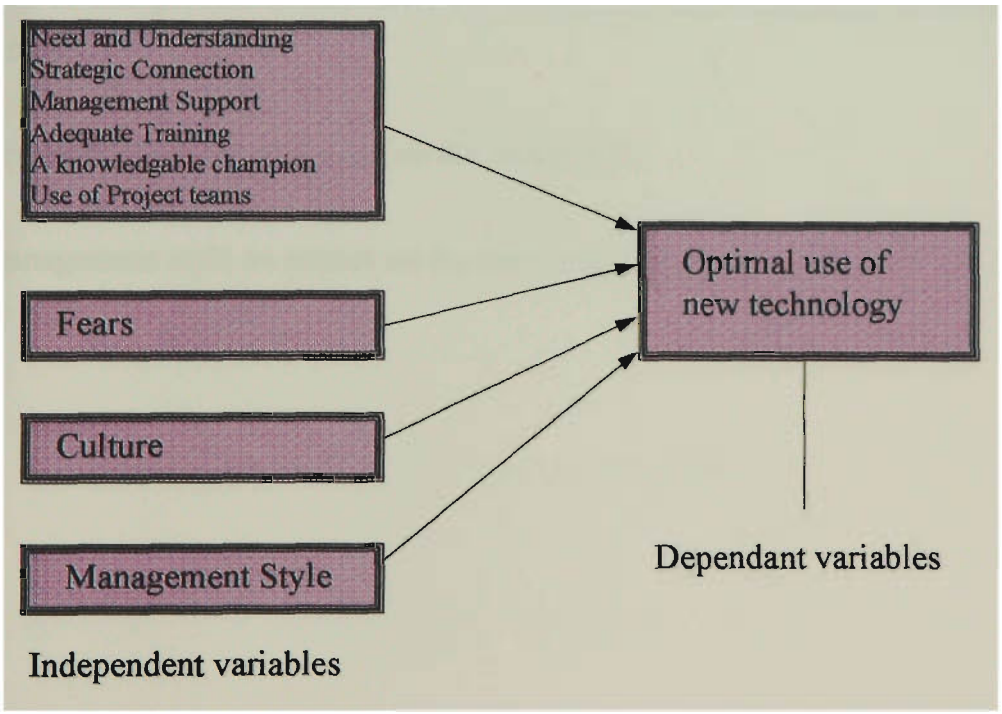
This study will look at the necessity of the various rationalist factors and assess the impact of the contextual, cultural and management factors in the two textile organisations to establish what is required for a timely successful adoption.

RESEARCH TOPIC AND QUESTIONS

Theoretical Framework

The extent of the achievement of this optimal use is explained by the presence of the independent variables and if present, their suitability to successfully cope with the resultant change. It is clear that the effective attainment of the optimal use of new technology is a long and iterative process for an individual company. This research concentrates on the start and the end of the process more so than the many stages that occur during the adoption.

Diagram of Theoretical Framework



Research Questions

1. Do the key prescriptive requirements as described by the rationalist school of thought in the literature review need to be present for a successful adoption/implementation of new technology? ie.

   A. need and understanding
   B. strategic connection
   C. management support
   D. adequate training
   E. a knowledgeable champion
   F. use of project teams

2. Do fears of change, loss of influence, de-skilling and fear of displacement lead to resistance?

3. Does culture type have an impact on the outcomes?

4. Has management style an impact on the outcomes?

METHODOLOGY

Purpose of Study

To research the adoption of new technology at two companies in order to identify the critical success factors, isolate the main problem areas and make recommendations as to the best approach when implementing this colour measuring technology. The approach of each company and their relative success will be compared. This will be achieved by addressing the research questions posed above.

Research Design

Type of Investigation

This is correlational research question testing study to identify the main problems associated with the successful adoption of a new measuring technology in the textile industry.

Study Setting

Non-contrived setting under normal working conditions.

The dependant variable in this study is the movement by companies towards the optimal use of new technology.

Researcher Interference

There was no interference apart from interviews and questionnaires.

Time Horizon

All interviews and questionnaires were conducted over a four month period.

Unit of Analysis

As this research is interested in the opinions and experiences of individual users and managers, the unit of analysis was originally each individual. However, the unit progresses to the organisation as both case study companies are compared.

Preliminary Industry Investigation

Five textile companies were visited in order to gain a general idea of the main problems encountered and assess the critical success factors. Reactions to the technology within companies were conflicting and diverse. Management and users were interviewed individually in most cases and encouraged to give their honest impressions in confidence.

This preliminary investigation helped confirm that all relevant key factors were included in the case study research.

Population in Sample

Due to the relatively small number of employees involved directly with this technology a 100% sample of the population was desired in the questionnaire. This was achieved in the case of Brintons Carpets and almost achieved at Godfrey Hirst where one respondent could not be contacted. At Brintons all six respondents were interviewed at least once and at Godfrey Hirst this figure was twelve. The questionnaire was explained to all and in most cases was answered anonymously.

	Brintons		Godfrey Hirst	
	Population	Sample	Population	Sample
Management	2	2	3	3
Users	4	4	10	9

Management and users were issued with different questionnaires in order to get different perspectives on the same issues.

Data Collection Methods

Questionnaires were issued to all but two on a Monday morning and 15 were returned within 3 days. The other two were delayed due to overseas travel and the last of the original issue arrived within three weeks.

Variables and Measures

The User questionnaire comprised 32 items and the Management questionnaire 31 items, (Refer Appendix V).

The six "rationalist" requirements were tapped in 9 User questions and in 11 Management questions.

Culture was tapped in 12 User questions and 13 Management questions.

Management style was dealt with in 7 User questions and in 12 Management questions.

Fears were pursued in 9 User questions and 6 Management questions.

All of these questions were measured through multiple items on a 5 point Likert type scale.

Further items of information were measured by users - two items and management - five items.

Due to the close interrelationship between some variables, eg. culture and management style, many questions were used in more than one analysis.

The student t-test is used to measure the degree of significance of some mean results.

A cultural survey based on the work of Deshpande, Farley & Webster (1993) was also filled in by all respondents in an effort to classify culture type of each of the two organisations. (Appendix VII).

RESULTS

Preliminary Industry Investigation

Main Observations

1. Lack of adequate training was a general observation in all but one company. This appeared to be linked with a certain amount of ignorance on the part of management initially of the demands and implications of the technology. Most companies approached the technology with more apprehension than conviction. Vendor support was very inadequate. This was also experienced by this researcher whilst attempting to gather information on the technology from the vendor.

2. Resistance was very evident in most companies and in some cases it paralleled enthusiastic acceptance from some employees. Many users seemed to struggle with the reasons for their resistance to the technology and fear of its consequences was reported. This resistance sometimes appeared in the guise of no confidence in the technology. On further probing this lack of confidence was sometimes accompanied by admitted lack of input on the part of the user. This indicated deeper problems, eg. communications, fear, culture, management style etc.

3. Organisations without an experienced champion struggled. This situation was compounded by a perceived lack of vendor support or management reluctance to pay for support.

4. Line management commitment appeared to be lacking in the less successful companies.

5. Failure to convince users and, in some cases, management of the real potential of the technology was highlighted as a key factor.

6. In no company was there any monetary or promotional reward involved in the successful adoption of the technology.

7. Reasons for adoption of the technology were varied. In two companies, management admitted that reduction of staff was a prime motivation. In one of these two companies reduction of the influence/power of the technical dyeing staff and a reduction in their numbers was readily volunteered as one of the main reasons to acquire this technology, by the Production Director. Other benefits were considered as a bonus. Not surprisingly some employees were suspicious of the motives of management. Improved quality, better consistency, reduced costs, better lead times, customer and accreditation demands were generally cited as the prime reasons.

The general feeling captured was that three companies achieved a reasonably satisfactory outcome after much effort. One company failed miserably and abandoned the technology. Another company appeared to have a stress free very successful outcome in a very short period of about 5 months.

The key elements identified are tabulated and their presence indicated by a X.

Company	Good	Knowledgeable	Man.	Need		User	Good	Strategic	Outcomes
	Training	Champion	Support	Perceived	Resistance	Involvement	Communication	Connection	
1		x		x	x		x	x	Success with much difficulty
2	x	x	x	x		x	x	x	Good timely success
3			x	x	x		x Eventually	x	Initial failure - success after
									Management restructure
4		x	x	x	x	x	x	x	Success after difficulty
5				By manage	x			x	Abandoned the technology
				only					

Key Elements Table - Preliminary Investigation

It is clear that these observations are closely aligned with the literature findings. Company 2 (Brintons Carpets), the most successful company was very willing to partake in this research. Company 1 (Godfrey Hirst) the other case study involved was one of the three apparently moderately successful adoptees which initially was unenthusiastic but eventually wholeheartedly partook in the study.

From this early perspective the two participants, whilst similar in many ways appear to be diverse enough in their experiences and problems to indicate good potential for this study to unearth many of the main problems associated with this new technology.

The only trouble free adoption (Brintons) was marked by a very large input in training. This involved a company representative spending one month at the parent company's operation in the UK followed by the parent company's champion visiting Geelong for one month. Company 5, which abandoned the technology supplied training for one person for one day. This company also purchased and had the technology delivered before any potential user knew it was being considered. This training contrast perfectly matches the companies' respective outcomes.

As none of the companies studied remotely matches Brintons for training input or success one has strong evidence that training could be a key factor.

All companies indicated the computerised match prediction system was purchased as part of their competitive strategies. Even company 5, which failed to implement the system had a clear view of how this technology could be strategically advantageous. They failed to convey this to their employees because management could not sell the benefits of the technology. The preliminary results proved invaluable in directing the case study research.

Case Study Results

Preamble

The case study results point to a superior performance by Brintons in just about every key area. Results indicate that only in the area of prior knowledge of the technology does Godfrey Hirst have any advantage. Brintons clearly approached the adoption in a better way and soon overcame their ignorance and achieved success in a short time.

The results of the study and Brintons' remarkably successful outcome point to a good method, good planning and a readiness to embrace new technology. Their approach is marked by enthusiasm and a complete absence of resistance. Training and management support is good and a knowledgeable champion using a team approach helped produce a good timely result for the company.

Godfrey Hirst, whilst not as accomplished as Brintons in their adoption, performs reasonably well regarding strategic connection, resource input, the presence of a knowledgeable champion and the absence of fear. However, appreciation of the need for this technology and training are only mediocre. Communications, management support for the champion and users' early involvement are areas where Godfrey Hirst performed poorly. Results show much resistance to the technology and a reluctance on the part of management to confront the real causes of this resistance and a preference for restructure as a solution.

However, reasonable success did eventuate for Godfrey Hirst albeit after great difficulty and much delay.

Research Questions

1. Must the key prescriptive requirements as described by the "rationalist" school of thought be present for a successful adoption/implementation of new technology?
   Note: All the mean results were measured as a 1-5 Likert scale where 1 means strong agreement and 5 means strong disagreement.

1A. Need and Understanding - refer to User questionnaire results, Q2, 4, and 5 and Management questionnaire results Q 2 and 4, Appendix VI.

Results (Mean)

	Godfrey Hirst		Brintons
		n =( )	n - ( )
Need	Management	1.67 (3)	1.00 (2)
	Users	3.22 (9)	2.25 (4)
Understanding	Users	2.89 (9)	2.25 (4)

Management at both companies felt that this technology was needed. Godfrey Hirst users were not convinced. Users at both companies understood why the technology was purchased.

It can be concluded from the overall results that there was an appreciation of the need and an adequate understanding at both companies. Supporting evidence for this conclusion could logically be drawn from Users Question 20. Where Godfrey Hirst (mean 2.11) and Brintons (mean 1.50) both consider the system better than the old manual system.

Of the original five companies investigated, four perceived a need for the technology as did management of the fifth. This company which failed could not convince their users of the need to adopt this technology.

1B. The presence of a strategic connection - refer User questionnaire Q3 and Management Questionnaire Results Q3 Appendix VI.

Results (Mean)

	Godfrey Hirst	Brintons
	n = ( )	n = ( )
Management	2.33 (3)	1.00 (2)
Users	3.11 (9)	1.75 (4)

There was a strong connection at Brintons and Godfrey Hirst was reasonable overall. However, Godfrey Hirst users were fairly neutral to this connection. Results from the original investigation indicate all five companies purchased this technology as part of a key strategy. However, there is little additional evidence gathered to indicate that this technology was purchased by any company except possibly by Brintons, as anything but a manufacturing aid. Certainly, Godfrey Hirst, judging by their poor management support and lack of involvement on the part of the Chief Executive, do not signal the importance one would expect from a key strategic adoption.

1C. The presence of management support - Refer User questionnaire Results Q13, 14 and 16, Management questionnaire results Q11 and 18, Appendix VI.

Results (Mean)

Godfrey Hirst		Brintons
	n = ( )	n = ( )
Management	3.67 (3)	2.00 (2)
Users	3.11 (9)	1.75 (4)
Top management support for champion	2.33 (3)	1.00 (2)
Line management support for champion	3.67 (3)	1.50 (2)

There is strong management support for Brintons. Godfrey Hirst perform poorly, particularly line management where there is a significant difference in performance as indicated by Student t-test, which shows significance just outside the 10% level (Appendix XI).

Interviews and additional comment on questionnaires strongly support this evidence. Examples of additional comments on Godfrey Hirst user questionnaire are "it was us (technical staff) versus them (production staff) and they didn't care if the technology didn't work". Another stated that "line management stood back and didn't care if it worked or not". Clearly these users needed better support from management.

1D The presence of adequate training - Refer User questionnaire results Q 6, 7, 8 and 9 and Management questionnaire Q10 and 12, Appendix VI.

Results (Mean)

Godfrey Hirst		Brintons
	n = ( )	n = ( )
Management	3.33 (3)	1.00 (2)
Users	3.33 (9)	2.50 (4)
Induction program users	3.89 (9)	2.00 (4)

Much better training at Brintons. Godfrey Hirsts' performance is mediocre. Interestingly, Brintons felt their training could be further improved. The significant difference between both companies regarding induction training as indicated by Student t-test relates well to the companies different experiences. The result 5.03277 is significantly above the 5% level.

Interview evidence at all companies suggests training to be a key factor and to have been underestimated by most companies.

1E. *The presence of a knowledgable champion - Refer User questionnaire results Q10, Management questionnaire results Q5, 6, 7, 8 and 9 Appendix VI.*

Godfrey Hirst (mean 2.33) had an adequate champion as had Brintons (1.50). Support differed for the champions and communication was poor at Godfrey Hirst which made that champion's task more difficult.

Interview evidence supports the above. Preliminary investigation at the original five companies strongly supports the need for a knowledgeable champion.

1F *The presence of project teams to solve problems - refer User questionnaire results Q11 and 12 and Management questionnaire results Q21 Appendix VI*

Results (Mean)

	Godfrey Hirst	Brintons
	n = ( )	n = ( )
Management	3.33 (3)	2.50 (2)
Users	3.22 (9)	1.75 (4)

No definite team strategy was employed at Godfrey Hirst. Brintons did use this approach and their comments support positive results eg., "this technology was new and we all worked together and supported one another".

A brief glance at Godfrey Hirsts' questionnaire results highlights that half of the respondents' experiences were generally negative and the remainder indicate a largely positive experience which is more in line with the Brintons result. The more consistent standard deviation result at Brintons supports this. This devision in the Godfrey Hirst results raises the possibility that a team approach may have raised the problems and issues involved and could have led to solutions and a smoother adoption. The eventual solution to this devision was a restructure which placed the technology largely in the hands of the most committed and the employment of an extra person. This restructure did eventually lead to success but at a cost of time and restricted use of the technology.

Question 2

Will fear of change, loss of influence, deskilling and displacement lead to resistance - refer User questionnaire results Q17-23 and 25-26 and Management questionnaire results Q19 and 25-29 Appendix VI..

Results Table for Fears

Criteria	Godfrey Hirst n = 9	Brintons n = 4	Result
New technology is better	Agree - mean 2.11	Agree - mean 1.50	Grounds for fear
New technology is more consistent	Agree - mean 2.11	Agree - mean 1.00	Grounds for fear
Reduction in control/input	Disagree - mean 3.78	Disagree - mean 3.75	No grounds for fear
Skills loss expected	Disagree - mean 3.33	Disagree - mean 3.50	No grounds for fear
Skills gain expected	Agree - mean 2.56	Agree - mean 1.50	No grounds for fear
Job loss expected	Disagree - mean 3.89	Disagree - mean 4.25	No grounds for fear
Job more interesting	Neutral - mean 3.00	Agree - mean 1.50.	No grounds for fear
Job is changed	neutral - mean 3.00	Agree - mean 2.25	No grounds for fear
Status will be enhanced	Disagree - mean 3.11	Agree - mean 2.75	Little grounds for fear

The only criteria tested that could reasonably induce fear is that there is wide agreement that the technology is better and more consistent than manual assessment. Godfrey Hirst users did expect a slight reduction in status (3.1) but not significant. The other criteria were strongly positive or neutral particularly fear of job loss (3.9 and 4.2) and can confidently be expected to compensate for the negative expectations. Resistance was not due to fear.

Question 3

Does culture type have an impact on the outcomes - refer User questionnaire results Q1,3,5,13,14,15,27,28,29 and 31 and Management questionnaire results Q3-8 and 13, 14, 15, 16, 18 and 21.

Culture Related Influences Table - Users Only

Criteria	Godfrey Hirst n = 9	Brintons n = 4
Strategy Awareness	3.11	1.75
Reason for Purchase Awareness	2.89	2.25
Good induction training	3.89	2.00
Problems understood by management	3.22	2.75
Benefits understood	2.22	1.75
Involved at early stage	4.22	2.25
Users views considered	3.78	3.00
Users contribution valued	3.89	3.75
Good management support	3.11	1.75
Reward expected	3.78	2.50
Training quality	3.33	1.75

Good communications are not diligently practiced at Godfrey Hirst. Employee (user) contribution is not very highly valued and reward for success is not expected. Management support is lacking.

Brintons perform better in all areas but perceptions of users contribution as not valued highly, contradicts management results below which show that user contribution is valued. Godfrey Hirst did not involve their users early whereas Brintons did. Student t-test results of 7.80277 shows a significant difference between the companies above the 5% level.

Culture Related Influences Table - Management Only

Criteria	Godfrey Hirst n = 3	Brintons n = 2
Key company strategy	2.33	1.00
Technology potential understood	1.67	2.50
Good champion	2.33	1.50
Top management support for champion	2.33	1.00
Line management support for champion	3.67	1.50
Resources support for champion	2.67	1.00
Culture suitable for change	3.00	1.50
Employees involved early	4.33	2.50
Employees involvement is helpful	3.00	2.50
Benefits explained	2.67	1.50
Good management support for users	3.67	2.00
Team approach used	3.33	2.25

As in User Table previous page, Brintons's performance is far better. For Godfrey Hirst there is confirmation for users perceptions on management support and low value on users early involvement. Team approach was not used.

Organisation Culture Survey

	Clan	Adhocracy	Hierarchy	Market
Godfrey Hirst	112.1	96.2	100.5	88.09
Brintons	105.6	92.2	105.5	100.1

Results of the organisation culture type survey indicate Brintons to be market orientated and hence more innovative (Deshpande et al 1993) and Godfrey Hirst to lean towards a clan type culture. Whilst this research is not conclusive, it coincides with much of the literature that proposes that market orientated cultures are more open to change than organisations with clan type cultures.

Question 4

Does management style have an impact on the outcomes - refer User questionnaire results Q11-16, 27-29. Management questionnaire results Q5-8, 14-16, 18, 21, 24, 28, 29.

Management Style Related Influence Table - Users Only

Criteria	Godfrey Hirst n = 9	Brintons n = 4
Teamwork - problem solving	3.44	1.75
Communication Q11,12,13,15,16,27,28,29	3.33	2.22
Management support adequate	3.11	1.75
Line management support	2.67	1.50
Views seriously considered	3.78	3.00
Employee early involvement	4.22	2.55

Management Style - Related Influence Table - Management Only

Criteria	Godfrey Hirst n = 3	Brintons n = 2
Teamwork	3.33	2.50
Communication Q11,14,15,16,21	3.26	2.30
Management Support Adequate	3.67	2.00
Line Management support for champion	3.67	1.50
Employee early involvement	4.33	2.50
Employee involvement is beneficial	3.00	2.50

Under the management style criteria examined, Brintons results display a much more democratic, participative management style. Communication is good and management support is very good. For user involvement there is a significant difference above the 5% level (student t test) between the companies. Godfrey Hirst on the other hand rely much less on user involvement, relying more on the traditional approach. Interestingly, Godfrey Hirst management concedes that top management and line management support is lacking whereas users don't rate this support as poorly. This could reflect a laissez faire approach by some users and a failure by line management to drive the implementation. This suspicion is supported by champion's disclosure of little support or commitment from line management towards the technology.

CONCLUSIONS

Findings from the foregoing will be discussed and conclusions drawn.

Discussion

It is indicated from this research that of the five companies examined that four were successful and one abandoned the technology due to failure to implement.

Of the two case study companies, one was a resounding success, mastering the technology within six months. The other company also succeeded but took five times longer.

As the same technology was used by all companies, a technology which is widely recognised as the most appropriate to the task, then selection of the technology is not an issue and hence certain complications are removed.

Whilst there is evidence to support the existence of all the key factors from the literature, there was very little evidence in the case study of "fear" as discussed by the contextualist school of thought. A greater leaning towards the prescriptive factors was indicated coupled with a need for awareness of the cultural factors, an assessment of the suitability of the management style and the likely impact of each.

The reasons for resistance to computerised match prediction technology at Godfrey Hirst is not clear. It is possibly caused by a combination of factors. Certainly the commitment and conviction of management was not felt by all concerned with the adoption. The responsibility for the implementation was left largely to the champion who often had to operate in a climate of non cooperation without adequate management support. Even though the users could see the potential of the technology and appreciate the benefits, many of them failed to make the necessary effort to ensure a smooth adoption. Some openly resisted, apparently without serious challenge to their stance.

Most likely a poor introduction programme, mediocre training and poor management support combined to convince some users that a successful adoption was not a priority and that unfounded resistance would be tolerated thereby reducing the necessity to make the required effort. It appears that Conn's (1987) Management Imperative of a resolute commitment and an unwavering patience to see it through was not present at Godfrey Hirst on this occasion.

Conclusions

Depending on how success is defined in regard to this technology, one could conclude that both companies had successfully adopted this technology. However, being pedantic, one could conclude that only full timely use of all features is the only measure that qualifies as a successful adoption. This approach would probably eliminate the description of successful adoption from all in the real world. A more reasoned conclusion from this research would be as follows.

Brintons Carpets can claim great success in its adoption of this technology considering its outcome in the use of a selected number of features chosen. One has no doubt that with the demonstrated success of its approach that it will successfully master the other available features when and if it choses.

However, with Godfrey Hirst, whilst success was eventually achieved in most of the features attempted, the cost, the angst, the delay and the strong likelihood of failure for future expansion of the system disqualify the company from declaring its adoption as successful.

In general, a tentative conclusion that a committed, considered approach by management involving a knowledge of the technology and its demands, its people and its strategic plans for the technology coupled with a culture and climate receptive to change is by far a healthier way forward than an approach characterised by autocracy and forced change in the hope that commitment and success will follow.

All the key issues found in the literature are valid in regard to this technological change to some degree. Closer attention and greater detail is required in general for the rationalist prescriptive factors as they are considered the 'hardware' or 'nuts and bolts' of the adoption. Contextual factors do not require the same emphasis but awareness on the part of planners and management of their existence and possible impact is necessary in order to be prepared for their appearance. Cultural factors and management style rest somewhere in between the other two categories in regard to importance. Whilst they do not have the same potential negative impact as for example a bad training programme or an inadequate champion, they are ever present and do affect the way things get done and how problems are solved. Knowledge and awareness of the type of culture and management style is important in so far as management style can be varied to suit circumstances during the adoption and also the adoption can be used to encourage change in the current culture of the company if appropriate.

Specific conclusions will be drawn on all the individual research questions.

Q.1A Need and Understanding

Evidence suggests that a need for and a wide understanding of this need is required for success. Refer to the failure of Company 5 - the only company that did not convince its users of the need failed to implement. Godfrey Hirst only barely convinced their users of this need. Clearly this need which may not be obvious to some at the beginning can slowly be appreciated as the technology's benefits are shown.

Conclusion

A certain amount of need is required to be present initially and understanding can develop over time.

Q1B Strategic Connection

The evidence points to this connection being helpful but certainly not crucial. Suggestions in the literature that it is crucial do not apply to this technology where, for example, at Brintons there is every indication that was it not a strategic acquisition it would still have most likely been successful.

Conclusion

Helpful but not a key factor.

Q1C Management Support

There is strong evidence that management support was lacking at Godfrey Hirst. This is likely to have contributed to the frustration felt by the champion and those committed to the adoption. This caused delays and allowed uncontested resistance to continue unchallenged. Line management's lack of support contributed further to these problems. It is reasonably clear that this lack of support hindered the adoption to a fair degree.

Conclusion

The presence of strong management support is a major facilitating factor towards a smooth adoption.

Q1D Training

Apart from Brintons, all companies underestimated training requirements. Brintons learned well from the experience of their parent company in the UK and got off to a good start. In spite of this they claim their training could be improved which indicates how unprepared the other companies were. Godfrey Hirst's poor result for induction training reinforces this point but also reflects on its attitude to the contribution and participation of users. Inadequate training is indicated as a cause of delay for success.

Conclusion

A good training programme is an important contributor towards a successful adoption.

Q1E Presence of a Knowledgeable Champion

Strong evidence from all research suggests this is a major factor. Considering the complexity of the technology and the change involved it is no surprise that the findings point to the need for the guidance, leadership and technical expertise of a knowledgeable champion as identified in the literature. It is clear from Godfrey Hirst's experience that other factors, eg. management support and involvement, are a necessary requirement to avail of the benefits of a knowledgeable champion.

Conclusion

A knowledgeable champion is an important contributor to a successful adoption if adequately supported.

Q1F Team Approach

Was not highlighted in the preliminary investigation as a key factor. Brintons evidence suggests that it helped. Godfrey Hirst's results indicate that a team approach would have been a help.

Conclusion

A team approach is helpful but not crucial.

Of the six rationalist factors assessed, management support, a good training programme and the presence of a knowledgeable champion are the major factors and if present together are likely to overcome other difficulties that might arise.

Q2 Fear of Change, Loss of Influence etc

There is some suggestion in the preliminary investigation that these fears exist. This was also confirmed by management of two companies. However, in the case studies the overwhelming evidence is that fear is not a factor. In fact the results point to a very positive response to the consequences of adopting this technology.

Conclusion

Fear caused by the adoption of this technology is not a key factor.

Q3 Culture Type

Brintons clearly have a more supportive type culture and better communication than Godfrey Hirst. The "Despende" cultural survey indicates that Brintons are market oriented and hence more innovative. The literature suggests that the foregoing conditions present at Brintons make it more amenable to successfully adopting new technology. This inconclusive evidence suggests that Brintons' culture is more suitable to successfully adopting a new technology.

Conclusion

Culture does have an impact that is not easily defined and probably not major.

Q4 Management Style

Management style at Godfrey Hirst is fairly autocratic and does not encourage participation from employees. This is reflected in its approach to this adoption typified by poor communications, an inability to deal with problems and a perception of poor management support by all concerning the technology. Brintons outperformed Godfrey Hirst in all of these criteria suggesting a likely relationship between its management style and its success. Similarly with culture management style probably influences the way the rationalist factors operate and also the degree of effectiveness they enjoy.

Conclusion

It is likely that management style has an impact but not major.

See recommendation for adoption of a computerised match prediction. Appendix IX.

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Appendices

Appendix I

Profile of Usage - Godfrey Hirst

Source: Godfrey Hirst Management

Feature	Full Use	Tool	Measure of Success
Colour Grading	✓		1 2 3 4 **(5)**
Match Prediction		✓	1 2 3 4 **(5)**
Match Correction		✓	1 2 **(3)** 4 5
Raw Material Assessment	✓		1 2 3 4 **(5)**
Stock Control			1 2 3 4 5
MRP Application			1 2 3 4 5
Integration with other systems			1 2 3 4 5
Dye Selection		✓	1 2 3 **(4)** 5
Effluent Control			1 2 3 4 5
Transmission measurement	TRIALS	ONLY	1 2 3 4 5
Re-use of dye liquor		✓	1 2 3 **(4)** 5
Sample Trials		✓	1 2 3 4 **(5)**

1. Unsuccessful
2. Slightly Successful
3. Reasonably Successful
4. Successful
5. Very Successful

Definitions

Full Use - products are processed through the system

Tool - system is used as an additional tool to back up manual system

Appendix II

Profile of Usage - Brintons

Source : Brintons Carpets Management

Feature	Full Use	Tool	Measure of Success
Colour Grading	✓		1 2 3 4 **5**
Match Prediction		✓	1 2 **3** 4 5
Match Correction		✓	**1** 2 3 4 5
Raw Material Assessment	✓		1 2 3 **4** 5
Stock Control	✓		1 2 3 4 **5**
MRP Application			1 2 3 4 5
Integration with other systems			1 2 3 4 5
Dye Selection		✓	1 2 **3** 4 5
Effluent Control			1 2 3 4 5
Transmission measurement			1 2 3 4 5
Re-use of dye liquor			1 2 3 4 5
Sample Trials	✓		1 2 3 **4** 5

1. Unsuccessful 2. Slightly Successful
3. Reasonably Successful 4. Successful 5. Very Successful

Definitions

Full Use - products are processed through the system

Tool - system is used as an additional tool to back up manual system

Questionnaire

Appendix III

Management

1.	This technology was purchased in order to	A.	Fully use its potential eventually
	Please indicate by circling A, B or C	B	Merely act as a tool for back up
		C	Fully use only some of its features

Please circle appropriate number and comment if you feel it will be helpful

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
2.	There was a critical need to acquire this technology Please explain what was critical _____ _____ _____ _____ _____	**1**	**2**	**3**	**4**	**5**
3.	The adoption/development of this technology was part of key company strategy. Please explain _____ _____ _____ _____ _____	**1**	**2**	**3**	**4**	**5**

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
4.	I had a good understanding of the potential of this technology before purchase _____ _____ _____ _____ _____	1	2	3	4	5
5.	The technology champion * was adequately knowledgeable and properly prepared to effect a successful implementation	1	2	3	4	5
6.	The technology champion received top management support	1	2	3	4	5
7.	The technology champion received line management support	1	2	3	4	5
8.	The technology champion received adequate resource support eg, time, facilities, access etc	1	2	3	4	5

* The technology champion is the person charted with organising and driving the implementation of this technology.

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
9.	The technology champion had previous experience in this technology. Expand if necessary. _____ _____ _____ _____ _____	1	2	3	4	5
10.	Training was adequate Please expand if necessary. _____ _____ _____ _____ _____	1	2	3	4	5
11.	I was aware of the nature and extent of the problems that would be encountered during implementation.	1	2	3	4	5
12.	Training was more difficult than anticipated.	1	2	3	4	5
13.	The culture of the company at the time of implementation was conducive to change, eg this technology adoption.	1	2	3	4	5

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
14.	All employees concerned were involved in the planning stage prior to purchase. Expand if necessary	1	2	3	4	5
15.	Employees involvement from the earliest stage is very helpful	1	2	3	4	5
16.	Management adequately explained the benefits of this technology to all users.	1	2	3	4	5
17.	Everybody involved was capable of learning the system	1	2	3	4	5
18.	Management support was adequate to solve users problems.	1	2	3	4	5
19.	I expected the workload to decrease once the system was up and running.	1	2	3	4	5

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
20.	The workload increased due to this system. Explain if necessary. _____ _____ _____ _____ _____	1	2	3	4	5
21	A team approach was used to solve problems. Expand if necessarry _____ _____ _____ _____ _____	1	2	3	4	5
22.	Vendor support was adequate. Please expand if necessary. _____ _____ _____ _____ _____	1	2	3	4	5
23.	The benefits of the technology were greatly exaggerated by the vendor.	1	2	3	4	5

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
24.	The company tried to do too much too fast. Explain further if necessary. _____ _____ _____ _____ _____	1	2	3	4	5

25.	Did the technology demand any structural change in the organisation	**Yes**	**No**
	If yes please explain _____ _____ _____ _____ _____		
26.	Were major problems encountered during implementation	**Yes**	**No**
	If yes please explain _____ _____ _____ _____ _____ _____		

27.	Please indicate what areas problems were experienced	Training
		Resistance
		Technology performance Consistency
		Facilitator
		Resources
		Vendor support
		Union involvement
		Management support Others, explain if necessary

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
28.	There was resistance to this technology	1	2	3	4	5
29.	As a manager I understood the basis to this resistance. Please explain. _____ _____ _____ _____ _____	1	2	3	4	5
30.	With hindsight, this technology has been worthwhile acquiring.	1	2	3	4	5

31.	Briefly explain what changes in approach you would make if starting over again.

Questionnaire

Users

1.	This technology was purchased in order to	A	Eventually use all its functions
		B	Merely act as a tool
	Please indicate by circling A, B, C or D	C	Fully use some features
		D	Don't know

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
2.	There was a critical need to acquire this technology Please indicate what was critical. _____ _____ _____ _____ _____	1	2	3	4	5
3.	This technology was a key part of company strategy. Please explain if necessary. _____ _____ _____ _____ _____	1	2	3	4	5
4.	I understood this technology before purchase	1	2	3	4	5
5.	I understood clearly why the company acquired this technology	1	2	3	4	5

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
6.	Technology induction program was adequate. Explain if necessary. _____ _____ _____ _____ _____	1	2	3	4	5
7.	Training program was good. Explain if necessary. _____ _____ _____ _____ _____	1	2	3	4	5
8.	Sufficient time for training was made available	1	2	3	4	5
9.	A user manual was made available	1	2	3	4	5
10	Technology champion* understood my problems	1	2	3	4	5
11.	I worked as part of a team on this project. Explain if necessary. _____ _____ _____ _____	1	2	3	4	5

* Technology champion is the person charged with organising and driving the implemntation of this technology.

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
12.	Problems were discussed and solved on a team basis rather than on a one on one basis.	1	2	3	4	5
13.	Management understood my problems. Comment. _____ _____ _____ _____	1	2	3	4	5
14.	Management support was adequate. Comment _____ _____ _____ _____	1	2	3	4	5
15.	I clearly understood the advantages this technology had for the company	1	2	3	4	5
16	My immediate supervisor understood and was supportive concerning problems I had with this technology. Comment _____ _____ _____ _____	1	2	3	4	5

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
17..	This technology makes my job more important. Comment. _____ _____ _____ _____	1	2	3	4	5
18.	This technology makes my job more interesting. Comment _____ _____ _____ _____	1	2	3	4	5
19	This technology reduces the control/input I have over my job. Comment _____ _____ _____ _____	1	2	3	4	5
20.	This technology has potential to do a better job than the previous manual system. Comment _____ _____ _____ _____	1	2	3	4	5

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
21..	This technology changes my job and the way I perform it. Comment. _____ _____ _____ _____	1	2	3	4	5
22.	This technology removes some of my skills from the task. Comment. _____ _____ _____ _____	1	2	3	4	5
23.	With this new system I will acquire new skills. Comment _____ _____ _____ _____	1	2	3	4	5
24.	This system holds benefits for me (eg. satisfaction, status, etc) Please explain. _____ _____ _____ _____ _____	1	2	3	4	5
25	This system reduces my workload	1	2	3	4	5

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
26	This system could lead to job losses if successfully implemented and operated.	1	2	3	4	5
27.	I was involved from an early stage in the planning for this adoption. Please explain. _____ _____ _____ _____ _____	1	2	3	4	5
28.	My views were seriously considered	1	2	3	4	5
29.	I had an impact on the way this system was implemented. Please explain _____ _____ _____ _____ _____	1	2	3	4	5
30.	I co-operated fully with management on this project. Please explain _____ _____ _____ _____	1	2	3	4	5
31.	This company will reward my successful use of this technology	1	2	3	4	5

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
32.	The full use of this system will lead to more consistency in colour measurement and reproducibility of shades	1	2	3	4	5

Please include here any comments you feel may be relevant

Questionnaire Results

Godfrey Hirst Users

Technology Survey
Company A Group - Users

Question	1	2	3	4	5	6	7	8	9	Mean	Std Dev
1											
2	3	1	3	3	5	3	4	4	3	3.22	1.09
3	3	2	2	2	5	3	4	4	3	3.11	1.05
4	2	4	3	4	2	4	2	4	4	3.22	0.97
5	2	2	2	3	4	4	2	3	4	2.89	0.93
6	5	5	5	2	5	4	2	4	3	3.89	1.27
7	1	4	5	2	5	5	2	2	4	3.33	1.58
8	1	4	3	1	3	5	2	2	5	2.89	1.54
9	2	2	2	1	5	4	4	2	4	2.89	1.36
10	1	2	3	1	5	4	3	3	5	3.00	1.50
11	2	2	3	2	5	4	4	4	3	3.22	1.09
12	2	2	3	2	5	4	5	3	5	3.44	1.33
13	2	3	3	3	5	4	3	3	3	3.22	0.83
14	4	3	3	3	2	4	3	3	3	3.11	0.60
15	2	1	1	2	2	4	2	3	3	2.22	0.97
16	5	2	3	2	2	4	2	2	2	2.67	1.12
17	2	4	3	1	5	4	4	2	3	3.11	1.27
18	1	4	2	1	5	4	5	2	3	3.00	1.58
19	5	3	3	4	5	4	2	4	4	3.78	0.97
20	1	3	1	1	2	3	4	3	1	2.11	1.17
21	1	2	4	3	5	4	2	3	3	3.00	1.22
22	4	2	3	4	5	3	2	3	4	3.33	1.00
23	2	2	2	1	3	4	4	2	3	2.56	1.01
24	2	2	3	2	3	3	4	2	4	2.78	0.83
25	4	1	4	3	5	3	4	2	4	3.33	1.22
26	2	2	4	4	5	5	4	4	5	3.89	1.17
27	4	5	5	4	5	5	4	4	2	4.22	0.97
28	2	5	3	3	5	5	5	3	3	3.78	1.20
29	2	5	3	3	5	5	5	4	3	3.89	1.17
30	2	2	3	2	3	3	2	3	3	2.56	0.53
31	2	5	3	3	5	3	5	4	4	3.78	1.09
32	1	1	1	1	3	3	5	2	2	2.11	1.36
	2.39	2.81	2.94	2.35	4.16	3.90	3.39	3.00	3.39	3.15	0.62

Technology Survey											
Company A - Group		Management									
Question	1	2	3	4	5	6	7	8	9	Mean	Std Dev
1											
2	1	2	2							1.67	0.58
3	2	3	2							2.33	0.58
4	1	2	2							1.67	0.58
5	1	4	2							2.33	1.53
6	2	3	2							2.33	0.58
7	4	3	4							3.67	0.58
8	2	4	2							2.67	1.15
9	2	4	3							3.00	1.00
10	2	4	4							3.33	1.15
11	5	2	2							3.00	1.73
12	1	2	2							1.67	0.58
13	5	2	2							3.00	1.73
14	5	4	4							4.33	0.58
15	2	4	3							3.00	1.00
16	2	4	2							2.67	1.15
17	1	2	3							2.00	1.00
18	4	4	3							3.67	0.58
19	2	4	2							2.67	1.15
20	4	2	3							3.00	1.00
21	4	4	2							3.33	1.15
22	2	4	3							3.00	1.00
23	4	2	2							2.67	1.15
24	4	3	3							3.33	0.58
25											
26											
27											
28	1	2	2							1.67	0.58
29	2	2	2							2.00	0.00
30	2	2	1							1.67	0.58

Questionnaire Results
Godfrey Hirst Management

Questionnaire Results
Brintons Carpets Users

Technology Survey											
Company	B Group -	Users									
Question	1	2	3	4	5	6	7	8	9	Mean	Std Dev
1											
2	3	1	3	2						2.25	0.96
3	2	1	2	2						1.75	0.50
4	4	3	4	2						3.25	0.96
5	3	2	2	2						2.25	0.50
6	3	1	2	2						2.00	0.82
7	4	2	2	2						2.50	1.00
8	3	1	2	2						2.00	0.82
9	2	2	2	2						2.00	0.00
10	2	1	2	2						1.75	0.50
11	2	1	2	2						1.75	0.50
12	2	1	2	2						1.75	0.50
13	4	2	2	3						2.75	0.96
14	2	1	2	2						1.75	0.50
15	2	2	1	2						1.75	0.50
16	1	2	1	2						1.50	0.58
17	1	2	4	4						2.75	1.50
18	1	1	2	2						1.50	0.58
19	4	2	4	5						3.75	1.26
20	1	2	2	1						1.50	0.58
21	2	3	2	2						2.25	0.50
22	4	2	4	4						3.50	1.00
23	1	1	2	2						1.50	0.58
24	3	2	2	2						2.25	0.50
25	3	4	2	2						2.75	0.96
26	4	5	4	4						4.25	0.50
27	2	2	2	3						2.25	0.50
28	3	2	4	3						3.00	0.82
29	4	4	4	3						3.75	0.50
30	2	1	2	2						1.75	0.50
31	3	2	2	3						2.50	0.58
32	1	1	1	1						1.00	0.00

Questionnaire Results

Brintons Carpets Management

Technology Survey											
Company	B Group -	Management									
Question	1	2	3	4	5	6	7	8	9	Mean	Std Dev
1											
2	1	1								1.00	0.00
3	1	1								1.00	0.00
4	3	2								2.50	0.71
5	1	2								1.50	0.71
6	1	1								1.00	0.00
7	1	2								1.50	0.71
8	1	1								1.00	0.00
9	1	1								1.00	0.00
10	1	1								1.00	0.00
11	2	3								2.50	0.71
12	3	2								2.50	0.71
13	2	1								1.50	0.71
14	1	4								2.50	2.12
15	1	4								2.50	2.12
16	1	2								1.50	0.71
17	1	2								1.50	0.71
18	2	2								2.00	0.00
19	4	2								3.00	1.41
20	1	2								1.50	0.71
21	1	4								2.50	2.12
22	4	4								4.00	0.00
23	2	4								3.00	1.41
24	4	4								4.00	0.00
25											
26											
27											
28	5	4								4.50	0.71
29	3	4								3.50	0.71
30	1	1								1.00	0.00

ORGANISATIONAL CULTURE

These questions relate to what your company is like. Each of these items contains four descriptions of organisations. Please distribute 100 points among the four descriptions depending on how *similar* the description is to your company. None of the descriptions is any better than any other; they are just different. *For each question, please use all 100 points.* You may divide the points in any way you wish. Most businesses will be some mixture of those described. There is no right answer.

KIND OF ORGANISATION (PLEASE DISTRIBUTE 100 POINTS)

PLEASE READ A TO D FIRST BEFORE ALLOCATING POINTS

A	My organisation is very output focused. A major concern is with getting the job done, without much personal involvement	...../100 POINTS FOR A
B	My organisation is a very dynamic and entrepreneurial place. People are willing to stick their necks out and take risks.	+ ...../100 POINTS FOR B
C	My organisation is a very formalised and structured place. Established procedures generally govern what people do.	+ ...../100 POINTS FOR C
D	My organisation is a very personal place. It is like an extended family. People seem to share a lot of themselves	+ ...../100 POINTS FOR D
		100 Total Points

LEADERSHIP (PLEASE DISTRIBUTE 100 POINTS)

PLEASE READ A TO D FIRST BEFORE ALLOCATING POINTS

A	Managers in my organisation are generally considered to be mentors (wise or trusted advisers or guides)	...../100 POINTS FOR A
B	Managers in my organisation are generally considered to be administrators	+ ...../100 POINTS FOR B
C	Managers in my organisation are generally considered to be innovators	+ ...../100 POINTS FOR C
D	Managers in my organisation are generally considered to be hard-drivers (results/output focused)	+ ...../100 POINTS FOR D
		100 Total Points

WHAT HOLDS THE ORGANISATION TOGETHER (DISTRIBUTE 100 POINTS)

PLEASE READ A TO D FIRST BEFORE ALLOCATING POINTS

A	The glue that holds my organisation together is commitment to innovation and development. There is an emphasis on being first.	...../100 POINTS FOR A
B	The glue that holds my organisation together is loyalty and tradition. Commitment to this runs high	...../100 POINTS FOR B
C	The glue that holds my organisation together is tasks and goal accomplishment. An output focus is commonly shared	...../100 POINTS FOR C
D	The glue that holds my organisation together is formal rules and policies. Maintaining a smooth-running organisation is important here.	...../100 POINTS FOR D
		100 Total Points

WHAT IS IMPORTANT (PLEASE DISTRIBUTE 100 POINTS)

PLEASE READ A TO D FIRST BEFORE ALLOCATING POINTS

A	My organisation emphasises permanence and stability. Efficient, smooth operations are important	...../100 POINTS FOR A
B	My organisation emphasises growth and acquiring new resources. Readiness to meet new challenges is important	...../100 POINTS FOR B
C	My organisation emphasises human resources. High cohesion and morale in the firm are important	...../100 POINTS FOR C
D	My organisation emphasises competitive actions and achievements. Measurable goals are important	...../100 POINTS FOR D
		100 Total Points

Thankyou for your assistance

Please return the questionnaire in the envelope provided and we will send you a copy of the report prepared from the data.

If you would like us to send you a copy of "Literacy Training Best Practice in Australian Industry" for $50, please tick.

please tick for a copy(s)

☐

DIALOG

67

WORLD TEXTILES

Information Retrieval Service

FILE DESCRIPTION

WORLD TEXTILES has been produced by Elsevier Science Publishers since 1990, following their takeover from the Shirley Institute. It provides coverage of world literature on the science and technology of textile and related materials; on the technical economics, production, and management of the textile and allied industries; and on the consumption of and international trade in textile materials and products. It offers comprehensive coverage of the world's relevant textile literature as recorded from about 500 international primary and secondary sources since January 1970. The database corresponds to the print *World Textile Abstracts*.

SUBJECT COVERAGE

WORLD TEXTILES covers a wide range of textile-relevant subject matter including:

- Synthesis, Physics, and Chemistry of Polymers for Fibers
- Science, Technology, Properties, Products, and Utilization of Fibers, Yarns, and Fabrics
- Chemical and Mechanical Treatment of Textiles
- Technical Management and Economics of Production Processes
- Production, Consumption, and International Trade Data
- Test Methods, Quality Control, Specifications, Standards, and Legislation
- Pollution, Safety, and Health Hazards
- Utilization of Textiles in Industrial, Medical, and Other Applications
- Directory Listings for the Textile and Related Industries

SOURCES

WORLD TEXTILES provides access to approximately 500 periodicals published throughout the world. In addition, U.K., U.S., and European patents; U.K., U.S., and international standards; books; pamphlets; technical and conference reports; statistical publications; and many other forms of published information are covered.

DIALOG FILE DATA

Inclusive Dates:	January 1970 to the present
Update Frequency:	Monthly (approximately 600 records per update)
File Size:	171,000 records as of March 1991

ORIGIN

WORLD TEXTILES is produced by Elsevier Science Publishers. Questions concerning file content should be directed to:

Ian Woods
Elsevier Science Publishers LTD
Regency House
34 Duke Street
Norwich NR3 3AP
England

Telephone: 0603 626327
Telex: 975247 CHACOM G
Fax: 0603 667934
DIALMAIL: 14281

DIALOG

Information Retrieval Service

119

TEXTILE TECHNOLOGY DIGEST

FILE DESCRIPTION

TEXTILE TECHNOLOGY DIGEST, produced by the Institute of Textile Technology, provides international coverage of the literature of textiles and related subjects. Selected articles from current technical sources summarize the technological advancements and applications of science and research to the textile industry. Coverage includes the various aspects of textile production and processing, as well as the automation and management systems of these operations. TEXTILE TECHNOLOGY DIGEST corresponds to the print publication of the same name.

Most TEXTILE TECHNOLOGY DIGEST records (approximately 90%) contain abstracts.

SUBJECT COVERAGE

TEXTILE TECHNOLOGY DIGEST provides information on virtually every area relevant to textiles, including the following:

- Conferences, Forecasts, Education, Research
- Physics, Biology, Chemistry, General Sciences
- Management, Industrial Engineering, Unions
- Testing and Measurement
- Laundering, Drycleaning, Care Labeling
- Apparel Design and Production
- Dyeing and Finishing of Textiles
- Industrial Fabrics, Surgical Products, Home Furnishings
- Geotextiles, Composites, Ropes
- Polymers, Man-made Fibers, Natural Fibers
- Conservation and Preservation of Textiles
- Machinery and Parts for Mills and Labs
- Home Economics, Consumerism, Retailing
- Chemicals, Dyes, Resins, Catalysts
- Pollution, Carcinogens, Safety, Energy
- Marketing, Quality Control, Statistics
- Yarn and Fabric Manufacturing Techniques

SOURCES

TEXTILE TECHNOLOGY DIGEST provides access to articles, books, pamphlets, reports, theses, trade literature, surveys, standards, specifications, conferences, directories, statistical publications, translations, and exhibitions in the world's published literature. Over 650 periodicals are scanned for coverage. Patents are included only up to 1985.

DIALOG FILE DATA

Inclusive Dates:	January 1978 to the present
Update Frequency:	Monthly (approximately 700 records per update)
File Size:	185,000 records as of April 1991

ORIGIN

TEXTILE TECHNOLOGY DIGEST is produced by the Institute of Textile Technology. Questions concerning file content should be directed to:

Dennis Loy, Senior Editor
Textile Technology Digest
Institute of Textile Technology
P.O. Box 391
Charlottesville, VA. 22902-0391

Telephone: 804/296-5511
Fax: 804/977-5400

No special terms or conditions.

DIALOG

399, 308, 309, 310, 311, 312

CA SEARCH*

Information Retrieval Service

FILE DESCRIPTION

CA SEARCH combines the condensed version of *Chemical Abstracts** with controlled vocabulary CA General Subject Index Headings and CAS* Registry Numbers, each with its modifying phrase. Related general subject terminology from the CA *Index Guide** is also included. Chemical substances are represented by CAS Registry Numbers. Corresponding substance information may be searched in the DIALOG chemical substance files such as CHEMNAME™ (File 301).

All records from the 8th Collective Index Period forward are contained in File 399; Files 308-312 contain records from the individual Collective Index Periods as indicated in the table below.

SUBJECT COVERAGE

The literature of chemistry and its applications is divided into the following principal areas:

- Applied Chemistry
- Biochemistry and Biology
- Chemical Engineering
- Classes of Substances
- Macromolecular Chemistry
- Organic and Inorganic Chemistry
- Physical and Analytical Chemistry
- Properties and Reactions

SOURCES

The following sources are included in CA SEARCH: journal articles, patents, reviews, technical reports, monographs, conference and symposium proceedings, dissertations, and books.

DIALOG FILE DATA

File	Collective Index Period	Inclusive Dates	Accession Numbers	Update Frequency	File Size
399	8th-	1967-present	66000001-	Biweekly	8,072,239‡
308	8th	1967-1971	66000001-75157995	Closed File	1,314,665
309	9th	1972-1976	76000001-85201798	Closed File	1,772,194
310	10th	1977-1981	86000001-95231484	Closed File	2,201,680
311	11th	1982-1986	96000001-105237781	Closed File	2,302,409
312	12th	1987-1991	106000001-	Biweekly (approximately 17,000 records per update)	491,757‡

‡As of January 1988, Volume 108, Issue 2.

ORIGIN

CA SEARCH is produced by Chemical Abstracts Service. Questions concerning file content should be directed to:

Manager, User Education
Chemical Abstracts Service* (CAS*)
P.O. Box 3012
Columbus, OH 43210

or

DIALOG Customer Services
Dialog Information Services, Inc.
3460 Hillview Avenue
Palo Alto, CA 94304
Telephone: 800-3-DIALOG (800-334-2564)
415/858-3810
DIALMAIL: DIALOG CUSTSERV

DIALOG

240,840

PAPERCHEM

Information Retrieval Service

FILE DESCRIPTION

PAPERCHEM is a comprehensive database covering international patent and journal literature related to pulp and paper technology and including such related subjects as the chemistry of cellulose, hemicellulose, carbohydrates, lignin, and extractives; engineering and process control; corrugated and particle board; forestry; graphic arts; corrosion; equipment; packaging; pollution; water; and power. Nearly 1,000 periodicals in more than 20 languages are screened as well as the patent gazettes of six major countries. The database corresponds to the print *Abstract Bulletin of The Institute of Paper Science and Technology*.

All PAPERCHEM records include bibliographic references and over 95% of the records include abstracts. A corporate source field is included whenever provided in the original source publication. All records are assigned descriptors from a controlled vocabulary.

SUBJECT COVERAGE

PAPERCHEM covers virtually every topic related to the chemistry, engineering, and production technology used by the pulp and paper industry. Typical subjects covered are:

- Pulp, Paper, and Board
- Packaging
- Engineering and Process Control
- Finishing and Converting
- Gluing, Labeling, and Sealing
- Films, Foils, and Laminates
- Fiber Webs and Nonwovens
- Forestry and Pulpwood
- Spent Liquors and Pollution Control
- Silvichemicals and Residues
- Mill Construction and Operation
- Machinery Equipment and Maintenance
- Graphic Arts
- Corrosion
- Economics and Research
- Tissue Culture

SOURCES

Included in PAPERCHEM are abstracts of journal articles, books, dissertations, patents, review and research articles, symposia, and translations. Patents comprise approximately 40% of the records in this file.

DIALOG FILE DATA

Inclusive Dates:	July 1967 to the present
Update Frequency:	Monthly except June (approximately 1,200 records per update)
File Size:	Approximately 267,180 records as of August 1989

ORIGIN

PAPERCHEM is produced by The Institute of Paper Science and Technology (formerly The Institute of Paper Chemistry). Questions regarding the PAPERCHEM file, its content, access restrictions, or document delivery services should be directed to:

Database Manager
Information Services Division
The Institute of Paper Science and Technology
575 14th Street NW
Atlanta, GA 30318

Telephone: 404/853-9500
Fax: 404/853-9510

The PAPERCHEM database, copyrighted by The Institute of Paper Science and Technology, is essentially a private file whose usage is restricted mainly to the Institute's supporting member companies and to those organizations who wish to pay the prescribed annual subscription fee. The subscription fee provides users with unlimited access at a significantly reduced price through DIALOG's File 840. The Institute recognizes the need for limited or casual access by some organizations to respond to infrequent inquiries or to evaluate becoming a PAPERCHEM subscriber. DIALOG File 240 is offered to meet these needs.

Dialog

293

ENGINEERED MATERIALS ABSTRACTS

Information Retrieval Service

FILE DESCRIPTION

ENGINEERED MATERIALS ABSTRACTS (EMA) is a joint production of ASM International (US) and Institute of Metals (UK). The database corresponds to the publication of the same name, which began publication in January 1986. Informative abstracts are included for most records.

SUBJECT COVERAGE

EMA provides comprehensive coverage of the world's published literature concerning: 1) the science of polymers, ceramics, and composite materials intended for use in the design, construction, and operation of structures, equipment and systems; and 2) the practices of materials science and engineering as they relate to these materials. Composite materials represented in the coverage are primarily non-metallic, with ceramic or polymeric matrices. Laminated and composite structures, such as honeycombs, essentially consist of non-metallic materials, although metal flakes, fibers, or other forms may occur as reinforcement.

Subjects covered include materials, properties, processes, products, and forms of these engineered materials.

SOURCES

Each month about 1,500 documents from a variety of international sources are scanned and abstracted for the EMA database, with intensive coverage of appropriate journals, conference papers, reviews, technical reports, books, dissertations, government reports, and U.S., British, and European patents. Approximately 80% of the sources cited are in English.

DIALOG FILE DATA

Inclusive Dates:	January 1986 to the present
Update Frequency:	Monthly (approximately 1,500 records per update)
File Size:	24,000 records as of August 1987

ORIGIN

EMA is produced by Materials Information, a joint service of ASM International (US) and the Institute of Metals (UK). Questions concerning the content should be directed to:

Barbara Sanduleak
Manager, Information Services
Materials Information
ASM International
Metals Park, OH 44073

Telephone: 216/338-5151 ex. 620
Telex: 980-619
DIALMAIL: 13073

? compute[illegible]match?(w)predict?(w)syste--?
38953 COMPUTER?
4391 MATCH?
9408 PREDICT?
110128 SYSTEM?
S1 4 COMPUTER?(W)MATCH?(W)PREDICT?(W)SYSTEM?
?type 1/3/1-3^H4

1/3/1 (Item 1 from file: 119)
DIALOG(R)File 119:Textile Technol.Dig.
(c) 1994 Inst.of Textile Technology. All rts. reserv.

484295 07371/85
UNITED KINGDOM TEXTILE MACHINERY: A HIGH-TECH SPECIALITY INDUSTRY.
African Textiles
: 19; 21-23 (Apr./May 1985).
CODEN: ATEXDN; ATEX

1/3/2 (Item 2 from file: 119)
DIALOG(R)File 119:Textile Technol.Dig.
(c) 1994 Inst.of Textile Technology. All rts. reserv.

429586 08416/82
MACBETH CMS/III COLOR MATCHING SYSTEM.
Macbeth, A Division of Kollmorgen Corp., P.O. Box 950; Newburgh, New York 12550,
June 10, 1982. 1 p.

1/3/3 (Item 1 from file: 248)
DIALOG(R)File 248:PIRA
(c) 1994 Pira International. All rts. reserv.

0223968 Pira Acc. Num.: 9883523 Pira Abstract Numbers: 08-91-PT01651
Title: COLOUR MATCHING SYSTEM LEADS TO COST SAVINGS
Authors: Anon
Source: Converter vol. 28; no. 1; Jan. 1991; p. 10
ISSN: 0010-8189
Publication Year: 1991
Document Type: Journal Article
Language: English

1/3/4 (Item 2 from file: 248)
DIALOG(R)File 248:PIRA
(c) 1994 Pira International. All rts. reserv.

0029781 Pira Acc. Num.: 3221062 Pira Abstract Numbers: 02-80-01062
Title: COMPUTERIZED COLOUR MATCHING
Authors: Johnson A
Source: BR. INK MKR vol 22 no 1 Nov 1979 pp 22-24
Publication Year: 1979
Document Type: Journal Article
Language: unspecified
?logoff

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        $0.12     0.004 Hrs File1
  $0.12  Estimated cost File1
  $0.10  MARKNET
  $0.22  Estimated cost this search
  $0.22  Estimated total session cost    0.004 Hrs.
le 411:DIALINDEX(R)

ALINDEX(R)
(c) 1994 Dialog Info.Svcs.

* DIALINDEX search results display in an abbreviated ***
t format unless you enter the SET DETAIL ON command. ***
extile
You have 7 files in your file list.
(To see banners, use SHOW FILES command)
f
No valid files specified
how files

le Name
-- -------------

computer?(w)math?(w)r^Hpredict?(w)system?
No files selected.  Use SET FILES to choose at least two files; then use
     SELECT alone to reissue this SELECT statement.
 textile
You have 7 files in your file list.
(To see banners, use SHOW FILES command)
computer(^H?(w)math?(w)predict?(w)system?
ur SELECT statement is:
 computer?(w)math?(w)predict?(w)system?
         Items    File
         -----    ----

No files have one or more items; file list includes 7 files.

computer?(w)math^Hch?(w)predict?(w)system?
ur SELECT statement is:
 computer?(w)match?(w)predict?(w)system?
         Items    File
         -----    ----
             2    119: Textile Technol.Dig._1978-1994/Jun
             2    248: PIRA_1975-1994/Oct B1

2 files have one or more items; file list includes 7 files.

(computer?(w)match?(w)predict?(w)st^Hystem?) and ((introduc? or implement
ur SELECT statement is:
 (computer?(w)match?(w)predict?(w)system?) and ((introduc? or
lement) and problem?)
         Items    File
         -----    ----

No files have one or more items; file list includes 7 files.

19,248
   22aug94 19:27:43 User015286 Session D992.2
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  $3.00  Estimated cost File411
  $2.52  MARKNET
  $5.52  Estimated cost this search
  $5.74  Estimated total session cost    0.104 Hrs.

TEM:DS  - DIALOG OneSearch
le 119:Textile Technol.Dig.  1978-1994/Jun
     (c) 1994 Inst of Textile Technology
le 248:PIRA  1975-1994/Oct B1
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Appendix VII

Recommendations

As a result of the foregoing research, the following recommendations are suggested for the optimisation of the adoption of a Computerised Match Prediction System.

1. Get a sound basic understanding of the technology and its potential impact on the employees.

2. Understand the strategic benefits this technology has for your organisation and be prepared to convince all concerned of these benefits.

3. Employ a knowledgeable technologist with implementation experience. Alternatively, be prepared to train a well rounded technical employee full time off site for at least two months. This time will give enough exposure to prepare the employee for advance applications of the technology for the future.

4. Once the decision to proceed is taken, involve all concerned to secure their commitment and contribution. It is important to resolve all management doubts before arrival of the technology.

5. Secure and circulate freely, literature on the technology and try to create enthusiasm whilst at the same time dealing with any apprehensions that arise.

6. An adequate training programme must be prepared and be flexible enough to change with the inevitable changes/challenges that will certainly arise. Note that vendor support is very inadequate as discovered by this research and by this researcher whilst compiling facts.

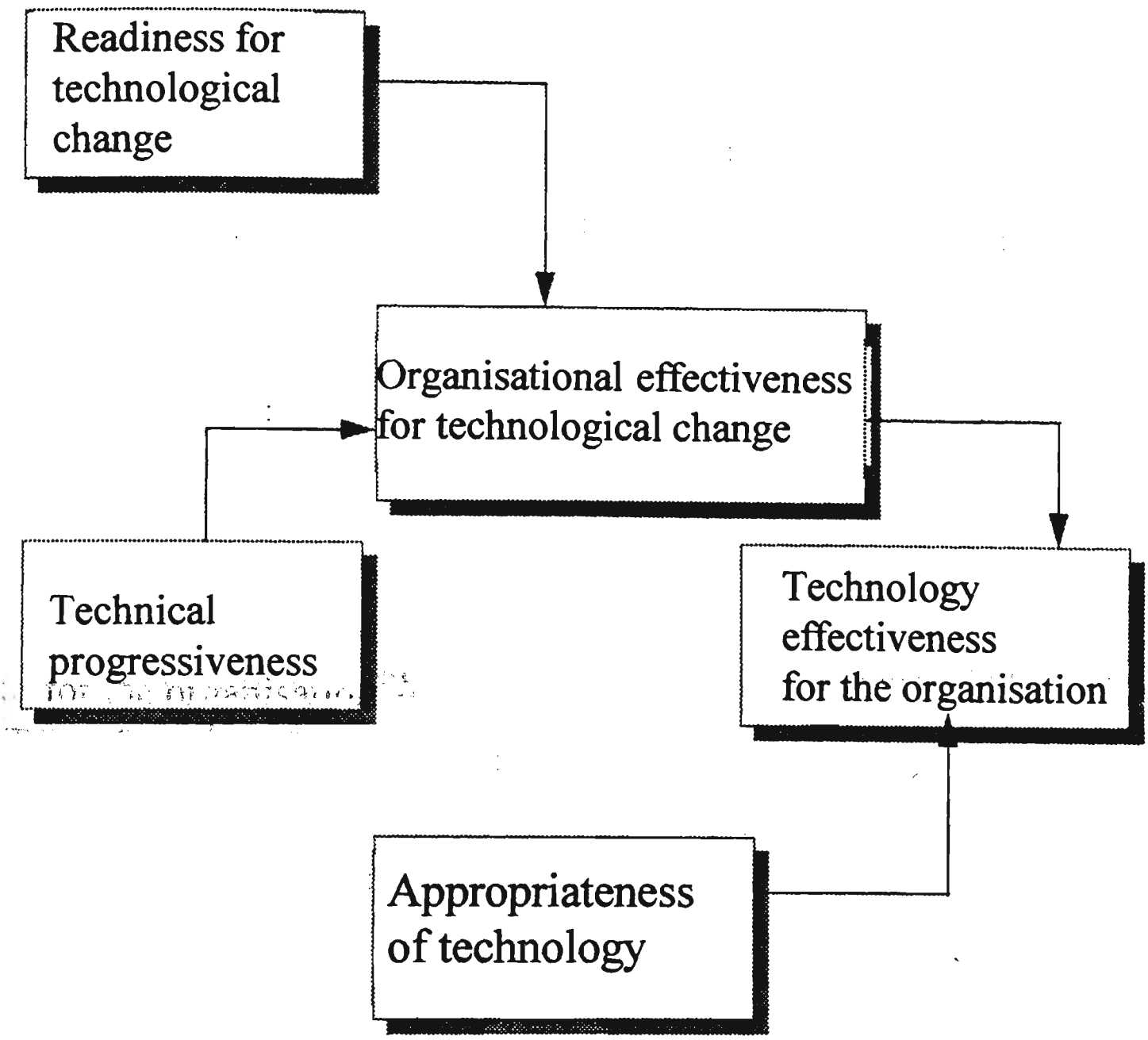
7. Continually encourage participation on the part of users in the process and in decision making.

8. Create a climate of support, particularly during training and ensure all involved feel the enthusiasm of top management.

Should this approach be foreign to the organisations' traditional approach, then this would be a good time to start on the road to change and let the arrival of computerised match prediction technology signal a new beginning.

Models of Effective Technology Adoption

Agrawal RK 1992



Student t-test Calculations

Line Management Support

$$t = \frac{3.67 - 1.5}{.29\sqrt{1/3 + 1/2}} = \frac{2.17}{0.533287} = 4.069$$

Induction Training

$$t = \frac{3.89 - 2.0}{1.04\sqrt{1/9 + 1/4}} = \frac{1.89}{0.38755} = 5.03277$$

Early Involvement of Users

$$t = \frac{4.22 - 2.25}{.74\sqrt{1/9 + 1/4}} = \frac{1.97}{0.25247} = 7.80277$$