

Electronic Business Center—An International Resource Center Advancing Theoretical and Technical EB Education

Authors:

Amy Trappey, National Tsing Hua University, Hsinchu (300), Taiwan, trappey@ie.nthu.edu.tw
Jiang-Liang Hou, National Tsing Hua University, Hsinchu (300), Taiwan, adamhou@ie.nthu.edu.tw

Abstract— *The Electronic Business Center (EBC) at National Tsing Hua University (NTHU) in Taiwan is an innovative educational resource center sponsored by the Ministry of Education. The philosophy behind establishing EBC is to build an open resource center for online e-business technology learning and knowledge sharing among the academic community, industries and government. A three-tier architecture is carefully planned and developed for EBC operation. Through the architecture, the most-updated resources can be customized and distributed to other users without the limitations of locations and time. The center provides sophisticated technologies, facilities and course materials to support the EBC participants in education, outreach, R&D, and technical transfer. Consolidating the technical infrastructure and outreach strategies, the major accomplishment of the center can be categorized into four tracks. They are in outreach, education, prototype hosting and technology (R&D) transfer. The concrete deliverables include interdisciplinary program planning in e-commerce, online teaching materials and case study design, international workshops, education and training events, construction of web-based resource center, newsletter publications, student project exhibits. In order to enhance the outreach capability, applications of information technology include the video conferencing, ubiquitous computing and intelligent multi-channel call center for higher service quality and efficiency. The critical feature of EBC in e-learning is to provide a collaborative environment that integrates the industry, application service providers and researchers from partner universities to demonstrate an internationalized and industry-oriented training and education platform. In a very cost and time effective way, the objectives of educational resource exchange and distribution are accomplished via the on-line collaborative network.*

Index Terms— *Resource Center, Innovative Education, E-Learning, Electronic Business (EB).*

INTRODUCTION

The Electronic Business Center at National Tsing Hua University (EBC at NTHU), Hsinchu, Taiwan was established in 1999 in the Department of Industrial Engineering and Engineering Management. It is the first and only Engineering College and College level center at NTHU and no other college has established an e-business center under an Engineering College in Taiwan. It is a strategic step toward bridging the gap between research and industry outreach. Conforming to the government strategies, the center focuses on the development and implementation of innovative e-business methodologies and technologies by incorporating the academic efforts. The center is partially supported by Ministry of Education and emphasizes on establishing a demonstration environment and online resource center for education and training. The operation infrastructure and strategies are the critical foundation for the success of the resource center. The principal strategies of EBC is to leverage education, research and industrial cooperation via the following approach:

Integration of Comprehensive and Advanced Resources

NTHU is the top university for training industrial engineers in Taiwan. Most of the graduates play dominant roles in other universities, institutes and industries. On the basis of the close relationship with the academic and industrial sectors, many EBC resources can be promoted and integrated with other universities and companies. Thus the objectives of demonstration and resources sharing can be readily fulfilled.

Provision of University Open Resources to Partners

Since the faculty participating into EBC has numerous experiences and hardware/software resources in manufacturing automation and electronic business. The faculty has participated in many projects from National Science Council, Ministry of Education, Ministry of Economic Affairs and other private sectors and as a result, many EB solutions are established and

are embedded into the education programs. Under the philosophy, EBC can be treated as a demonstration case for solution implementation to the academic and industrial partners.

Support of Innovative EB Research

The EBC team aggressively participates in many R&D and EB related projects including collaborative design management, global logistics management and knowledge management. In these projects, EBC cooperates with non-profit R&D centers (e.g., the Industrial Technology Research Institute and Corporate Synergy Development Center, etc.) to promote manufacturing automation and e-business technologies to the industry and the successful scenario can be incorporated into related courses as demonstration cases.

The results of the projects continued to sustain activities during the year 2002 and contributed to the strengthening of ties between EBC and its industrial and academic partners (in Taiwan, mainland China, and internationally) through a series of workshops, seminars and other activities. The center continues to enhance its capabilities and achievements in research, education and international outreach in tight partnership with industry.

CENTER INFRASTRUCTURE

Operation of EBC relies on the software/hardware infrastructure, partnership and operation model for advancing theoretical and technical EB education. The center promotes interaction among leading research faculty from the College of Engineering, the College of Technology Management, and the College of Information and Electronics. The Engineering College Industrial Liaison Program depends on the EB Center to increase business contacts, to supply industry with qualified and well-trained employees and to strengthening alliances so that corporate funding will play a greater role in college research programs.

Software and Hardware Infrastructure

An integrated, functional layout (job-shop oriented layout) with five divisions, namely, the project division, Server Division, R&D Division, Training Division and Technology Division, is designed to accomplish the specialized tasks (as depicted in Figure 1).

The EBC has developed an industrial sponsorship program and has built cooperative partnerships with local and international firms. The program demonstrates industrial solutions and applications from leading participants through research project execution. The related sponsors and partners include:

- **Software providers:** Oracle, Great Plains, Promatis, DSC, Proyoung, Avectec, AsiaTek, Pitotech
- **Hardware providers:** QIC, I-Trust, TeleSynergy
- **Research institutions:** Center for Aerospace Science & Technology (CAST) and the Mechanical Industry Research Lab (MIRL) at Industrial Technology Research Institute (ITRI), the Corporate Synergy Development Center (CSD), OCP, the Tze-Chiang Foundation of Science and Technology
- **Aerospace/Defense partners:** AIDC, Boeing, China Airlines, Goldsun, Taiwan Aerospace Industry Association, Devco

Academic Partnership

The EBC has developed close links with academic partners through joint projects and resource sharing:

- **The National Taiwan University of Science and Technology (NTUST):** Joint MOEA R&D projects in innovative IP knowledge management.
- **National Chiao Tung University (NCTU):** The EBC is providing research support for NCTU faculty and graduate students conducting a WTO impact study on the Taiwan and China electronics industries (funding from the Fairbank Center and the JFK School of Government, Harvard University).
- **Da Yeh University (DYU):** Joint Ministry of Education projects.
- **I-Sou University (ISU):** Joint Ministry of Education projects.
- **Nan-Kai Institute of Technology (NKIT):** Joint Ministry of Education projects.
- **Ta-Hua Institute of Technology (THIT):** Joint CSD projects.
- **Long-Hua Institute of Technology (LHIT):** Joint Ministry of Education projects.
- **Ming-Sing Institute of Technology (MSIT):** Joint Ministry of Education projects.
- **Purdue University (USA):** The EBC provided e-business training support and lecture materials for a Mainland Chinese delegation visiting Purdue (funding from the U.S. Department of Commerce).
- **Lang-Jo University (China):** The cross-strait student exchange program. The EBC hosted students from Lang-Jo University majoring in computer science and applied mathematics that visited to study advanced e-business technology.

Industrial Liaison

International Conference on Engineering Education

July 21–25, 2003, Valencia, Spain.

The EBC has extended its e-business outreach program through the College of Engineering Industrial Liaison Program (CoE-ILP) to more than 60 industrial members. Many of these members are the leading international firms. In addition to maintaining contacts with industry, the EBC hosts foreign trade delegations that visit the center and demonstrate leading technology to liaison members. Recent visits have been sponsored by the Commercial Section, the American Institute in Taiwan (The University of Southern California Media Center) and the Australian Trade Development Agency Austrade (demonstration of Auran Technologies game development and multi-player platform). Our industry liaison leaders also include dominant electronics firms such as TSMC, UMC, MXIC and SIS.

Operation Model

In addition to the academic partnership, the education and research resource center integrates the energy from various organizations (including the government, non-profit R&D institutes, private companies, application service providers and universities). As shown in Figure 2, a three-tier architecture is developed for EBC operation. With the three-tier operation, the resources can be customized and outreached to other users through the online resource center. The three tiers are:

- **Tier 1:** Define the operational strategies and center infrastructure.
- **Tier 2:** Design the interdisciplinary programs and on-line teaching resources. Hold workshops and conferences (both at the center and through video conference) to disseminate the latest theoretical and technical knowledge in e-business areas.
- **Tier 3:** Develop an online resource center to provide newsletters, prototype applications, case reports, course materials and teaching aids. In addition, a multi-channel contact center is implemented to improve the educational service quality.

In general, with the three-tier architecture, EBC forms a tightly connected supply and demand chain with the other participants to successfully carry out the tasks of outreach (conferences and workshops), education (programs and training courses), prototype demonstration (prototype applications) and technology transfer (as shown in Figure 3). Based on the operation model, the service quality and depth can be significantly improved.

OUTREACH AND EDUCATION

On the basis of the proposed infrastructure in Tier 1, outreach and education in Tier 2 and demonstration and technology transfer in Tier 3 can be systematically accomplished. In Tier 2, the detailed fulfillment includes design of educational programs and course materials, conferences and workshops, and training.

Course Programs

Since the EBC team consists of faculty with various experiences in education, research and consultancy in the areas of manufacturing automation and e-business. With the appreciable hardware and software resources, EBC supports the execution of two EB related programs, i.e., the Electronic Commerce Program and the Manufacturing Automation and Electronic Business Program. The Electronic Commerce Program is a university level program for undergraduate students. By integrating teaching resources from various colleges of social society, electronic engineering and information science, industrial engineering and engineering management, and technology management, the program are divided into two tracks, namely “e-commerce and management” and “e-commerce and information technology”. Students can be well educated with comprehensive training of EB technologies and management strategies. On the other hand, the Manufacturing Automation and Electronic Business Program incorporates faculty with research interests of industrial automation, B2B e-commerce, e-business, systems engineering and information technology and aims at incubation of professional and skillful students with automation and EB background.

Course Materials

On the basis of the two proposed programs, several EB related course materials are re-designed to support teaching. In the years 2001 and 2002, six online course materials including Electronic Commerce, Enterprise Integration, Active Web Programming, Logistics Management, Enterprise Resource Planning and Supply Chain Management are designed and teachers or students from anywhere can easily access the materials through the web (under the Knowledge Management function) at anytime. The online materials designed for different level of universities and institutes consist of the course architecture, course chapters, case reports, slides, as-synchronous videos, latest business news, examinations and student projects. It is the main objective of the online materials to provide the teachers, students and other entities with the hands-on and multifold resources for efficient and effective training. In order to enhance the material depth and quality, two to three professors in each specific area from distinct universities are assigned for the material design of each course. Quality, consistency and accessibility of the course materials are stressed.

Conferences, Workshops and Seminars

International Conference on Engineering Education

July 21–25, 2003, Valencia, Spain.

To elevate EBC to the international stage, several international and domestic conferences, workshops and seminars were held in the years 2001 and 2002 [1,2]. The main philosophy of these conferences and workshops is internationalization and industry-oriented (i.e., the aerospace industry). Professors from universities, EB-related staff from SMEs and students interested in EB topics were invited to share the latest EB methodologies and technologies. The video conferenced technique was used to provide simultaneous knowledge sharing without geographical barriers. To successfully hold the workshops and seminars, EBC cooperated with the government, R&D centers and partner universities. The invited speakers are experts with excellent perspectives of the industry development, enterprise application integration (EAI) and global supply chain management.

In addition to the workshops, EBC also actively intercommunicates with international universities and associations (in USA, Canada, China Mainland, Japan and Korea) via informal academic visits. The visibility of EBC can be significantly gained and much valuable input can be obtained for EBC improvement.

TECHNOLOGY DEMONSTRATION AND TRANSFER — ONLINE RESOURCE CENTER

A web-based platform for EBC online resource sharing is established [3]. The platform aims at providing comprehensive and hands-on training and education resources for methodology demonstration and technology outreach.

Platform Architecture

The EBC resource sharing platform is developed via tools including ASP, JAVA and Oracle systems and hosted in EBC server division (<http://EBC.ie.nthu.edu.tw>). The platform is an opened environment and can be regarded as an example for EB technology implementation and demonstration since the EB technologies and strategies are implemented on the platform by students. The major modules under the platform are:

- Introduction and briefing of EBC
- Information about conferences and workshops
- E-knowledge management
- E-newsletter publication
- Student projects
- Prototype systems and call center
- Online video conference

E-Knowledge Management

In accordance with the proposed course programs, the EBC faculty is divided into sub-teams based on their professional background. Each sub-team consisting of several professors from distinct universities is responsible for the design of a specified e-material. An E-Knowledge Management function under CRM is provided for training resource accessing. A standard course material format is applied for all courses to ensure the quality and consistency of the materials. Users are allowed to download all the course materials anywhere at anytime. All the resources are opened and free but all the users should register for an account so that quantitative analysis of EBC performance evaluation can be carried out. Each course material consists the comprehensive contents including the outline, objectives, user guide, chapters, online forum, video on demand and news, etc. (Figure 4). As stated in previous section, in the years 2001 and 2002, six e-materials (i.e., dynamic web programming, electronic commerce, supply chain management, enterprise integration, logistics management and enterprise resource planning) about EB technologies and strategies are accomplished.

E-Newsletter Publication

The contents of the e-newsletter include the development and applications of electronic solutions, information about EB activities and the latest industrial news (especially the aerospace industry). To increase the depth of the newsletter, each partner university is assigned to be responsible for a specified track based on the university characteristics. The contents of all tracks from distinct universities are integrated into a consistent format and quality. The newsletter is not only published on the web but also sent to related professors and industries via e-mail. The main tracks of the e-newsletter are (Figure 4):

- Information about EB-related activities: Briefings of EB related conferences, workshop and activities held in Taiwan.
- Development of EB technologies: Features, capabilities and implementation of commercial electronic solutions in the areas of SCM, ERP, PDM and CRM.
- Successful scenarios of EB technology applications: Background, strategies, models and benefits of EB technologies in particular enterprises.
- EBC activities and accomplishments: EBC project progresses and abstracts of the conferences, workshops and academic visit.
- Industrial news: The latest news about the industry supply/demand chain and application service providers.

International Conference on Engineering Education

July 21–25, 2003, Valencia, Spain.

- News of partner universities: Information and accomplishments of other e-resource center.

CONCLUSIONS

During the start up, the EBC was dedicated in the aerospace e-business exchange with several sponsorship and funding from Boeing, the Ministry of Economic Affairs and the Ministry of Education of the ROC government. After several years of operation, the EBC is established as a national resource center and dedicated to the advancement of e-business research, education, and outreach. On the basis of EBC's successes in previous years, the center continues to enhance its capabilities and achievements in advanced EB technologies and methodologies in partnership with the government, academic sectors and industries. Using the well-organized architecture and operation model, the EBC and its partners (including other universities and industrial partners) form a unique supply chain model for educational collaboration and networking. In the near future, the EBC will work toward its ultimate goal as a leading international R&D center by advancing e-business research, education and outreach.

ACKNOWLEDGEMENT

The research is partially supported by Ministry of Education, Taiwan.

REFERENCES

- [1] The Electronic Business Center, *Lectures of BOEING Industrial Cooperation Project Workshops*, 2001.
- [2] The Electronic Business Center, *The Proceedings of the 2001 APEC Small and Medium E-Commerce Symposium*, National Tsing Hua University, June 26-28, 2001.
- [3] The EBC Online Resource Center, <http://EBC.ie.nthu.edu.tw/>.

FIGURES AND TABLES

FIGURE. 1
THE EBC FACILITY LAYOUT.

Electronic Business Excellency Center (EBEC)
The Panoramic View

Engineering Building I

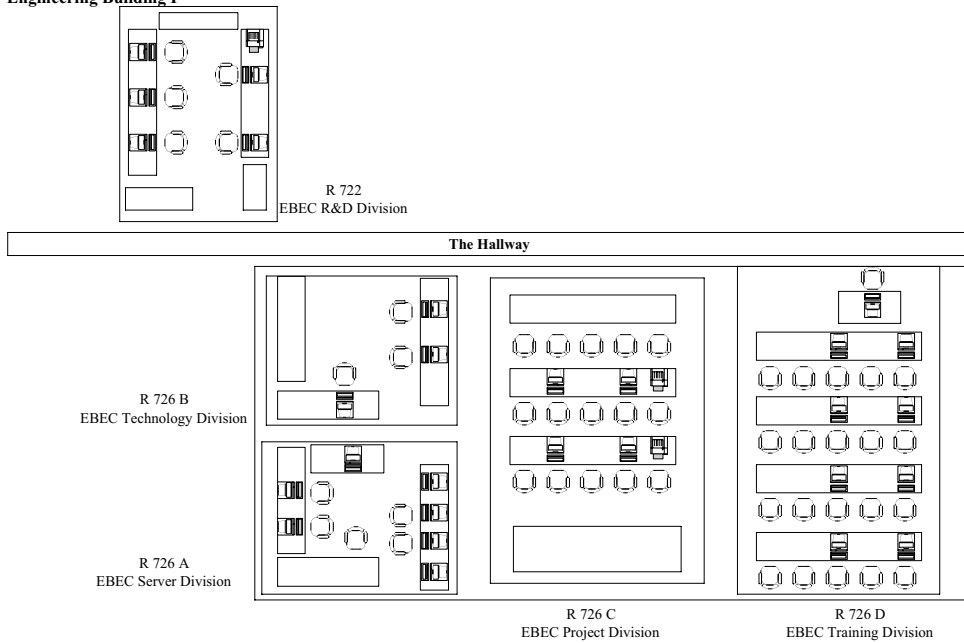


FIGURE. 2
THE THREE-TIER ARCHITECTURE OF EBC OPERATIONS.

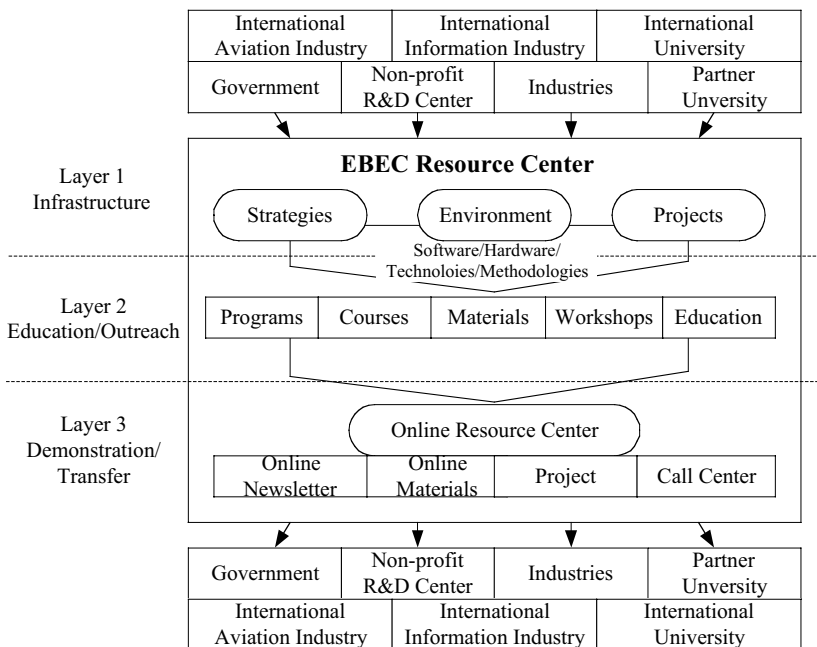


FIGURE. 3
THE EBC UNIVERSITY AND INDUSTRY PARTNERSHIP MODEL.

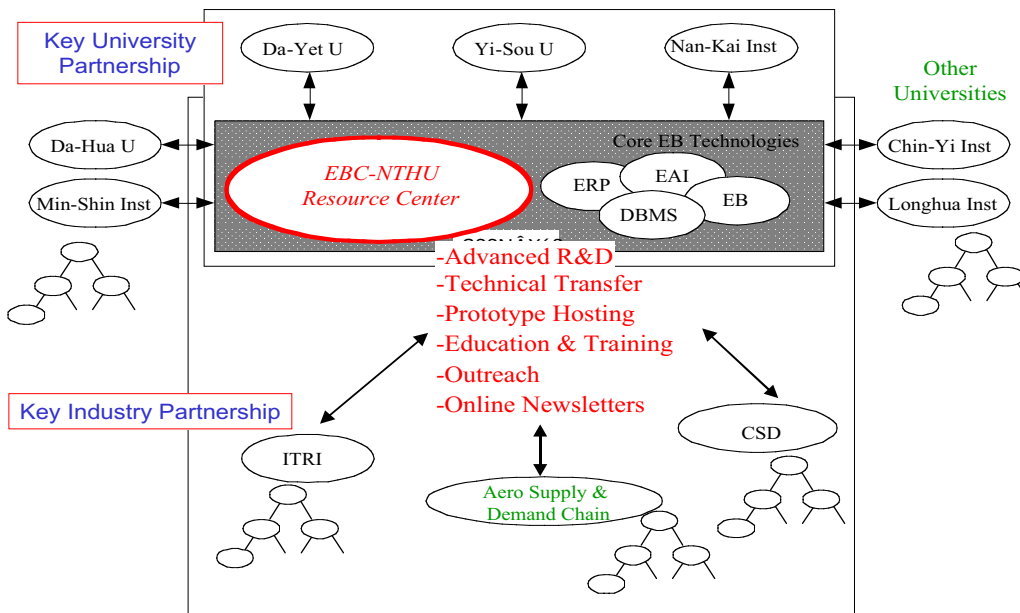


FIGURE. 4
THE EBC ONLINE COURSE MATERIALS AND NEWSLETTERS.

