

<p>Institution: University of Bedfordshire</p>
<p>Unit of Assessment: 19 - Business and Management Studies</p>
<p>Title of case study: Increased e-business adoption in SMEs through online support tools and research informed interactive training</p>
<p>1. Summary of the impact</p> <p>This case study refers to the work in supporting SMEs' e-business adoption undertaken by staff in the Business and Information Systems Research Centre (BISC) led by Professor Duan. Our research was supported by a number of EU funded projects, including VEGNET (knowledge transfer in e-supply chains), TRIMAR (e-marketing for SMEs), TRICTSME (e-commerce in SMEs), LFEC (Languages for e-commerce), Webstep (Business website design for SMEs), amongst others. SMEs are the principal beneficiaries of all these projects, with our research impacts on SMEs including:</p> <ul style="list-style-type: none"> • An increased level of e-business adoption in SMEs • Improved e-business performance and management capacity at regional and international level • Influences on policy making, raised awareness and debate among business communities and policy makers as regards the sharing of know-how and best practice with international business partners • Follow-on projects funded by EU to realise the research impact (e.g. three rounds of Webstep project and TRIMAR).
<p>2. Underpinning research</p> <p>Over the past 15 years (1998-present), Prof. Duan and her colleagues have worked on various research projects supporting SMEs in collaboration with international (e.g., China), European, and UK partners. The specific research underpinning this case study has been drawn from a number of key projects seeking to understand and address e-business adoption barriers, to identify key success factors for SMEs and to develop SME strategies to achieve positive business impacts. The following underpinning body of research was undertaken by the University of Bedfordshire as the lead investigator:</p> <ol style="list-style-type: none"> 1. <i>The Identification of SMEs' support needs and an investigation of the state of the art research and practice in e-business adoption including e-commerce, internet marketing, and e-supply chain management in SMEs.</i> Surveys and interviews were conducted by BISC in China, Europe and UK, between 1999 and 2007, funded by EC grants, to identify SMEs' training and decision support needs in e-business strategy development and successful adoption. BISC coordinated the following projects: TRICTSME, TRIMAR, and VEGNET [3.1]. 2. <i>The Development of web-based intelligent support systems for SMEs.</i> Two web-based intelligent systems WITS (TRICTSME project) and TRIMAR (TRIMAR project) were developed by BISC with contributions from project partners between 1999 and 2003 to meet the decision support, education and knowledge transfer needs of SMEs. These two systems were innovative because they represented two of the earliest web-based intelligent systems for the delivery of expert support to non-experts in SMEs on the Web. They were pioneering because they transferred stand-alone expert systems to Internet-based expert systems. Powered by knowledge-based and case-based reasoning techniques, these web-based intelligent systems provided interactive and tailor-made analysis and advice to SME managers. Outcomes were disseminated through peer reviewed journals, keynote speeches at international conferences such as the International Conference on E-Business Technology and Strategy (iCETS 2012), the Second International Conference on Computers and Computing Technologies in Agriculture (CCTA 2008) and the International Conference on Organisational Support Systems, Poland (1999) [3.2]. 3. <i>The Development of web-based intelligent training and education systems for SMEs.</i> The web based training systems developed were intelligent, interactive, online portals for SMEs. Emerging Artificial Intelligence methods, such as case based reasoning and ontology (e.g., LFEC e-learning modules and TRIMAR modules) were adopted in developing the online training systems [3.3]. An e-learning system for vegetable supply chain management was developed in China by the VEGNET project and received certification by software licence in China. 4. <i>The Development of training materials and provision of workshops for supporting SMEs in adopting e-business.</i> Informed by our analysis on the SMEs' training needs and preferred

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training delivery approaches based on the evidence collected in TRICTSME, the university attracted ESF funding to help local SMEs in understanding e-business concepts and designing and launching their first e-business web site through a series of six interactive training workshops. The success of Webstep1 attracted the follow-up funding for Webstep 2 and 3 projects. Over 1,000 local SMEs benefited from Webstep training [3.1].

5. *Research on the key factors affecting transnational knowledge transfer.* To address the cross-country knowledge transfer problems encountered in our projects, we proposed and applied a transnational knowledge transfer framework. We also identified key factors affecting knowledge transfer at the transnational level. A comprehensive review of the literature and a Delphi survey were conducted. Findings were published in academic books and a top journal [3.4, 3.5].

A Summary of the relevant projects awarded to UoB as principal applicant by EU.

Year	Project Title	Funding Program	Total/Grant	Partner Country
04/07	Enhancing Vegetable Supply Chain Management with Internet Technologies (VEGNET)	Europe Aid ASIA-ITC	€546,000 €327,600	UK, CN, DE, GR
00/03	On-line Intelligent Training System for e-Business Issues in Internet Marketing for SMEs (TRIMAR)	LLP Leonardo da Vinci	€320,043 €240,032	UK, SK, PL, PT, DE
98/01	A Web-based Intelligent Training System for the Use of ICT in SMEs Manufacturing (TRICTSME)	LLP Leonardo da Vinci	€105,000 €78,750	UK, DE, PL, SK, PT

Key UoB researchers involved:

Prof. Duan (1995-present) – principal investigator and project co-ordinator of VEGNET and TRICTSME, and principal investigator of TRIMAR; Mrs Mullins (Lecturer 1990-2002) – project co-ordinator and principal investigator of TRIMAR and principal investigator of TRICTSME; Prof Hamblin (Head of Dept., 1993-2003) – co-investigator of TRICTSME and TRIMAR; Ms Xu (2005-2009) – researcher of VEGNET; Dr Bentley (2000-present) – co-investigator of VEGNET; Mr. Greenway (2000-2001) and Ms Jin (2001-2003) – researchers of TRIMAR.

3. References to the research

- 3.1 Duan, Y., Mullins, R. and Hamblin, D. 2002. "Addressing ICTs Skill Challenges in SMEs: Insights from Three Country Investigations", *Journal of European Industrial Training*. 26 (9), 430-441. (Google Scholar citation: 28, by 28-10-2013).
- 3.2 Duan, Y., Edwards, J.S., and Xu, M. 2005. "Web Based Expert Systems: Benefits and Challenges", *Information & Management*, 42(6), 799-811. (ABS 3* Ranking, impact factor 2.214), Google Scholar citation: 61, by 28-10-2013).
- 3.3 Duan, Y., Burrell, P., Mullins, R., and Jin, H. (2005) "A Case-Based Reasoning Approach to Enhance Web-Based Training on Internet Marketing". IFIP International Federation for Information Processing. Book Chapter. Artificial Intelligence Applications and Innovations, ISBN 978-0-387-28318-0, DOI 10.1007/0-387-29295-0_60, 557-566, Springer, Boston
- 3.4 Duan, Y.; Nie, W. and Coakes, E. 2010, "Identifying Key Factors Affecting Transnational Knowledge Transfer". *Information and Management*. 47(7), 356-363. (ABS 3* ranking, impact factor 2.214), Google Scholar citation: 32, by 28-10-2013).
- 3.5 Duan, Y.; Bentley, Y.; Fu, Z.; Zografos, K.G., and Bemeleit, B. 2008. "Enhancing Chinese Agribusiness Supply Chains with Internet Technologies: A Trans-national Knowledge Transfer Approach". *Industry and Higher Education*, 22 (5), 1–10.

4. Details of the impact

Three EU-funded projects are listed to provide details of impact.

VEGNET (2004-2007). VEGNET raised awareness of the benefits of using Internet technologies in the fresh produce supply chain among fresh produce SMEs in the UK and China. It provided training and education for over 100 managers in China; developed two pilot implementations in China; identified barriers to Internet adoption; and highlighted gaps in the uptake of the Internet between SMEs in the UK and China for Chinese policy makers. VEGNET partners in China gained experience in facilitating transnational knowledge transfer, developing mutual understanding, and enhancing university-business knowledge transfer in China. Key beneficiaries were SMEs in the

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fresh produce sector in the UK and China.

Major impacts of VEGNET are:

- **Increased adoption of e-business** through two pilot applications and three training workshops in China [5.1]. Three on-site training workshops were organised for 50 managers from fresh produce businesses in China. Follow up feedback demonstrated that the training has had long term impact on their business practices through launching and improving their business web site, increased use of ICT in the company and improved e-business knowledge and management capacity [5.3]. In a wider context, China's e-business adoption increased dramatically at the end of the project (e.g. 45% annual increase in 2008 and 22% in 2009 www.chinadaily.com.cn/bizchina/2010-08/31/content_11232419.htm). The annual increase has remained at an average level of 25% since 2009 (www.iresearchchina.com/views/5206.html).
- **Improved knowledge/understanding** for over 50 SME managers in China through the development and implementation of the (licensed software) e-learning systems jointly developed by BISC and China Agricultural University (CAU) [5. 2].
- **Raised awareness in the business communities of the fresh produce sector** in the UK and China through in-company visits and two large scale surveys with UK and Chinese SMEs by BISC, the distribution of 1000 project brochures in Shouguang International Vegetable Festivals, project posters in partners' research exhibitions, regular press releases, organizational web sites of Chinese partners, etc. One of the posters based on the VEGNET findings was awarded the **best project for business impact** [5.8, 5.9].

TRICTSME and TRIMAR (1998-2003). TRICTSME was one of the earliest EC-funded projects aimed at helping SME managers to adopt e-commerce. The project investigated the perceived problems with the use of ICTs and e-commerce, and established that the lack of skills, knowledge and technical understanding of e-businesses was the major barrier to e-business adoption and success. It identified the SME managers' needs for support for e-business strategy development and technical training as critical factors for e-business success. Surveys and focus groups captured specific SME needs. The development of an online intelligent support and training system for e-commerce success employed a web-based expert system as its main component.

Following the success of TRICTSME, we were granted EU funding to continue our research in supporting SMEs in e-business adoption. An EU evaluation report commented that "*TRIMAR focused on a niche area addressing a specific training gap experienced by a significant proportion of SMEs*". TRIMAR identified SMEs' current practice in using internet marketing and their critical support needs to improve their business competitiveness through effective internet marketing using a pan-European survey in five participating countries. Our team designed the survey instruments and conducted the survey in the UK. Informed by the empirical findings, we developed an online self assessment tool and an intelligent training system for internet marketing for SMEs. The intelligent training system offered systems and human solutions to specific queries, which were then translated into the languages of the participating countries. Companies could search a case study database to identify similar problems to their own and learn from others' solutions. Case-based reasoning techniques developed in artificial intelligence were adopted as a major system component. This innovative approach used 70 cases collected by 11 project partners from Germany, Poland, Portugal, Slovakia, and UK.

Key beneficiaries of both projects were SMEs in the UK, Germany, Portugal, Poland, and Slovakia.

Major impacts of TRICTSME and TRIMAR are:

- **Increased e-business adoption in SMEs** through better understanding of SMEs needs for providing an appropriate level of training and support. Project findings were used successfully in bidding for ESF funds (**Webstep1**) to provide interactive training workshops to help SMEs launch and improve their business website. Project outputs were used in developing training materials used in the training workshops. The training workshops were undertaken by over 1,000 SMEs. Follow up project evaluation after six months of the training for **Webstep2** showed 53% of participants launched or were in the process of launching their business website as the result of the training [5.4]. Recent follow-up contacts with five Webstep participants in April 2013 demonstrated that the training provided "stepping stones" and "catalysts" in terms of new business directions, business expansion, improved customer experience, and personal career change (online businesses) [5.5].

- **Improved e-business skills and management capacity among SMEs at the European level.** This was achieved by: 1. Providing online (WITS and TRIMAR web site) and offline access (workshops) to expert support and training; 2. Involving six SMEs as formal project partners in TRIMAR; 3. Conducting two pan-European surveys addressing e-business support needs and skills gaps with over 1,000 SMEs; 4. Conducting two focus groups involving UK SMEs on e-marketing success; 5. Co-ordinating 70 case studies in five EU counties and undertaking 15 case studies in the UK on internet marketing success in SMEs; 6. Completing 50 end user (SMEs) surveys showing their positive feedback and satisfaction with the online support and training systems developed by the projects. These can be evidenced by the project evaluation reports of TRICTSME, TRIMAR, WEBSTEP 1, 2 and 3 [5.4, 5.5, 5.6]. For example, the TRIMAR evaluation report provided strong evidence from SMEs as to the project impact; *“The information supplied by TRIMAR (online training and support system) has all the ingredients to enable an SME to become a global success”, “I learned about many more aspects that have to be considered to improve the site and thus the success of the site”* [5.6].
- **Raised awareness among European SMEs and improved their e-business performance.** This was achieved through case studies, focus groups, sector surveys, project websites, company visits, leaflets, trade and industry magazine publications, etc. [5.6]. The work has also benefited a wider audience through published papers, invited keynote speeches, presentations and talks at various local, national and international events [5.7, 5.8].
- **Influenced policy makers and contributed to the policy making.** The barriers and gaps identified by the TRICTSME survey showed the lack of e-commerce adoption in manufacturing SMEs. The finding that the regional e-commerce adoption was only 11% among manufacturing SMEs attracted the attention of Luton MP Margaret Morgan, who visited the university and requested a report. The report was forwarded to the local Business Link service to raise awareness. Our work on improving ICT skills shortage in EU projects also attracted attention from the international consultancy company Education Impact. Prof Duan contributed to their report for the Maltese government in addressing ICT skills shortages. The Maltese Government has applied the various recommendations and has itself developed a number of initiatives. *“Many of the report’s recommendations are making their way into policy driven initiatives delivered in under a year with more scheduled to come.”* [5.9].

5. Sources to corroborate the impact

- 5.1 VEGNET – follow up statements in 2013 for evidence of the business impact from companies in China (Shandong Shouguang Euro-Asia Special Vegetable Co. Ltd and Shouguang City Demonstration Area of Vegetable High Science and Technology Management Office).
- 5.2 VEGNET – e-learning Software License Certificate in China in 2010 (Vice President, CAU)
- 5.3 VEGNET – training workshop participants impact information and statement in 2013 (Vice President, of CAU and MD, Beijing Zhongnong Futong Horticulture Co. Ltd)
- 5.4 TRICTSME and TRIMAR projects – Webstep 2 training workshop audit report, submitted to ESF South East Regional Office.
- 5.5 Webstep follow-up report containing testimonials from 5 participants collected in April 2013. Email correspondence and telephone interview notes available with Edward Byrne Associates Dentists in Bedford, SKF.com, perfect-print.co.uk, dmacintyre.co.uk, and aZtec.co.uk.
- 5.6 TRICTSME and TRIMAR user evaluation reports submitted to LDV programme UK office ECOTEC (now Ecorys UK).
- 5.7 Prof. Duan gave an invited keynote speech on “Innovation and Entrepreneurship: Keys to E-Business Success in SMEs”, International Conference on E-Business Technology and Strategy (iCETS). icets.info/2012china/program/keynote-speakers/dr-yanqing-duan/
- 5.8 Prof. Duan gave an invited keynote speech on “Accelerating Internet Adoption in the Fresh Produce Supply Chain: A VEGNET Approach”, 2nd Int Conference on Computers and Computing Technologies in Agriculture (CCTA 2008), China. Attendance included Chinese government officials. Project poster was awarded the best poster for Research Impact by a guest judge from the business organisation www.beds.ac.uk/news/2008/jul/080709-research.
- 5.9 Impact of government policy-making at international level: Prof Duan was interviewed on government policy on improving ICT competence and skills in Malta by Education Impact. Maltese government has applied the recommendations as stated in Education Impact’s website: eifellowship.net/?p=177, www.educationimpact.net/case-studies/mita-report.