THE CONTRIBUTIONS OF PROJECT MANAGEMENT AND INTERNATIONAL COLLABORATION IN THE AREA OF ENERGY EFFICIENCY AND LOW FRICTION DESIGN

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ABSTRACT

The paper justifies the necessity of implementing Project management for international activities in order to improve the quality of social and cultural environments. It deals with scientific research involving innovation, entrepreneurship and new organizational structures. The main objectives of the paper are: to disseminate the most important contributions of the Intensive program ―POWERING THE FUTURE WITH ZERO EMISSION AND HUMAN POWERED VEHICLES‖ and to present the contribution of the scientific team from University of Ruse in the Intensive Programme in the frame of analysis of existing prototypes of human powered vehicles. The advantages of using such vehicles for reducing the global warming are considered. Finally, the role of the successful management of the project is underlined.

KEYWORDS

International collaboration, Erasmus LLP Intensive Programmes, Global Warming and Energy, Project Management

INTRODUCTION

Velomobiles are currently used in Europe as practical and environmentally responsible means of personal transportation. The sustainable and developed modern society is aware that the supply of fossil fuels is finite and their application has negative environmental consequences. Alternate solutions to our total dependence on fossil fuels are required at this moment of development and globalization of society. The velomobile plays an important role as part of the solution in Europe. The Erasmus Longlife Programme (LLP) entitled ―POWERING THE FUTURE WITH ZERO EMISSION AND HUMAN POWERED VEHICLES‖ funded by the Greek State Scholarships Foundation and coordinated by the Alexander Technological Educational Institute of Thessaloniki (ATEI), Greece is intended to elaborate prospective velomobile as a prototype of road ready machine [1].

Objectives of presented investigation

It is the objective of this paper to present the contribution of a successful project management to the intensification of international collaboration between multinational, multidisciplinary scientific teams. This can be proved by a closer investigation of the context that surrounds the Erasmus LLP Intensive Programme ―POWERING THE FUTURE WITH ZERO EMISSION AND HUMAN POWERED VEHICLES‖. The seed of the overall project was an idea coming from a scientific team of the Industrial Sciences and Technology Department of the Karel de Grote Hogeschool (KdG), Belgium. The idea, stemming from the needs of modern life in Belgium and most large European cities in general, was developed by the head of KdG International Office, into a possible European Educational Project. The collaboration of KdG with ATEI in similar projects has finally led to a joint application for funding of the proposed project. In this final proposal of the overall effort, scientific teams from ten European Institutions of ten European countries came together into a multidisciplinary educational activity funded by the Greek State Scholarships Foundation in the frame of Erasmus LLP Intensive Programmes (IPs). The content of the IP includes a strong variety of topics in several main areas: Electrical drivelines and Power electronics; Low drag design; CAD/CAM; Vehicle stability design; Human power; Mechanical driveline.

The scientific team form University of Ruse, Bulgaria, consisted of A. Dobreva, G. Georgiev and V. Dobrev, significantly contributed to the low friction design of mechanical parts. Innovative design solutions of spur and planetary gear trains with increased energy efficiency and improved load distribution are developed. Theoretical research of different design versions of planetary gears and considerations about the load distribution among the elements of such gear trains are implemented. The following conclusions are summarized: An innovative design of planetary gear train is presented; the main advantages of this design solution are the improved energy efficiency parameters. New solutions and recommendations for the elaboration of innovative design versions of spur and planetary gear trains with improved efficiency and load distributions are analyzed.

Management of the project

As mentioned in the previous section, the project is coordinated and managed by one of the partners, namely ATEI. In order to achieve successful results, a very specific structure of the management was selected. A project contact person at each Partner University was appointed to communicate with the rest of the partners and inform local teachers and students. Moreover, the scientific and educational content of the project was divided into six topics, the coordination of each of which was appointed to a topic leader. The latter were selected according to their experience on the specific subject and in project management. Each topic leader had the responsibility of organizing the educational activities of the topic (lectures, workgroups, laboratories etc) as far as the teaching content and the selection of the teachers. They all had to report to the project coordinator who was also responsible for the financial management of the project.

The project consortium complies very well with LLP Erasmus Intensive Programme objectives, since the geographical distribution of the partners includes almost all parts of the European Union, as revealed by the list of partner-Universities are Alexander TEI of Thessaloniki, Greece (COORDINATOR); University of Bradford, UK (GENERAL MEETING ORGANISER); Universitat Politècnica de Catalunya, Spain (INTENSIVE PROGRAMME ORGANISER); ISEP, Portugal; Karel de Grote, Belgium; Kaunas University of Technology, Lithuania; Kologn Hochschule, Germany; University of Radom, Poland; University of Ruse, Bulgaria; Turku University of Applied Sciences, Finland. Within the consortium, there are partners with great experience in EU projects (KdG, Bradford) and relatively newer partners, such as Kaunas University of Technology and University of Ruse.

Among the various activities of the project, there is the main one, a two week intensive educational procedure that takes place in the establishment of one of the partners bringing together more than 18 teachers and 50 students, several information activities taking place in each partner university and a general meeting prior to the main activity that is also necessary for successful management of the project. In the frame of the project, a website is also created.

Working with prototypes of human powered vehicles

Taking into consideration global warming and greenhouse effect, the scientific team of University of Ruse has made a literature investigation looking for already famous alternatives to help the cause. Hybrid cars and/or riding bikes have become very popular solutions considering the effect of global warming upon the environment, sustainability and management of economics of modern societies. Some of these pedal-powered recumbent vehicles are even starting to come with electric assistance for climbing steep hills. The aerodynamic quality of that human-powered vehicle (HPV) is very important. An indicative vehicle of this category is illustrated in Fig. 1a [2].

Furthermore, velomobiles such as the ―Go-One3‖ velomobile with electrical support [3] appear to have significant increase in popularity. This velomobile is a three-wheel, totally enclosed tricycle that is considered a human-powered vehicle (HPV). Its capabilities are increased with a 700-watt electrical assist motor if desired. The ―Go-One3‖ has high visibility, maneuverability and sustainability as long as the driver (rider) has energy or the battery holds out. It is illustrated in Fig. 1b [3].

(a)  (b) 

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Some small cars could include both pedals and electric hybrid motors. Modern geared cycles are quite efficient transportation machines. In terms of energy input per kilometer those vehicles are very efficient. It is a matter of gears and patience of the driver (rider). Regular bikes have not changed much since they started using sprocket drives: better gears, different handlebars, etc. Velomobiles are usually tricycles with aerodynamic bodies. A rider who is used to riding frequently could hold a speed of 30mph quite a long time in an aerodynamic velomobile. Power cranks are elements of the mechanical drive which are to be used for balanced rotation with both legs. Two speed crank sets could be preferred instead of external gears.

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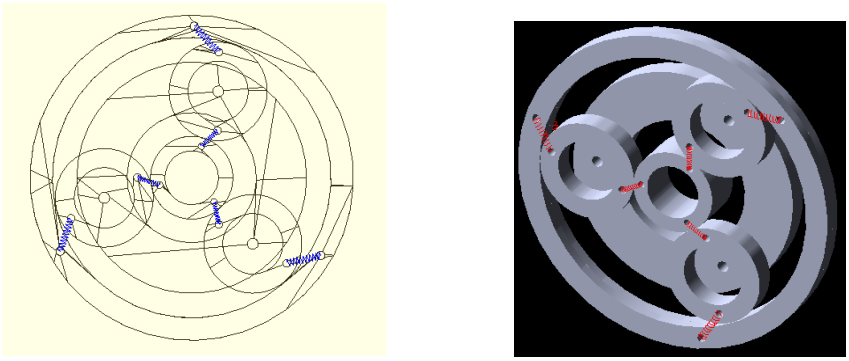

Fig. 2: Model of the investigated gear train in equilibrium [4].

The contribution of the scientific team of University of Ruse is based upon previous investigations of representatives of the University of Ruse [4]. Planetary gear trains could be very appropriate. After the model of the gear train elements, which are assumed to be ideal solid bodies, has been created in SolidWorks, the mesh stiffness is presented through elastic elements in the working environment of MSC.ADAMS (Figure 2). The advantages of this model are presented in [4]. Other examples of application of planetary gear boxes in mechanical drivelines of vehicles are shown in [5].

Outcomes of the project

The following outcomes resulting from the activities of the presented project based upon its successful management were achieved:
1) The international variety of lectures and teaching methods will provide students with the best practices and experience from different countries and partner universities.
2) Some students diploma works based on the IP outputs will be carried out at participating universities.
3) Network of contacts between students from different countries will be organized, which will contribute to their future realization as European professionals.
4) All the students will have the opportunity to work in a competitive environment with other young future professionals.
5) The system of international contacts will contribute to the possibility for the students of finding a job in their future professional area in European enterprises.
6) Links and structures between these cities authorities, urban transport companies and institutions and universities will be established.

CONCLUSIONS

The following conclusions are deduced:
1) The successful Project Management contributes to intensifying of International collaboration for the multinational scientific teams.
2) The project management and the intensive work on international contacts support the international research involving innovation and new organizational structures.

Fig. 1. Velomobile prototypes Velomobile (a) as described in [2], (b) ―Go-One3‖ [3]

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