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Shiromi Arunatileka
University of Western Sydney

Athula Ginige
University of Western Sydney

Ana Hol
University of Western Sydney

Robyn Lawson
University of Western Sydney

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Robyn Lawson, Shiromi Arunatileka, Athula Ginige, Ana Hol

University of Western Sydney, Australia
r.lawson@uws.edu.au, shiromi@cit.uws.edu.au, a.ginige@uws.edu.au, a.hol@uws.edu.au

Abstract

This paper outlines developments in a pilot project established to investigate possible strategies that could be adopted by Australian toolmakers to allow them to be more competitive in the global market. The toolmakers agreed to eTransforming their individual businesses, and to collaborate with each other as a virtual organization. Results to date show progress in eTransforming their organizations and steady movement towards eCollaboration. It is suggested that trust is a crucial underlying aspect of successful collaboration, and as such needed to be addressed earlier in this project. The next step in this research will be to deploy the identified strategies and evaluate the outcomes. Future studies include the expansion of the framework and strategies to other Australian toolmakers.

1.   Introduction

Over the past decade organizations have progressively used Internet technologies to transform their businesses. Initially email and the creation of websites offered a range of services to conduct business electronically. More recently organizations that have mastered some of the technologies are looking to further change their business processes to leverage the opportunities offered by a global marketplace, for example, small businesses collaborating with other in order to gain a competitive advantage. A number of issues arise with making this higher-level transition, such as lack of knowledge and expertise, cost and time to undertake the transformation. In addition, current predictions are that business will be predominantly conducted online and organizations that are slow to embrace web technologies will be left behind. There is now a focus on these two types of organizations – those that need to move towards eTransformation, and those that need to move further along the eTransformation path. This paper details a pilot study of four organizations that are taking the first steps towards eTransformation with the intention of collaborating with each other.

1.1   eTransformation

eTransformation is a planned and evolutionary move towards leveraging web technologies to enhance business. In addition to implementing the technologies, this move is characterised by the need to evaluate processes within the organization and manage relationships (Al-Mashari, 2001). Certainly, organizations can take a step-by-step approach that suits their industry sector and customer base.

This research study was undertaken in the south west region of Sydney, which has the fastest growing economy in Australia, and consists of 10% of the population. Over 80% of the 72,000 businesses in this region are small to medium enterprises (SMEs), with manufacturing among the largest industry sectors. Manufacturing SMEs with a website in the region stands at 65% in 2003 (Khandelwal et al, 2004), which has risen from 41% in 2000 (Lawson et al, 2003). Key factors that inhibit eBusiness activities have not dramatically changed over time, with major barriers including lack of IT expertise, cost and time to implement. The Advanced Enterprise Information Management Systems (AeIMS) Research Group at the University of Western Sydney (UWS) has been at the forefront of the region in researching and collaborating with local industry associations and SMEs. Examples of the research include a methodology for successfully transforming SMEs to eBusinesses – see Figure I (Ginige et al, 2001) and the development a strategic model to undertake the transformation – see Figure II (Arunatileka & Ginige, 2003). The research outlined in this paper tests these models for eTransformation in a pilot study of four toolmaker SMEs.
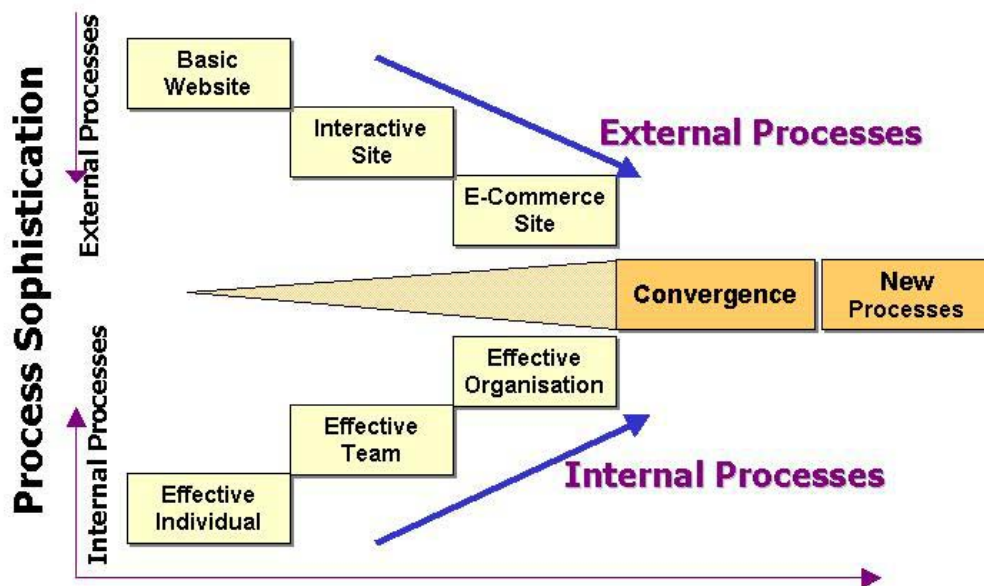
Figure I: *eTransformation Roadmap (Ginige et al, 2001)*

Studies of web sites and changing business processes led to the progressive creation of a number of phases that an organization can move through to successfully eTransform their organization (Ginige et al, 2001). During this study each of the four participating toolmaker was placed on the roadmap.
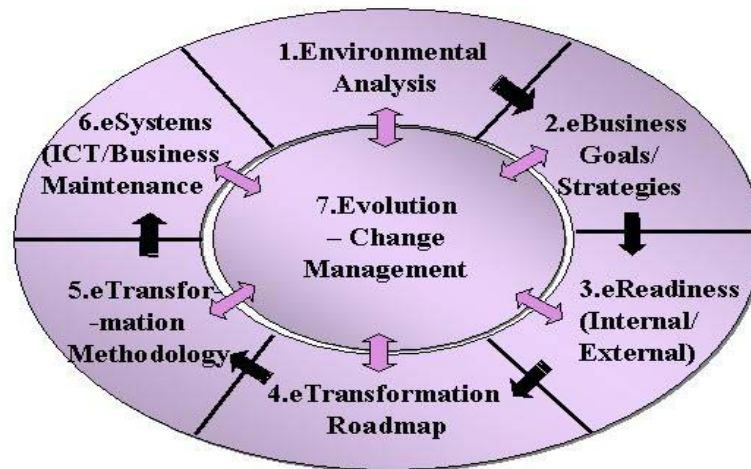
Figure II: 7E Model in Transformation (Arunatileka & Ginige, 2003)

The seven E's in transformation was developed from an analysis of existing eTransformation methodologies and models (Arunatileka & Ginige, 2003). The seven factors, which comprise the seven E's model was applied to the participating SMEs in this study. This model represents the process that a single SME can utilise in transforming their business to an eBusiness.

1.2   eCollaboration

eCollaboration is defined as partnerships or teams using information and communication technologies (ICT) to achieve a common goal (Kock & D'Arcy, 2002). For instance, two organizations in the manufacturing industry (one manufacturing a plastic bottle, the other a plastic lid) have successfully collaborated to market one product, a plastic bottle with a lid (Ginige, 2004). Some resistance to change is apparent, despite the increased awareness of benefits from eCollaboration, and therefore a high level of trust is required for it to be successful (Schuster, 2002). Perceived interaction qualities, both interpersonal and technological are vital to developing trust, as is satisfaction with the collaboration process (Hol & Lawson, 2004). Indeed, Boddy et al (2000) have identified that making the decision to work collaboratively is easier than the implementation.

The 7E Model in eTransformation (Arunatileka & Ginige, 2003) illustrates the path that can be undertaken by a SME. This study examines the eTransformation process within each of the participating SMEs, and in addition, investigates the collaboration process among these four organizations. Kock & D'Arcy (2002) assert that there are six factors that make up eCollaboration, namely the collaborative task, the eCollaboration technology, the participants in the collaborative task, mental schemas of the participants, the physical environment, and the social environment. These factors are relevant to the Toolmaking industry in Australia:

- The collaborative task: toolmaking jobs beyond the capacity of one of the toolmakers;

- The eCollaboration technology: IT infrastructure deployed to the toolmakers in this pilot project;

- The participants: the four toolmaking SMEs, Austool Limited, and UWS researchers;

- Mental schemas of the participants: The knowledge and experience of: (a) the toolmakers in producing their products; (b) Austool in understanding the industry and skill sets; and (c) UWS researchers in implementing the IT infrastructure;

- The physical environment: the geographical location of the toolmakers, which are not co-located and therefore need to apply effort to using the eCollaboration tools;

- The social environment: the perceptions of trust among the participants as well as peer pressure among the toolmakers.

Ginige (2004) argues that organizations with the same capabilities can collaborate to gain advantage by acquiring jobs beyond the capability (in size or complexity) of a single organization. Ultimately, what is important is gaining the competitive advantage by increasing market share and lowering costs, and therefore maximising profit and return on investment. The technology and methodology utilised enables the main objective to be achieved in a seamless, user-friendly and cost-effective way (DeZoysa, 2001). Trust between participants is a key factor, particularly within the pilot project so that the project aim is realised. Trust between the four toolmakers when undertaking collaborative projects is also an important factor.

1.3   Toolmaking Industry in Australia

The Australian Toolmaking Industry is part of the wider Manufacturing Industry, and consists of about 600 organizations with over 6,000 employees. The majority of these organizations fit into the SME category (ABS, 2004), with ninety percent employing less than 50 employees. Over the past decade there has been a reduction in employment, which corresponds to an increase in imported tooling (Austool, 2004). Collaboration is considered essential for the industry to survive and prosper, as is access to international markets.

Austool Limited is an association committed to advancing the Australian toolmaking industry and is located in south west Sydney. The four participating toolmaking SMEs are members of Austool, and fit into the small category of SMEs. They did not have a website, and carried out business in the traditional manner in toolmaking with manual systems and face-to-face communication. At the start of the project the four toolmakers, the members of the AeIMS research team and Austool project leaders had had only minimal contact with each.

2.   The Study

A qualitative study using Action Research methodology was undertaken and this project represented one cycle within the Action Research framework. Techniques of questionnaires, interviews and observations were conducted, as well as a series of joint meetings. To fully understand and document the process necessary for eCollaboration, the iterative process of Action Research was selected as it encapsulates the steps of diagnosing, action planning, action taking, evaluation and specific learning. In addition, it allows interaction between the researchers and the participants with a view to improving the quality of actions taken within the project (Avison et al, 1999).

The overall aim of the pilot project was to examine possible strategies that could be adopted by Australian toolmakers to allow them to be more competitive in the global market. Using the 7E Model in Transformation, specific objectives for this cycle of the Action Research include:

- analysis of the global environment for the toolmaking industry;

- identification of factors for gaining competitive advantage in the global market;

- identify eReadiness of the four toolmaking SMEs;

- develop a suitable eTransformation strategy for the four toolmaking SMEs;

- develop and deploy identified strategies within the SMEs;

- review and evaluate the outcomes of the strategies.

An examination of the viability of implementing eCollaboration strategies with the participants was also a focus.

3.   Results of Pilot Study

3.1   7E Stage 1: Environment Analysis

A study undertaken in 2004 by Austool Limited, revealed that the reasons for the downturn within the Australian industry included:

- a shrinking domestic market due to migration of manufacturing to foreign countries;

- excess capacity due to reduced domestic market demand and new technologies;

- customer demand for lower prices and more services;

- rising costs, particularly labour-related costs; and

- commercial uncertainties that may restrict investment in new technology.

The emergence of new competitors in low cost countries such as China and Korea has impacted on the toolmaking industry worldwide, resulting in the shrinking of the industry in Western countries. Trends in global toolmaking include:

- integrated production (China);

- advantages of low cost (China);

- skilled labour (China);

- strong international sales and marketing (China, Taiwan);

- design in Taiwan – manufacture in China;

- shorter lead times and competitive prices (China, Taiwan);

- pooling resources through consolidations and mergers (USA);

- adoption of latest computer technologies for manufacturing (Portugal);

- clustering and cluster development strategies (Slovenia).

Virtual organizations have been established, such as the National Tooling Initiative (NTI) in South Africa, which has successfully brought together car manufacturers, automotive industry bodies, tool rooms, suppliers, training institutions and government bodies (Engineering News, 2004). Companies are buying out, or merging with other companies to strengthen their resources in an age of global competition and heightened demands from customers. Another motive for consolidation is that many customers favour large full-service organizations, as they do not have the resources to handle many small suppliers (PIMMA, 2000).

The major problems are that Australian toolmakers have higher labour costs, longer production runs and less cost effective pricing strategies. They also appear to adopt new technologies later than overseas competitors (Austool, 2004). To address the downturn, the toolmaking industry is keen to address the issues to achieve global competitiveness.

3.2 7E Stage 2: eBusiness Goals/Strategies

The four toolmakers participating in this study agreed to collaborate with each other, by utilising eTransformation strategies to increase their competitiveness as individual organizations, and as a combined virtual organization. Austool Limited is participating to evaluate the experiences of the four toolmakers with a view to expanding the strategies to other Australian toolmakers, and the following success factors have been identified:

- improved customer engagement;

- maintaining more effective technology diffusion;

- going global;

- integrating with the supply chain;

- rapid incremental innovation.

Austool's CEO and the project leader were interviewed as part of the project. The ranking of the toolmakers by Austool revealed that these four SMEs were at the smallest end of toolmakers in terms of size with less than ten employees. In terms of capacity of machinery, one organization would be termed as medium. However, in terms of quality all four organizations were at the high end, and therefore suited to working collaboratively. The issue of turnaround time was identified as a problem when working individually. Breaking down the barriers between the toolmakers was recognized as an issue to be overcome, as previously the toolmakers had been competitors. Trust needed to be established so that collaboration could take place.

To move the toolmakers higher in their ranking, Austool believes that increased capability through collaboration is necessary. Combined purchasing was also identified for steel and plastic supplies. Although Austool was not interested in participating with the toolmakers on a day to day basis, they did however see a role in acting as an intermediary to promote the collaboration. Marketing capabilities, strategic alliances and expanding the product lines were seen as strategies to move the organizations forward. The framework and methodology from the pilot study is of particular interest to Austool, as it plans to expand it to the toolmaking industry in Australia.

3.3 7E Stage 3: eReadiness of Toolmaking SMEs

The toolmakers had been in business up to 15 years and their main business was in precision engineering, plastic injection moulding and press tools. Members of the

research team visited each toolmaker on a number of occasions to evaluate the day-to-day activities, and to acquire requirements for the websites. On each occasion the owner was interviewed. The level of IT infrastructure was low, with dial-up Internet connections, PCs with Windows 98 or XP, no IT support structure, and word processing, email, and some CAD/CAM applications.

Business processes were discussed and a SWOT analysis carried out (see Table 1). The benefits that the four SMEs expected from the eCollaboration project included:

- purchasing power of four;

- ability to build tools faster;

- sharing of IT and other expenditure;

- market toolmaking collectively and individually;

- opportunities for international markets;

- increase in capability

- opportunities in other local industries.

Table 1: SWOT Analysis of the four toolmaking SMEs

Strengths	Weaknesses
Machine capability	Manpower
Skill to do any toolmaking	Marketing
Quality	High labour costs
Designing	Difficulty in lowering production costs
Production capability	Location and building capacity not sufficient to organise properly
Experience in the industry	
Strong industry association	Shortage of manufacturing tools in Australia
Opportunities	**Threats**
New customers	Overseas competition:
New customer industries:	- China, Taiwan, Korea
- building, construction, plumbing, food, household, automobile, medical, energy, electronic, aerospace, mining	Australian toolmaking not keeping pace with technology
International customers	Larger companies investing in China and Taiwan
New markets	Manufacturing in Australia declining
	Shortage of toolmakers
	Local competition for jobs

Existing niche markets were identified as: household, food, plumbing, construction and components. Potential niche markets include automobile, building, construction, energy, electronics, medical and sports.

The driving forces for eCollaboration acknowledged by the four SMEs were to:

- reach new customers;

- globally market individually and collectively;

- work collaboratively;

- increase market share;

- increase product range;

- gain competitive advantage;

- eliminate bottlenecks; and

- improve on technology.

Issues and concerns raised by the four SMEs include:

- trust;

- degree of collaboration;

- how to distribute the jobs;

- unified and equal standards;

- liability of work that the group undertakes;

- who makes final decisions;

- common understanding; and

- service level agreements on joint projects (jobs, payment, management).

These issues are discussed at joint meetings, with the understanding that some of these points need to decided by the toolmakers, particularly in relation to dividing the jobs. The project will provide the IT infrastructure to enable job sharing and quoting.

3.4 7E Stage 4: eTransformation Roadmap

To move the toolmakers onto the eTransformation Roadmap, the first phase established a basic website for each SME. The next phase identified strategies that could be undertaken to enable collaboration by the group. Figure III highlights the interactions possible at the business-to-customer, business-to-business and business-to-employee levels.
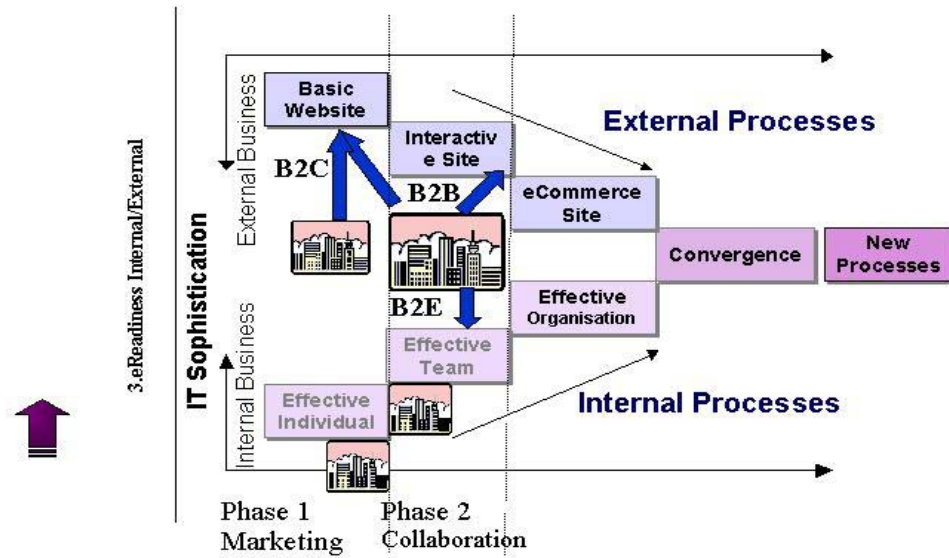
Figure III: Toolmakers position on the eTransformation Roadmap

3.5   Stage 5: eTransformation Methodology

Based on the data collected and analysed from the four toolmaking SMEs and from Austool Limited, the critical success factors for the toolmaking industry were identified, namely strategic marketing and eCollaboration based around the core issues of price, quality and delivery time (see Figure IV).
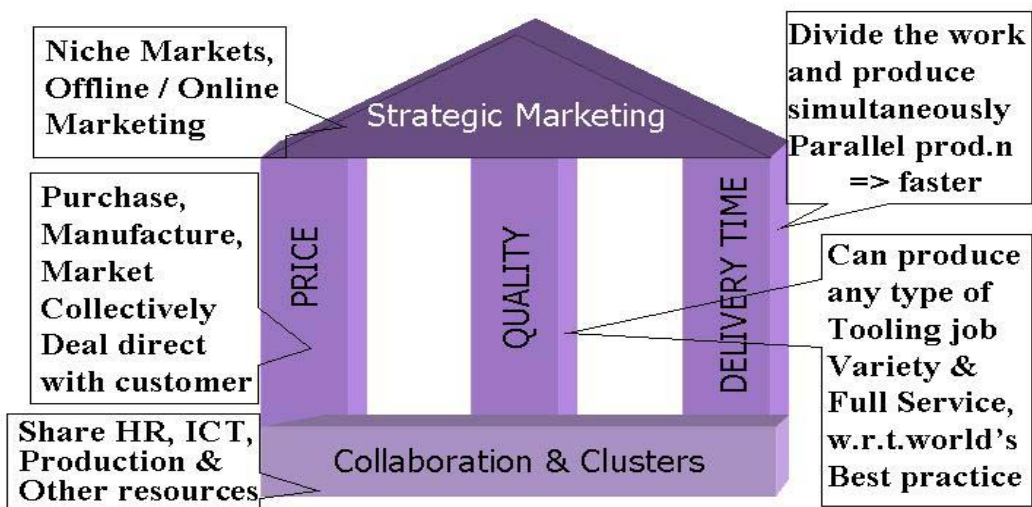

Figure IV: Proposed Strategies for Toolmakers

Ways for these four toolmakers to collaborate include Strategic Marketing, Resource Sharing, Project Sharing and Purchasing.

Strategic Marketing involves establishment of a website for each toolmaker, which will be followed by a portal to market the group. Austool also has a role to play in marketing through their organization. Resource Sharing includes sharing of staff, software licences and production capability. Project Sharing is based on projects that individual toolmakers acquire as well as projects that are acquired by the group. Purchasing from common suppliers can result in reduce costs.

The introduction of information technology to enable strategies for these toolmakers needs to be introduced at the individual level, and then after a period of adjustment can be widened to the group.

The toolmakers agreed that the information technology infrastructure required to achieve eCollaboration would initially be a peer-to-peer strategy as defined in Figure V. The reason for this decision was based on cost involved, the level of existing infrastructure and IT skills of the toolmakers. Issues to be addressed by the toolmakers include providing Internet access and undertaking training. Austool agreed to promote and market the collaboration project.

3.6   7E Stage 6: eSystems ICT/Business Maintenance

This stage will evolve over the coming year with the deployment of their website with dedicated server and domain name, a content management system for the website, software tools for sharing jobs and quoting, as well as a website marketing plan. The AeIMS Research group has agreed to provide maintenance and support for six months following deployment.
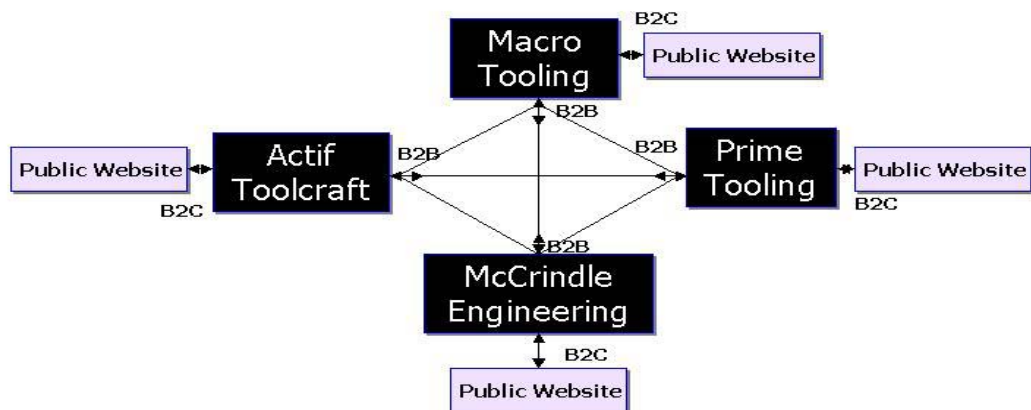

Figure V: Proposed Peer to Peer (P2P) Strategy

3.7   7E Stage 7: Evolution – Change Management

This stage involves managing the changes in an evolutionary manner over all other stages of the 7E Model. Issues that have arisen to date include overcoming a degree of resistance by the toolmakers particularly in relation to time, negotiating amended timelines with Austool Limited, and building trust. Deadlines needed to be moved on a number of occasions while developing the initial website, decisions related to the SMEs owning their own domain name and mapping the processes for the job sharing and quoting software.

4.   Discussion

Analysis of the results to date suggests potential advantages are feasible in eCollaboration among the toolmakers. Certainly, non-technical issues such as social, behavioural and strategic management dimensions, will ultimately drive collaboration. As discussed, collaboration and access to international markets are essential for the toolmaking industry to survive and prosper in Australia. The toolmakers have made the decision to work collaboratively and, as identified by Boddy et al (2000), successful implementation is posing some challenges.

Once placed on the eTransformation Roadmap, the 7E Model provided a framework for analysis of the process outlined in this pilot project. The participants became aware of their own position, and that of the other toolmakers. This process contributed to trust relationships developing among the toolmakers, and between the toolmakers and the researchers. Indeed, trust is integral to the Evolution-Change Management phase. More emphasise needs to be placed on the development of trust, as the time spent within this pilot project could not be sustained on a larger scale.

The next phase of the project will fully investigate the eCollaboration process using the six factors of eCollaboration as defined by Kock & D'Arcy (2002), particularly the mental schemas of the participants.

The environment analysis highlighted the major problem areas as higher labour costs, longer production runs and less cost effective pricing strategies. Through eCollaboration strategies such as global marketing, resources sharing, project sharing and common purchasing from suppliers, it is suggested that these problems could be reduced.

Analysis of the goals of the toolmakers indicate agreement between them, in addition to being consistent with the goals of Austool, such as improved customer engagement, more effective technology diffusion and competing in a global environment. When evaluating the eReadiness of the toolmakers, a high level of commitment to the process was evident, despite the low level of IT infrastructure evident within the organizations. Even with this high level of commitment, delays still occurred, and addressing the trust issue at an earlier point would have assisted a stricter adherence to deadlines.

In line with the Action Research nature of this project, it was identified that it would be necessary to develop the initial website before proceeding with other aspects of the project. This enabled the toolmakers to be placed on the eTransformation Roadmap, and did indeed improve the trust levels with the visual development of the website.

The strategies of strategic marketing, resource sharing, project sharing and purchasing were agreed to by the toolmakers, which allowed work to proceed in the development of the software tools for job sharing and quoting, as well as the development of a website marketing plan.

5.   Conclusion

The overall aim of the pilot project was to examine possible strategies that could be adopted by Australian toolmakers to allow them to be more competitive in the global market using Action Research methodology. The cycle addressed by this paper was to outline the eTransformation process, and highlight issues and challenges for the eCollaboration phase.

The eTransformation Roadmap was used to plot the position of the toolmakers and highlight the possibilities for further development of their eBusinesses. The 7E Model was used to move the toolmakers through the phases and create awareness for the eCollaboration strategies to achieve their goals of working collaboratively, increasing their market share and global marketing. The issue of trust was identified as needing to be addressed earlier in the project, and therefore become part of the process. Future cycles of the Action Research framework for this research will include social, behavioural and strategic management dimensions.

Action research methodology proved to be appropriate for this type of project, as it allowed for reflection of findings during the project, which resulted in changes being made. Action Research is an iterative process suitable for the 7E Model, with steps for diagnosing (Stages 1,2,3,7), action planning (Stages 4,5,7), action taking (Stages 6,7), evaluation and specific learning (all stages).

Future research involves evaluation of the deployment of the eCollaboration strategies as part of this project, and refinement of the framework and methodology to be tested in other industry sectors, and with other organizations within the toolmaking industry. Certainly Austool needs a successful outcome of the pilot project, as it has plans to use the framework and methodology extensively throughout the toolmaking industry in Australia.

In conclusion, the framework and methodology outlined in this paper can be tested in projects that design, implement and assess eBusiness solutions for SMEs. If virtual organizations are the way of the future, then eCollaboration technologies will enhance this trend.

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