

Terminal Evaluation

Latin America and the Caribbean

I. Outline of the Project

- Country : Brazil
- Project title : International Training Course on Manufacturing Automation Systems
- Issue/Sector :
- Cooperation scheme : Third Country Training Program
- Division in charge : Brazil Office
- Total Cost : 28,150,130Yen
- Cost per participant : 541,348Yen
- Share of Japan's Contribution : 77.1%
- Period of Cooperation : (R/D) : FY 2003 – FY 2007
- Partner Country's Implementing Organization: National Service of Industrial Learning (SENAI)
- Related Cooperation : Japanese Technical Cooperation for the SENAI-SP Manufacturing Automation Center project

1-1 Background of the Project

JICA and Brazilian counterpart, the National Service of Industrial Learning (SENAI), have implemented SENAI/SP Manufacturing Automation Center Project in order to attend demand on manufacturing automation technology in Brazil from 1990 to 1994.

In December 1996, Brazil and Japan signed a letter of agreement establishing a TCTP, with the aim of disseminating advanced technology in manufacturing automation in Latin America, via their respective cooperation agencies: ABC (Agência Brasileira de Cooperação) and JICA (Japan International Cooperation Agency). The coordinating agency is the national office of SENAI, through its Networking Agency for National and International Cooperation (GEART); the executing agency is the SENAI Center for Manufacturing Automation in the state of São Paulo, located at the Armando de Arruda Pereira SENAI School in São Caetano – SP, situated in greater São Paulo. The first five year project was from 1997 to 2001. After a one year interval, the second five year project commenced.

1-2 Project Overview

This terminal evaluation covers the first four years of the second project, from 2003 to 2006. Each June and July, a six week training program was held in São Caetano, with thirteen participants from different Spanish speaking countries of Latin America and the Caribbean. The instructors are regular SENAI staff.

(1) Project Purpose

To provide the participants from Latin American Countries with an opportunity to improve their knowledge and techniques in the field of manufacturing automation system.

Outputs of the Training Program

- 1) Output 1: Ability to design products utilizing resources of graphic communication, CAD (Computer Aided Design) at engineering stations, going on to generate the respective milling (CAM) programs and sending them to CNC (computerized numerical control machines) via DNC (Direct or Distributed Numerical Control).
- 2) Output 2: Ability to program and operate CNC machines and FMS (Flexible Manufacturing Systems).
- 3) Output 3: Ability to program and operate welding and manipulation robots with visual systems.
- 4) Output 4: Ability to integrate automatic manufacturing systems.

(2) Inputs

Japanese side:

Trainees received 52

SENAI's Side:

Local Cost (training) 116.958,59 reais local currency (6,434,207Yen)

II. Evaluation Team

Members of Evaluation Team:

Program evaluator Robert K. Walker, professor, Universidade Católica de Brasília.

Period of Evaluation:

14/07/2006 ~19/10/2006

Type of Evaluation:

Terminal

III. Results of Evaluation

3-1 Achievement of the Training Program

Achievements of each component of course can be summarized as below.

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Number of Applicants	22	15	40	39	n.a.	116
Number of Participants	13	13	13	13	n.a.	52
Countries Participated	6	5	8	11	n.a.	30
Duration	6 weeks (240 hours)	6 weeks (240 hours)	6 weeks (240 hours)	6 weeks (240 hours)	n.a.	

3-2 Result of Evaluation

(1) Analysis on the Achievement in terms of Outputs

	Year 1 (2003)	Year 2 (2004)	Year 3 (2005)	Year 4 (2006)	Year 5 (2007)	Average	Note if any revision in criteria during the course duration
Result 1 CAD/CAM/ CAE/CAT	91.92 3	82.77 2	93.31 3	85.80 2	n.a.	88.45 2.5	
Result 2 CNC	83.07 2	80.23 2	82.85 2	79.00 2	n.a.	81.29 2	
Result 3 Robotics	100.00 3	81.65 2	97.00 3	98.30 3	n.a.	94.24 2.75	
Result 4 FMS (integration)	97.30 3	88.46 2	87.31 2	91.90 3	n.a.	91.24 2.5	
Mean	93.07	83.28	90.12	88.80	n.a.	88.82	

*Achieved: 3, Partly Achieved: 2, Not Achieved: 1. Key: Achieved = average final grade > 89.99.

Partly Achieved = average final grade > 78.99 and < 90.00. Not Achieved = average final grade < 79.00.

(2)Relevance

(1) Relevance of the reasons for setting up the training program

1) Judging from the development needs and policies of the targeted countries, was the training program necessary?

Considering that nowadays export success seems to be a requirement for economic growth in small or medium sized emerging or less developed countries (which generally lack sufficient domestic demand to provide an incentive for substantial investment), it is noteworthy that it is restricted to just a few countries in Spanish speaking Latin America: Mexico, Argentina, Colombia and certain Central American countries. Of these, Mexico is the only one regularly characterized by quality exports to world markets (more in dynamic than in stagnant sectors); even there the predominance of "maquila" production for export, mainly to the United States, implies a situation which may be considered a mixed blessing. At any rate, countries such as Paraguay have made a political option for maquila-based production for export, through incipient but growing industrial modernization (although the country is still at the first stage of maquila, where the main attraction for foreign companies is cheap labor and low taxes). In this effort, the TCTP training program, as well as other JICA support within Paraguay, has been necessary. Furthermore, three of the thirteen 2006 participants (two from Peru and one from Venezuela) agreed that "Demand on the part of certain companies in my country for the technologies presented in the TCTP is very great, and there was never any pressure to participate in the TCTP." All participants agreed that "The diffusion of these innovations in my country is probable, among other reasons, because they represent the future." In terms of participant opinions regarding practical application at work, need seems to have been greater in 2004 and 2005 than in 2003 and 2006.

2) Was the training program the best way to transfer appropriate technology?

Technology transfer implies that the former participants will share what they have learned with their countrymen, and relevant technology will be adopted in local factories; however, there are many and varied obstacles to this process. While some presence-based learning is no doubt essential, because of the need for visits to factories and hands-on experience with the equipment in the training center, blended learning might be an even better alternative, with leveling of knowledge among participants prior to the presence-based course and continuing education afterwards, both through distance education provided in Spanish.

3) Was the condition for conducting training better in the host country than in Japan? If so, why?

Yes, because the cultural and linguistic differences are fewer, and the available competence, facilities and equipment were adequate.

4) In the case of TCTP, designing of curriculum, administration and management of the training course are entrusted and under the responsibility of training institutions in the host country. In this regard, was the entrustment of the training program reasonable in terms of improving capacity and ownership of the training institution?

Yes, although more advanced instructional technology, isomorphic with the sophisticated manufacturing technologies being transmitted, might well have been employed.

5) Was the training program meaningful in terms of promoting networking and cooperation among developing countries?

Yes, but networking via the internet, particularly via simulation and chats in association with distance education, might help to make this an enduring reality.

6) What were the pros/cons of conducting the training course in the host country?

SENAI has the competence to impart a systemic view of integrated manufacturing systems, and there are nearby factories in Greater São Paulo where participants can observe the practical utilization of the new technologies. The language difference (Portuguese is similar to Spanish) seems not to have been a major problem in presence-based education; however, collaboration with counterparts in nearby Spanish speaking countries may well be necessary if it is decided to develop and offer distance education in Spanish.

3-3. Factors promoting sustainability and impact

(1) Factors concerning Planning

The program itself is well structured, within a traditional training framework, and tested over the years: the activities (theoretical, practical and visits), together with the assigned or recommended readings, lead to evidence of learning (exercises and tests).

(2) Factors concerning the Implementation Process

The only adaptation to learners' needs is some remedial instruction for those lacking certain prerequisites (often holding back the others); a few more advanced participants are sometimes permitted to work on their own problems. It is considered inefficient. Some measures should be taken to provide those trainees who lack of sufficient knowledge with minimum information before the beginning of course.

3-4. Factors inhibiting sustainability and impact

(1) Factors concerning Planning

Assuming that the overall goal concerns the intended impact in the region, context analysis should have been conducted in advance, in order to identify needs and opportunities.

(2) Factors concerning the Implementation Process

In spite of the recommendation regarding distance education in the terminal evaluation of the previous five year project, the course is strictly presence-based. The instructional technology employed is commendable but less than state-of-the-art. Instruction is almost never related to each participant's own context.

3-5. Conclusion

The most important conclusion is that teaching and learning should be isomorphic with the sophistication and liberating potential of the new manufacturing technologies. Bringing participants together from many countries to acquire valuable experience with new technologies is one thing; having them sit in rows to listen to lectures in a foreign language is quite another. While there has always been an effort on the part of the TCTP executing agency to distribute class time between "theory" and "practice," there is certainly room for improvement in this regard. No matter what the blend between presence- and distance-based learning may be, modern information and communication technologies open up exciting new possibilities for learning and application.

In the annex, a detailed evaluation using the five DAC criteria (efficiency, effectiveness, impact, relevance and sustainability) is presented.

3-6. Recommendations

1) Adopt a blended learning (semi-presence based) approach to the next five year TCTP project. Ensure that all participants arrive in São Caetano having mastered the essential contents of each subject matter, so that most of the time at the Armando de Arruda Pereira SENAI School can be devoted to hands on practical learning and more time can be devoted to visits to nearby factories.

2) Promote continuing education, transfer of learning and support for professional technological instruction throughout the region through program-related distance education courses in Spanish for former TCTP participants (most of whom are professors or instructors), their students and others. Promote the goal of greater technical and cultural integration among the participating countries through on line discussion (chats) and collaboration.

3) Work toward increasingly sophisticated blended learning approaches, in an isomorphic relationship with the manufacturing technology itself. Simulation of flexible manufacturing systems, virtual factories and "representation" (as INET, in Argentina, refers to it) are possible models.

3-7. Lessons Learned

1) The region is not a major player in high technology global manufacturing, and only one of the participating countries regularly maintains a high quality of exports (measured by the ratio of dynamic to stagnant sector exports).

2) More advantageous dependency relationships are one possibility which may be considered attractive in some countries ("maquila" companies, which transform imported parts into products for export, are the outstanding example in the region). In its more advanced form, generally in electronics and the automobile industry, many of the competencies introduced by the International Course on Systems of Manufacturing Automation are of relevance.

3) Universities and training institutions exist in each country which provide a suitable venue for dissemination of innovations, but they require ongoing support for the efforts of former participants and others in this regard.

3-8. Follow-up Situation