

## International Cooperation in Engineering Education

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**ABSTRACT:** *In the era of global economy, the intense commercial transaction of goods and services among different countries has become common practice since the end of the twentieth century, resulting in the mobility of human resources. There is a high demand for experienced professionals with cross-cultural skills to work more effectively in international work environments. This paper reports on an international student exchange programme in engineering carried out between CEFET-PR, Brazil, and Zwickau University of Applied Sciences, Germany, over a period of three years (2000 – 2002). In this project fifteen final year students in engineering from both countries took part in an exchange. They participated actively in a study programme and in professional training in industry where they gathered data for case studies which they presented in their dissertation (first degree). Due to the excellent outcomes of the project in terms of qualified human resources for the two target markets, this pilot could be extended to other regions.*

### 1 INTRODUCTION

The process of restructuring globalising markets requires new knowledge and skills in human resources for international business environments. The networked training enterprise, like the networked manufacturing enterprise or the networked e-business enterprise, is under pressure to do more, better, faster, cheaper than ever before, to meet the needs of discriminating users in the global market.[1] Strategic alliancing between the stake-holding organisations across the global supply chain has been used to cut costs and add value in competitive global markets – through collaboration, through integration and by exploiting the diversity of skills and resources towards common regional and national goals. Cross-cultural skills and the infrastructure for managing across borders are a necessity in global markets [2]. Academic institutions devoted to training and endowing professionals with forward-looking capabilities, as well as research centres acting on innovation or new technologies, must find appropriate solutions to satisfy the demand for well-trained professionals.

Especially in the context of business transactions involving developed and newly industrialised countries work contexts have changed significantly in recent decades, according to Bruno [3]. Since the beginning of the 1990s, several companies with international shareholders have started businesses in Brazil. This is due to several reasons: a) to be present in the niche of emerging markets, b) to draw on the advantages of tax exemption conceded by the public authorities, c) to set up and operate industrial plants with advantageous business activities, etc. The emergence of the New Economy requires trained professionals to face the challenges of the new paradigm in the production process (e.g. the introduction of automated processes), in purchasing via e-commerce, and in the intense application of logistics operations in supply chain management.

This paper outlines one model of an innovative inter-regional exchange programme enhancing professional and organisational development in the automotive manufacturing supply chain. The project was carried out between a German institution, Zwickau University of Applied Sciences, offering professional training programmes very similar to those offered by a Brazilian institution, the technical University of CEFET-PR in Curitiba. There is scope for transferability of this pilot to other sectoral and regional clusters as part of a strategy for diversification and internationalisation. This project might therefore encourage researchers and institutions in other countries to develop a similar exchange

programme to collaborate in professional training to enhance human resources skills for international business.

## **2 THE PROJECT**

This project was started on the initiative of a German and a Brazilian researcher. Within the framework established between the Brazilian and German governments they developed an exchange programme between professionals and students of both countries. The overall objective of this project was to improve the socio-economic conditions in the regions involved (Paraná and Saxony) through shared knowledge and experience in professional training with strong emphasis on international management in the extended enterprise [4].

## **3 JUSTIFICATION**

Since the beginning of the 1990s, the automotive and supply industries from various countries of origin have established themselves in Paraná, a region with an agricultural infrastructure. Thus a segment of the production of goods has been added to this region demanding human resources with special skills. These companies have been and still are operating with specialists from the countries of origin (Sweden, USA, France, Germany and others) who gradually have to be replaced by Brazilian specialists.

Also at the beginning of the 1990s, after German reunification, in the region of Saxony a market began to emerge in the automotive sector. However, in contrast to Paraná, Saxony is a region with a long-standing tradition in engineering. Therefore the development of local resources in the automobile field was fast.

Based on comparable socio-economic contexts in Paraná and Saxony as 'emerging markets' in the phase of consolidation, with a range of common areas of concern regarding supply chain management in the global market, a strategic alliance was set up with the objective of creating value for the partners in the regions in the year 2000.

In both regions,

- the automotive manufacturing industry supports the regional economy. This constitutes 11% GDP in Brazil, 16.6% in Germany (1999); 11,1% GDP in Brazil, 20% in Germany (2001) [5]
- the automotive manufacturing and supply industries have shifted from the service function to a process of development in partnership and thus into a process of creating value along the whole supply chain. (The result is 'lean management', the 'manufacturing of modules' and 'just-in-time production'.)
- there are strong areas of correspondence in the strategic aims and training role of partner universities in professional and organisational development in the automotive and engineering sectors through research and training which provide a good basis for value-adding partnerships. [6]
- there are strong cultural and educational connections between Germany and Brazil in Paraná region, particularly in relation to engineering training (there are 5 million people of German origin mainly in the south of Brazil)
- belonging to trade blocs – MERCOSUR and EU – there is a great effort to reduce trading barriers as Mexico has already done in EFTA

## **4 METHODOLOGY**

The objective of the development of this exchange programme was limited to the study of the regions of Paraná and Saxony where the partner universities (CEFET-PR and Zwickau University of Applied Sciences) are located. The project included a field survey, academic lecturing, industrial training, and the development of a practice-oriented MBA programme in supply chain management and logistics which has been discussed in an earlier paper [7] and will therefore not be presented here. The programme was forecasted for three years starting in 2000, with a total participation of two academic staff members (the German and Brazilian project coordinators) and fifteen students. The academic staff had the task to coordinate the programme, carry out the field survey, plan courses and give lectures to participating students in special areas (supply chain management and logistics, and cross-cultural management).

The students of each country were required to engage in language learning, to attend seminars on cross-cultural themes, on supply chain management and logistics, and to do practical training with an automobile company. The coordinator for each country established the criteria for applied research to be realised (case studies) and for the selection of participating students. He/she also applied for financial support that could be used to further the participation of students in the training programme.

The academic and professional exchange programme between CEFET-PR and Zwickau University of Applied Sciences followed the objective to adapt the qualification profile of professionals to the requirements of the market in this context. The participating students acquired specific knowledge and skills for the local and global market through a special qualification programme in the partner institution, and through practical experience in companies in the automobile sectors in both regions. Efficient tools for new challenges in the volatile world of industry and economy were made available. Students had the opportunity to study latest theories in 'supply chain management', 'knowledge management', and 'cross-cultural management'. These theories offer methods to participate actively in the restructuring process of global markets. Apart from 'hard skills' such as solid qualification in engineering techniques, today's engineers must have 'soft skills', such as cross-cultural competence, that surpass the social competence required up to now.

In this exchange programme participants were sensitised to cross-cultural problems and potential synergies in global/local contexts not yet discovered. Theories of 'soft processes', 'cross-cultural' lectures, training programmes and supervision of students on the job supported their insight into the peculiarities of global and local processes. Forerunner theories were discussed with Research Fellows from the University of Aberdeen and the University of Edinburgh in video conferences. During students' practical training the coordinators also carried out discussions online and via video conferencing.

Practical training in companies gave students the opportunity to research an area with the support of new theories and to present their results as a case study in a dissertation in which, based on their observations, they devised necessary solutions to enhance enterprise processes.

## **5 DEVELOPMENT**

The project started soon after CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior) and DAAD (Deutscher Akademischer Austausch Dienst) had promoted the exchange programme. The work schedule of the coordinators was drawn up. It was decided to perform two work missions for each coordinator to be carried out during the exchange programme. The work missions started with a trip by the coordinator of the German institution to Brazil in September 2000.

### **5.1 WORK MISSION**

During the years 2000, 2001 and 2002 five work missions were realised in both the countries. During these periods the coordinators benchmarked the two partner universities. Moreover, they carried out a market survey. They visited 20 companies in the automobile sectors of each region, and also of the public institutions responsible for supporting human resource training, and acquired internships with research infrastructure and a salary for the participating students.

The duration of individual work missions was 6 weeks, during which each coordinator also had the opportunity to meet top managers from each institution.

### **5.2 STUDIES AND TRAINING MISSION**

Students of engineering and management courses in both countries were involved in academic studies and training missions. During the first six months, they attended an intensive language course, a cross-cultural workshop focusing on the target countries (Germany and Brazil), and a seminar on supply chain management and logistics. After that, they started a six-month industrial training with companies during which they gathered information for a case study to analyse in their dissertations (thesis for first degree).

### **5.3 DIFFICULTIES**

As the exchange programme was developed involving people from two different countries, each one with its own language, customs, distinct political system, academic structure, working habits, enterprise cultures and other factors, it was always prone to operational difficulties that had to be solved through the common sense and international experience of the coordinators from both countries. Communication

between the coordinators was carried out in Portuguese. Between the German staff and the Brazilian coordinator it took place in English. At the beginning, scholarship students communicated mainly in English and then gradually more and more in the language of the respective host country. As the managers of the host institutions did not always have a command of English, the German coordinator functioned as an interpreter.

A common difficulty was and still is the selection of scholarship students, as there are almost no students with fluency in German or Portuguese as a foreign language.

Another difficulty was also to establish the schedule for the exchange programme due to different academic calendars in the two countries.

## 5.4 ADVANTAGES

There is no question about the advantages obtained by the institutions and students that participated in the programme. The activities developed gave the unique opportunity to become acquainted with the cultures of different societies whereby productive activities should occur with the aim of developing in each country the socio-economic prosperity of the regions involved.

The institutions involved benefited from the exchange of academic staff. In the ultimate analysis it can be concluded that these staff performed knowledge up-dating activities in their fields of expertise, participating as listeners or lecturing courses.

For the students participating in the exchange programme, learning and improving knowledge of a foreign language, German for the Brazilians and Portuguese for the Germans, as well as the knowledge of the culture of each country, formed the cornerstone of the exchange programme.

The effective participation of transnational companies complemented the training activities for industrial training of students, enabling them to work in the activities that require a sound knowledge of the mechanism of international goods and services transactions.

## 6 RESULTS

This inter-institutional exchange programme, focusing on training professionals for the emerging demands of companies in the automotive sector, enabled the German and the Brazilian coordinator to gather information to develop three distinct training programmes:

- a programme to train logistics operators
- a programme to train logistics supervisors
- a Practice-Oriented Masters Programme in Supply Chain Management and Logistics (POMD) [4]

Students from both countries who were involved in the academic and industrial training in this exchange programme have excellent opportunities for employment with companies doing business world-wide.

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