

# The National Mechatronic Platform. The basis of the educational programs in the knowledge society

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**Abstract.** The shift from the information society to the knowledge based society caused by the mechatronic revolution, that took place in the 9th decade of the last century, launched a lot of challenges for education and researches activities too. Knowledge production development asks for new educational technologies to stimulate the initiative and creativity as a base to increase the productivity in the knowledge production. The paper presents details related on the innovative potential of mechatronics as educational environment for transdisciplinarity learning and integral education. The basic infrastructure of that environment is based on mechatronic platforms. In order to develop the knowledge production at the national level the specific structures are to be developed. The paper presents details related on the structure of the National Mechatronic Platform as a true knowledge factory. The benefits of the effort to develop the specific infrastructure for knowledge production in the field of mechatronics are outlined too.

## 1. Introduction

In the last two decades, an intense shift from advanced mechatronic systems to cyber physical systems (CPS) and social-cyber-physical systems (SCPS) is taking place [17], [23].

Cyber-physical systems are engineering systems that are built from upon the synergy of computational and physical components. The CPS of tomorrow will need to far exceed the systems of today in capability, adaptability, resiliency, safety, security, and usability. Examples of the many CPS application areas include the smart electric grid, smart transportation, smart buildings, smart medical technologies, next generation air traffic management, advanced manufacturing etc. CPS will transform the way people interact with engineering systems, just as the internet transformed the way people interact with information. However, these goals cannot be achieved without rigorous systems engineering.

The succession of major physical, biological, social and technological developments on a historical time scale shows accelerating evolution. Acceleration is obvious if we consider the gradually shortening time periods between subsequent milestones of development. This accelerating evolution can also be observed in terms of the emergence and maturation of human-created technologies. However, much less attention is paid to the changing place and role of information in the process of observable physical, biological, social and technological evolution. In our modern time, human engineering systems not only encapsulate information and knowledge, but also acquire the potential and abilities to regenerate information, and convert it into operative intelligence. As technology and intelligence continue to integrate, systems with a high-level working intelligence, even with a self-



reproductive intelligence, can be expected. It can be foreseen that already in the near future, but surely in the farther future, it becomes possible for intelligence to reside and evolve in multiscale engineered systems. This is assumed to facilitate human presence in even saturation of a nearby part of the universe. What is happening in our days is a kind of unrestricted integration of human acquired and artificially generated information with human created artefacts.

Advanced mechatronics and embedded systems are the foundation of CPS development [17], [23]. To expedite and accelerate the realization of cyber-physical systems in a wide range of applications, it is necessary to develop methods, tools, and hardware and software components based upon cross-cutting principles, along with validation of the principles via prototypes and test beds.

The paper is based on the following concepts: mechatronics, integration, interfacing, information links, complexity, mechatronic platforms, integrated design, transdisciplinarity, and integral education. The term mechatronics, patented by the Japanese at the beginning of the eighth decade of the last century, was used to describe the integration of the three major areas of engineering: mechanical engineering - electrical engineering, electronics - control science and, computer science [6], [21], [26], [32], [37]. The main feature of the mechatronic systems is dualism: energy flow - information flow.

Information links and information kinematic chains ensure flexibility and reconfigurability of the mechatronic systems. Mechatronics was born as a technology and very soon became philosophy, science of intelligent machines, science of motion control, and now, in the knowledge based society it is environment for transdisciplinarity learning and integral education. The basic concepts of mechatronics are: the system concept and the interface concept [21], [32]. In the case of compound systems like mechatronic systems, in which various elements having different properties such as mechanisms, electronic devices, software, etc. are combined with each other, the interfaces among the component elements and the subsystems are very important. Also the system interface with human operator is very important. For engineering practice, mechatronics has marked the shift from traditional, sequential engineering to concurrent (parallel) engineering. So that the concepts of integrated design or design for control were developed. In that context, the problems related on the integration-interfacing process, the information links and the control function integration are to be taken into account very early, in the stage of the conceptual design.

In 1986 the word “Mechatronics” acquired its citizenship in the vocabulary of the European Community. The Industrial Research and Development Advisory Committee (IRDAC) of the European Community (Doc. IRDAC PM 17-10-86/3) recognized mechatronics as one of the major needs to be met by the European Research and Educational programs [32].

The IRDAC decision stimulated the initiatives of the European Governments to develop national programs for promoting mechatronic philosophy in education and R&D activities. The USA Department of Commerce report entitled “JTECH Panel Report on Mechatronics in Japan”, elaborated in 1985, compared US and Japanese research and development trends in specific areas of mechatronic technology [8]. Based on the conclusions of the report, The National Foundation of Science launched the National Programme of Mechatronic Education. The program was managed by Stanford University.

The above mentioned events held by Japan, EU and USA, the projects and programs to promote mechatronic philosophy in education and R&D activities are considered as being a true revolution, the mechatronic revolution that shifted the advanced information society to knowledge based society [32],[33].

Integration is a natural process. In the literature are developed concepts like: integration philosophy, logic of integration [34], and in the papers [11], [33], the authors tried to demonstrate the phenomenon of integration and integrability based on information, material and energy support (informergic interaction). In the paper [19], the author defined the concept of integron as a messenger of integration, showing that the human body is the result of integrons hierarchy. The integration is the mechatronic paradigm [21], [32], [33], knowledge is the result of structuring and integrating information. As integronics is the science of integration processes and hyper integrated systems [33], [34], it deals with integration levels, integration degrees, hyper integrated systems and the benefits of

integration process. Integration is not a useless process. On the contrary, integration gives new possibilities to control the systems. Integration gives the possibility of association to complementary elements, the possibility of connecting, of forming cycles and networks. But integration also gives the possibility of obtaining a surplus of elements, a structural redundancy. In the case of hyper integrated systems (e.g. human body) where everything is linked to everything and everything depends on everything, the structural redundancy results in a fantastic combinatory redundancy. Integration therefore gives the systems larger possibilities to maintain their identity despite the second principle of thermodynamics.

In the integration process a special role is attached to information, and informational links since elements have to recognize one another in order to be able to unite in increasingly organized systems. For this reason, each element transports the substance and energy it consists of, structural information that can be recognized by the other elements. In this way, some elements attract and other rejects one another, giving birth to extremely varied systems [34], [35].

In the case of more complex systems there also appear integration subsystems, such as the nervous system, the endocrine system and the cardiovascular system that have the role of coordinating the millions of cells of the body [19], [34].

In the field of mechatronic systems the approaches to get integration of the elements of the three fields of engineering are based on hardware integration and software integration.

As it is emphasized in the literature, mechatronics opened new horizons in all the fields of activities, because of the synergy effect [6], [7], [21], [27], [32]. In the knowledge based society, mechatronics is the main vector of innovation and the main support to increase the work productivity in the knowledge production. As Stephen Hawking, English theoretical physicist emphasized, the twentieth century will belong to complexity [3]. The complexity is closely related to the idea of non-separability, which “seems to be a fundamental principle of all that is profound in the world” [3], [33]. Consequently, research and education of the future must be shaped by the force lines of the complexity and non-separability.

In other words, “creating the frame for complex and transdisciplinary thinking development in the structures, programs and areas of influence of Universities, will enable the progress towards its mission forgotten today – the study of universality”. Emphasis is provided by Prof. Basarab Nicolescu, founding president of the International Centre for Transdisciplinary Research and Studies, Paris [29-31].

In the knowledge society learning transdisciplinarity and integral education are major needs in order to stimulate initiative and creativity as a basis to increase the work productivity in the knowledge production. Some arguments to support that approaches are presented in the paper [31]. The 1<sup>st</sup> argument is the big-bang of the number of disciplines who increased from 7 (when first universities were founded in the 13th century), to more than 8000 in 2012. A great expert in a given discipline is totally ignorant in more than 7999 disciplines. The decisions which are taken in our troubled world are based on ignorance and this fact provokes inevitable crisis which will be deeper and deeper in the future. Second argument: the rapid changes in our contemporary world induce more and more unemployment and therefore human beings have to change their jobs several times during their active life. But passing from one job to another is practically impossible in the context of an accelerated super specialization. Third argument: recent discoveries in neurophysiology underline the unexpected fact that the analytic intelligence is too slow compared with the intelligence of feelings. Therefore, we have to find equilibrium in our educative system between the analytic intelligence and the interior being. Fourth argument: globalization induces an enormous migratory flux of people belonging to countries of a given culture, religion and spirituality towards countries of another culture, religion and spirituality. The new education has to establish the dialogue between cultures, religions and spiritualities. Fifth argument: the rapid advance of means of communication implies an increased complexity in an interconnected world. The new education has to invent new methods of teaching, founded on new logics. The old classical binary logic, that of “yes” and “no”, i.e. the logic of the excluded middle, is no more valid in the context of complexity. The last argument is the following:

solving problems in the real world forces university to interact with society, industry, banks and ecology. These problems clearly belong to the field of "trans": their resolution asks us to go beyond academic disciplines. Transdisciplinarity is therefore realistic and necessary for the survival of universities.

## **2. The concept of integral education**

Growing awareness of a system of education that does not keep pace with the modern world is demonstrated by numerous recent conferences, reports, and studies. The latest and most exhaustive report was developed by the International Commission on Education for the Twenty-First Century chaired by Jacques Delors, in cooperation with UNESCO [4], [30-31]. The Delors Report strongly emphasized four pillars of a new kind of education: learning to know, learning to do, learning to live together, and learning to be. In this context, the transdisciplinary approach can make an important contribution to the advent of this new type of education. In the "EU-2020" strategy is also mentioned that education and training are the engine of the intelligent, lasting and favourable to inclusion development.

There is one very obvious interrelationship between the four pillars of the new system of education: how to learn to make while learning to know, and how to learn to be while learning to live together? In the transdisciplinary vision, there is also a transrelation which connects the four pillars of the new system of education and which has its source in our own constitution as human beings. This transrelation is like the roof which rests on four pillars of a building. If any one of the pillars of the building collapses, the entire building collapses, the roof with it. And, if there is no roof, the building falls into ruin. A viable education can only be an integral education of the human being, an education which is addressed to the open totality of the human being, not to just one of the components.

At present, education privileges the intellect over the emotions or the body. This was certainly necessary in the previous era, in order to permit the explosion of knowledge. But this privileging, if it continues, sweeps us away in the mad logic of efficacy for efficacy's sake, which can only lead to our self-destruction. Of course it is not a question of limiting or increasing the number of hours provided for artistic or athletic activities. This would be like trying to obtain a living tree by juxtaposing roots, trunk, branches, and leaves. This juxtaposition would only lead to a semblance of a living tree. Contemporary education concerns itself with only the leaves. But leaves do not make a whole tree. Experiments made by the Nobel Prize-winning physicist Leon Lederman with children from disadvantaged neighbourhoods of Chicago demonstrates what we have been saying [29-31], [38].

Lederman convinced some secondary school teachers to initiate new methods for teaching physics based on the touching of different objects and the discussion of contributions of different sense organs (sight, touch, smell) in the process. All this was play: it took place in an environment far removed from the usual formal apprenticeship in mathematics and physics. And the miracle happened. Even children who came from very poor families, where violence, lack of culture, and disinterest in the typical activities of children reigned supreme, discovered the abstract laws of physics through play. One year earlier, these same children had been declared incapable of ever understanding any abstraction. It is interesting, moreover, to point out that the greatest difficulties of the operation and - it goes without saying - the major part of its cost, were due to the resistance of the teachers: they had a great deal of trouble abandoning their old methods. The teaching of teachers proved longer and more difficult than the work with children. The Chicago experiment shows well that the intelligence assimilates knowledge much better and much more rapidly when this knowledge is also understood.

## **3. The Mechatronic platforms as a basic infrastructure for transdisciplinarity learning**

The concept of transdisciplinarity introduced by Basarab Nicolescu is defined as "what is in the same time, in between disciplines, inside different disciplines, and beyond any discipline"; the finality of the transdisciplinary measure is the understanding of the world through the unity of knowledge [29], [30], [31]. As we know, the identity of a subject to be taught can be: disciplinary (mathematics, physics,

chemistry etc.), thematic (system theory-based on the concept of system) and trans-thematic (based on the complexity concept) [4-6].

In [3-5] it is proved that, in mechatronics, complexity is a thematic concept, as defined by Holton, which gives the depth of mechatronics identity, which is a trans-thematic one.

The concept of technological platform was launched in 2001 at the level of EU. Since then, more than 40 platforms were founded, integrating companies, research labs and institutes, universities, professional organizations for different fields of activities. As infrastructure, the mechatronic platforms are complex technical systems integrating elements of mechanical engineering (mechanisms, mechanical transmissions, etc.), electrical - electronic engineering elements (actuators, sensors, microcontrollers, filters, amplifiers, etc.) and control science - computer science elements. Mechatronic platforms can be: stationary, mobile, portable and virtual, [13], [14], [24], [27], [28] and [36].

Stationary platforms include: equipment's for education and research that are fixed in laboratories. Mobile platforms are made of mechatronic modules in a reconfigurable structure. They are used for research, demonstrations outside the universities and for industrial applications too (in schools, companies, etc.). Portable platforms are made of mechatronic modules of low-cost and low-weight; they make possible experiments everywhere and every time. Virtual platforms include virtual laboratories, virtual libraries, knowledge bases and source knowledge bases.

The innovative potential of mechatronic platforms has been presented in [13], [14], [24], [27], [36], but when it comes to use their transdisciplinary potential, the literature lacks in providing edifying solutions.

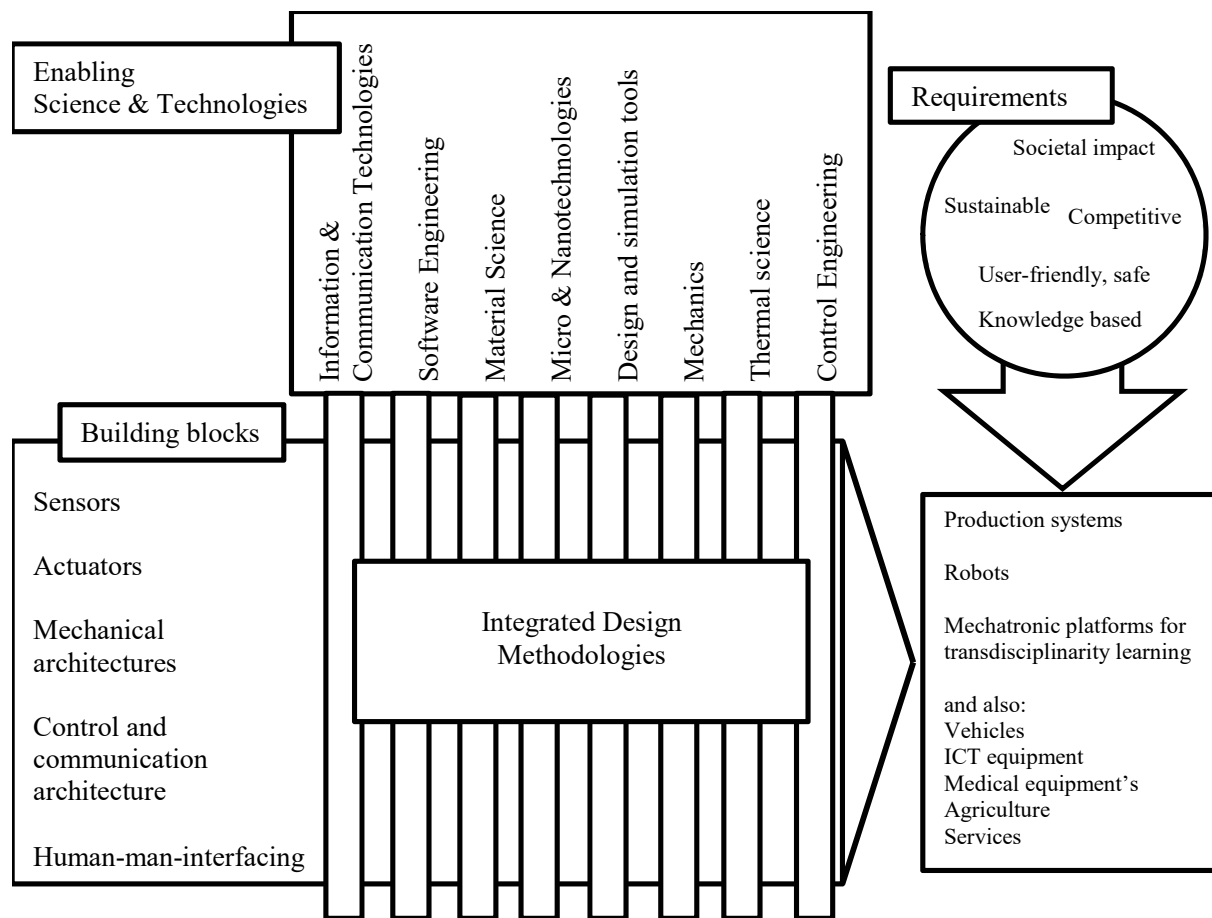
Mechatronic platforms are the basic infrastructure for learning transdisciplinarity too, in order to stimulate creativity and growth of labour productivity in the mechatronic knowledge production. It is important to note that, disciplinarity, pluridisciplinarity, interdisciplinarity and transdisciplinarity are complementary approaches [29], [30], [31].

Mechatronic knowledge is a technological one, or knowledge about how to manufacture intelligent products, systems and services [13]. Taking into account the trans-thematic identity of mechatronics, mechatronic knowledge is transdisciplinary one. Learning transdisciplinarity is a major need in the knowledge based society. Integral education ensures the achievement of this objective. The concept is introduced in [1], [2], [3], [12], [29], [31] and brings into attention educational and technological approaches where the subject participate in the educational process with his whole being (mind, emotions and physical).

Worldwide interest in mechatronics and its associated activities continue to grow annually. A summary of the main events that marked the evolution of mechatronics at international level is presented in [6], [7] and [33]. Mechatronics is a design philosophy: an integrating approach to engineering design. The primary factor in mechatronics is the involvement of these areas throughout the design process. Through a mechanism of stimulating transdisciplinary ideas and techniques, mechatronics provides ideal conditions to raise the synergy, thereby providing a catalytic effect for the new solutions to technically complex situations. An important characteristic of mechatronic devices and systems is their built-in intelligence that results through a combination of precision in mechanical and electrical engineering, and real-time programming integrated into the design process. Mechatronics makes the combination of actuators, sensors, control systems, and computers in the design process possible.

The mechatronic approaches are very knowledge intensive (Fig.1). They combine kinematics and dynamics, material technology, control engineering, information technology, micro technology, etc. Mechatronic systems, being the product of an integrated design approach, are superior to any products that could emerge from traditional sequential engineering approach [6], [21], [22], [28], [32].

The mechatronic approach is thus essential for the development of the manufacturing systems of the future.



**Figure 1.** The complexity concept as basis for trans-thematic identity of mechatronics.

#### 4. The structure of the National Mechatronic Platform

The mechatronics philosophy has developed in Romania since 1991, through the foundation of mechatronics branch in engineering in the technological universities Brasov, Cluj-Napoca, Iasi and Suceava. Nowadays, such a departments exist in almost all technical universities in the country [28]. In October 1999 begun the postgraduate courses on Technological Education for teachers from the high schools, in the Order of the Ministry of Education basis, no. 3971/12.06.1998. The previously configured educational plan was reconfigured by introducing specific disciplines for the mechatronics field. This way, mechatronics made its way into the undergraduate systems.

Through the common effort of specialists from Mechatronics departments in technical universities from all over Romania, such as The Transylvania University Brasov, University Politehnica of Bucharest, The Technical University of Cluj-Napoca, The University of Craiova, "Dunărea de Jos" University of Galați, The "Gheorghe Asachi" Technical University from Iasi, Politehnica University of Timisoara, along with specialist of FESTO Romania, (Corporation Festo from Germany is the main sponsor of the International Mechatronics Olympics) in over 15 years, managed to create the National Mechatronics Platform (NMP), as a pilot project.

NMP was inaugurated in May 2015, during the 6th edition of the Mechatronics Educational Days, hosted by the University of Craiova. The National Mechatronic Platform represents the technical-scientific fundament of the National Civil Society Platform on Lifelong Learning.

Such a structure, "The European Civil Society Platform on Lifelong Learning" operates in the European Union since 2005. The concept of a technological platform appeared in the EU in 2001 in the Lisbon Strategy [42].

The National Mechatronics Platform is conceived as a national mechanism which aims to activate material and human resources on a local, regional and national level, and also to ensure the systemic approach, in a holistic way of dealing with complex problems regarding education and training, in the knowledge based society.

NMP started with the development of the POSDRU project-FlexFORM (ID 64069) – Flexible Professional Training on Mechatronic Platforms Program. The Technical University of Cluj-Napoca was the coordinator of the project, while the other institutions mentioned above were working as partners. The Developed program, accredited based on the Order of Ministry of Education nr.4486/23.06.2011 was followed by 1500 physics, mathematics, informatics, chemistry and other technological disciplines teachers, from all the regions in Romania. Workshops on development were held in Education and Professional Development on Mechatronic Platforms Regional Centres (CREFPPM), founded in each of the universities taking part in the project, integrated in the structure of the Mechatronic Departments of all institutions, starting from September 2010. The project proceeded to begin on the 1st of September 2010. In September 2015, the final payment was made.

NMP has a structure that includes seven Regional Centres for Education and Professional Development on Mechatronic Platforms, integrated in the Mechatronic Department of each POSDRU project member mentioned. The Regional Centre founded in the Technical University of Cluj-Napoca is the coordinating one. Within the Regional Centres will be further developed Virtual Mechatronic Competence Centres. These will include: virtual laboratories and libraries, databases, sources of knowledge and other facilities regarding access to information in mechatronics, created for students, researchers, professors or any other interested users. After the pilot phase is validated, the network will be able to extend to other universities, organizations, institutes or companies. This way, NMP will become a veritable national company which will structure and integrate information, producing knowledge in such an important technological domain. All students, researchers, professors and interested persons will be able to employ at NMP. The professional and material motivation for all of them will contribute to an increase in the educational system of Romania. NMP will become financially autonomous after the validation of the working protocols. This way, the universities will become real Knowledge Factories [28].

The Regional Centres for Education and Professional Development on Mechatronic Platforms, integrated in the Mechatronics Department of the partner universities in the POSDRU project will constitute the nucleus for developing the Regional Platforms of the Civil Society on Education and Lifelong Learning. The structure of the NMP is shown in the figure 2.

The next steps of the platform development are oriented to integrate the platform in the educational system in Romania, defining the frame for self-financing operation and also to develop on that structure of The National Civil Society Platform on Lifelong Learning. These approaches are based on: the founding of The Regional Civil Society Platform on Lifelong Learning and integrating them in the structure of the Regional Centres for Education and Training on Mechatronic Platforms. The operational units of the Virtual Competence Centres on Mechatronics also are to be developed. The development of the specific infrastructure based on mechatronic platforms for educational environments for transdisciplinarity learning and integral education is another priority for the future approaches.

## **5. The benefits of the infrastructure for mechatronic knowledge production development**

Knowing the holistic and transdisciplinary approach needed today in the knowledge-based society and knowledge based-economy the effort to create the infrastructure for mechatronic knowledge production development is necessary in order to: support and promote applied research in transdisciplinary priority areas relevant to competitiveness in R&D activities and innovation at national level and in the line with global knowledge-based economy.



**Figure 2.** The structure of the National Mechatronic Platform (pilot phase).

As it was proved in the works [4], [5], [6], [33], the identity of mechatronics, based on the complexity concept is trans-thematic one. Integration is the mechatronic paradigm and interfacing is one of the mechatronics principles [21]. One of the main features of the mechatronic systems is their friendly interface. Through interface it is ensured the link and communication between the transdisciplinary object (level of reality) and transdisciplinary subject (level of perception) [27], [29], [31], [43].

Transdisciplinarity learning is a major need in the knowledge based society. That is an explanation of the initiative launched to learn transdisciplinarity and promote the philosophy in education and R&D activities [17], [23]. The new social-cyber-physical systems development are based on transdisciplinary approaches in science and education.

Scientific fundamentals regarding information links and the integration-interfacing process study based on mechatronic platforms capabilities will contribute to define mechatronics as environment for transdisciplinarity learning and integral education. By comparing against the other educational environments [39], [40], [41], for integral education, mechatronics answers to the needs of the educational technologies in the knowledge based society development. The improvements in the quality of life based on the main parameters defining the indicator are waited too.

*Safety:* Safety can be drastically increased through mechatronics: collision avoidance, active stability control, accuracy and safety barriers in surgery etc. A good example of the impact that mechatronics can have on safety can be found in the automotive sector. It is expected that, in the next ten years, electromechanical actuators will replace hydraulic cylinders in brake systems (source: MIT Technology Review, February 2003). Wires will replace the brake fluid conducts (drive-by-wire concept) and software will control the action that slows the car, based on the input received from the driver's foot. Sensors and diagnostic software will identify and correct for errors in real time to make sure the technology functions impeccably. It has been suggested that drive-by-wire might allow a car to be completely separate from its controls, meaning that a car of the future might theoretically be controlled by any number of different control systems: push buttons, joysticks, steering wheels, or even voice commands.

*Environment:* Mechatronic technology brings in discussion the problem of information, which is the most important key word on mechatronics in relation with material and energy. Satisfaction of the mind of human beings is caused by information and only information can increase added value of all things. Information means culture. Comparative analysis of the three components in terms of origin, resources and demands, promotes mechatronics as being a less polluting technology. Mechatronics is



considered to be a “clean” discipline, since it provides clean alternatives for less environment friendly solutions. The mechatronics discipline supports the development of resource-saving solutions by increasing system-efficiency and by integrating materials technologies (light weight structures) and life cycle engineering approaches in system development. In the end, mechatronics is really nothing but good design practice, a methodology for the optimal design. When the goal is to obtain an optimal design, also the resources involved in the design process are used in an optimal way.

*Health care, quality of life:* The mechatronics discipline plays an important role in many medical applications. Knowledge gained in for instance the design of an intelligent robot may be transferred into providing rehabilitation system to support individuals recovering from injury. Other mechatronic solutions are applied in: drug delivery systems, minimal invasive surgery applications. In the same field are included computed tomography systems and intelligent robots to operate in X-ray investigation systems.

*Working conditions:* The Human Machine Interface is one of the building blocks of a mechatronic system. Telemanipulation devices, haptic interfaces, etc. are showing a big potential in terms of improving working conditions. Furthermore, the reduction or elimination of noise and vibrations is a key research area which is not only responding to the requirement of accuracy, but which also has a big ergonomic relevance. Noise reduction and vibrations of mechatronic products and systems will contribute greatly to improve working conditions.

*Employment, Education and Training:* The competitiveness of the national manufacturing industries depends heavily on the availability of a “national force” in the area of mechatronics. The National Mechatronic Platform will contribute significantly to the establishment of this national force. Applied transdisciplinarity in education and training will stimulate the initiative and creativity and growth of labour productivity in the mechatronic knowledge production. Education and training based on mechatronic platforms ensures flexibility in action and thinking facilitating the professional reconversion. Theoretical and practical results of that work will contribute to define mechatronics as a new educational environment in the knowledge based society and to develop new educational and training services.

*Economic Growth:* The Virtual Competence Centre on Mechatronics will facilitate the access of SMEs' Enterprises to the knowledge in the field of mechatronics and that one will stimulate initiative and creativity. So that will increase the potential to participate in the competition for R&D Projects at national and international level. The access of researchers to the knowledge bases in mechatronics will stimulate the idea exchange and creativity. Improving the cooperation between industry research and academy is a major need to ensure competitiveness in the future.

## 6. Conclusions

Transdisciplinarity education clarifies in a new way a need which is presently felt more and more - the need for a permanent education. In fact, transdisciplinary education, by its very nature, should take place not only in teaching institutions, from the kindergarten to the university, but also in the work place - in fact, everywhere, and throughout our life. In teaching institutions there is no need to create new departments and new chairs; this would be contrary to the transdisciplinary spirit. Transdisciplinarity is not a new discipline, and a transdisciplinary researcher is not some new kind of specialist. The solution would be to create workshops for transdisciplinary research within every teaching institution. These workshops would be the locus for gathering together a group of teachers and students from a particular institution who generate and oversee their own organization and are all animated by the transdisciplinary attitude. The same experiment could be carried out within various enterprises, and within other collectives, as well as within national and international institutions. There is one particular problem which is posed by transdisciplinary education outside professional life. In a balanced society, the boundary between leisure time and apprenticeship time would gradually disappear. The information revolution could play a considerable role in our life for transforming training into pleasure and pleasure into training. The problem of unemployment of the young would certainly be alleviated by a hitherto unsuspected solution. In this context, grassroots efforts will play

an important role in transdisciplinary education throughout life. It is quite obvious that the various areas and ages of life call for extremely diverse transdisciplinary methods. Even if transdisciplinary education is a long-term, global process, it is still important to discover and to create places which help to initiate this process and insure its development. Almost all the applications developed based on mechatronic platforms (fixed, mobile portables, or virtual) integrate details related on the link: mechatronics-transdisciplinarity and the basic elements defining transdisciplinarity concepts (levels of reality, complexity, transdisciplinary object – transdisciplinary subject link, the included middle concept). The university is the privileged place for an education geared toward the exigencies of our time which could also be the pivotal place for an education directed not only toward children and adolescents, but also toward adults. The operational modules of the National Mechatronic Platform at the regional level, through their infrastructure and conceptual approaches ensure the environment for new educational technologies development and the knowledge production in the field of mechatronics development too.

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