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CONTRIBUTIONS CONCERNING THE PROMOTION AND OPTIMIZATION OF INNOVATIONS WITHIN THE TECHNICAL UNIVERSITIES

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Abstract: *Intellectual property (IP) is an important asset of a country. Growing and managing an IP portfolio may have a strong impact on the economy. The technical universities, which possess a huge knowledge pool, are in a key position to provide a positive contribution in this respect. In the present publication some proposals are made and possible contributions are outlined.*

Key words: *universities, innovation, patents, PhD-thesis, intellectual property.*

1. INTRODUCTION

Romania is in a special situation right now. It is regarded to be one of the so-called New Markets with an enormous need for many articles and products. The articles or products, however, have been developed in other countries and the respective intellectual property is controlled by these countries or the industry located there. The products are either imported into Romania or they are being produced in Romania under an appropriate license arrangement. This, however, means that the upside potential is almost always realized some where else. Romania is in this constellation only providing cheap labor forces and a consumer market for the respective products.

It is deemed to be a must for Romania to develop proprietary solutions and products and to protect these developments at an early stage in order to be in a stronger position in the global market place. The Romanian Universities could or should play an important and crucial role in this economic and geopolitical environment.

2. GENERAL PROFILE OF A TECHNICAL UNIVERSITY (TU)

The following constellation or offer of lectures and seminars is typical for a number of Universities:

a) basic preparational courses (mathematics, physics, etc.);

b) general technical fields (mechanics of materials, machine elements, mechanics);

c) synthesized technical fields or disciplines as well as applied sciences (technology, mechanical engineering, machine construction, management, computer sciences);

d) multidisciplinary fields, such as artificial intelligence (AI), computer linguistics, or such new fields called "Connectionism" where the fields of artificial intelligence, cognitive psychology, cognitive science, neuroscience and philosophy of mind connect or cooperate.

Basic questions: How do professors and students at a University work and study? Do they follow an individual or a collaborative approach?

Both are generally possible, but for the abovementioned fields a) and b) individual learning and studying are more likely to occur. Theoretically, these activities and the research in these fields could be carried out in an *ivory tower*. In the fields c) and d), however, a collaborative approach and the formation of multiprofessional teams are more promising. Networking with others and an international exchange are extremely important. Since the fields c) and d) are more complex and sometimes interdisciplinary, collaborations of experts from the different research and development disciplines are ideal. Groups who form interdisciplinary teams are more likely to successfully solve problems and come up with new unique an inventive ideas and concepts.

It is important to note that the way students learn will have an influence on how they cooperate or collaborate during their scientific careers. Students who are actively involved in group-based learning are more likely during their professional career going to seek the direct cooperation as member of a team. Shared goals and shared learning are considered to be a must for students and researchers who intend to be working in highly complex technical and scientific fields.

Who triggers or influences the respective team building process? In case of the fields a) and b) personal skills, personal passion and experience mainly matters and external stimuli or triggers are atypical. Quite often, the main driver for studies in these fields is intellectual curiosity, i.e. an internal motivation. Research activities in the disciplines of fields c) and d), which concern new technologies, for instance, are quite often funded and supported by the industry, where the clients, the competition and a visionary management define the goals for joint research and development activities. These disciplines are thus in many cases externally triggered. It is, by the way, more likely to generate income and to get funding in the fields c) and d) than in the other two fields.

It is thus not a surprise that Universities have become increasingly active in protecting their intellectual property. Since the early 1980s, the Universities of many OECD countries have experienced a rapid growth in pat-

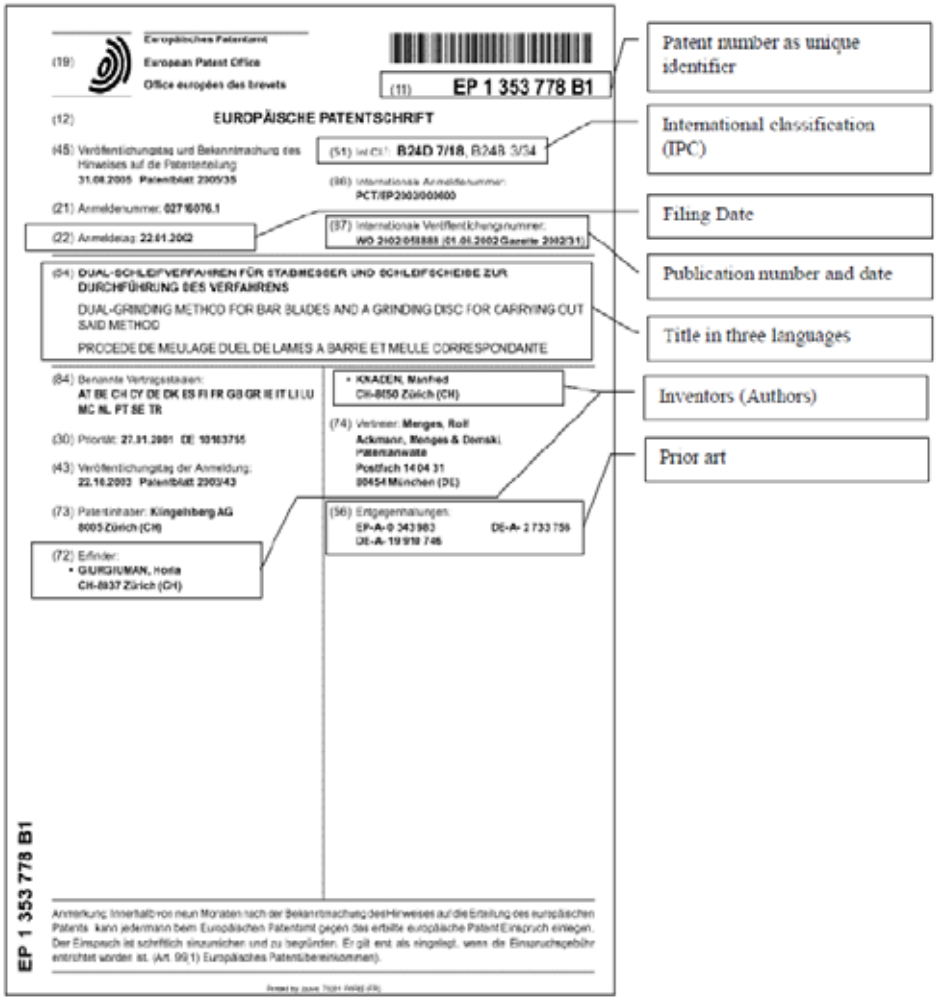

Fig. 1. Cover page of a patent application.

enting. In the year 2002, for instance, US universities received more than 1 billion US $ in gross revenues form the licensing of their patents.

It has been demonstrated in the meantime that university patenting is beneficial in promoting the technology transfer from academia to industry.

One key issue is the quality of these patents. The quality can be measured by the number of citations to these patents in subsequent patents. Another key element is the universities licensing policy or strategy. But also the management of technological innovation is very important.

3. PATENTS AND DOCTORAL-THESIS

Patent applications are in most cases written by patent professionals and thus follow a very well defined set of formal and legal rules. After having filed with a patent office, a patent application is examined in most countries by formalities officers and afterwards by qualified substantive examiners. It is their task to check whether the patent application satisfies the formal rules. During the substantive examination the patent applications content and the inventive contribution are judged in light of prior art. The examiner determines whether the patent application contains matter which is novel (on a global scale) and inventive.

Comments. There are a number of similarities if one looks at the Table 1. But there is one difference. The structure of a patent application is more or less standardized all over the world, whereas the structure of PhD-Thesis differs from region to region or country to country. Patent applications are being examined according to very strict legal principles, whereas PhD-Thesis are typically only reviewed by a local team of professors.

3.1. Structure of a patent application

A patent application is typically divided into a number of sections. These sections are:

- name of the Inventors and Title of the Invention,
- references to related applications,
- drawings,
- claims,
- abstract of the Disclosure,
- background of the Invention,
- objects of the Invention,
- brief Description of the Drawings,
- summary of the Invention,
- field of the Invention, and
- detailed Description of the Invention.

Some details of the cover page of a patent application are illustrated in Fig. 1.

3.2. Structure of a PhD-Thesis

A PhD-Thesis typically has quite similar sections. A comparison between the structure of patents and the structure of a PhD–Thesis is presented in the Table 1 [1].

From the above one can conclude that there are a number of similarities but also some differences. The authors of the present work recommend working on a standardization and international harmonization of PhD-Thesis in order to achieve a situation where the content of several PhD-theses can be compared and ranked more easily. This will also allow the respective University to benefit from PhD-theses since it will be more easy and efficient to file patent applications to seek protection for the underlying intellectual property, provided that the respective work is unique and commercially relevant.

An example of the cover sheet of a possible standardized PhD-thesis is presented in Fig. 2.

Table 1

Comparison of PhD-Thesis - patents

	PhD-Thesis	Patents
Concise title	Yes	Yes
State of the art / prior art	Yes	Yes
Description / specification	Yes	Yes
Informative drawings	Yes	Yes
Increased level of novelty or uniqueness	Yes	Yes
Patent claims	No	Yes
Conclusions	Yes	Yes
International classification (ISO or the like)	No	Yes[1)]

1): There is an international classification of patent applications. This IPC classification makes it easier to search related patent applications.

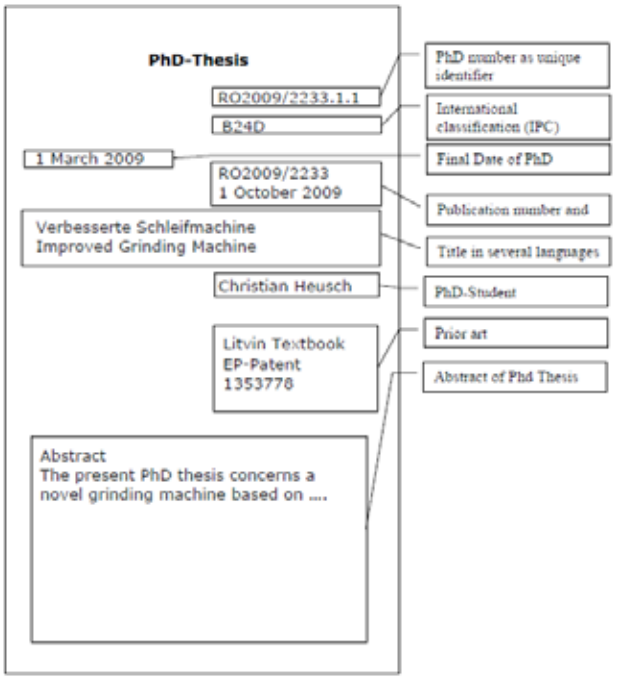

Fig. 2. Cover page of a of a standardized PhD-thesis.

4. HOW DO UNIVERSITIES CONTRIBUTE TO A NATIONAL INTELLECTUAL PROPERTY PORTFOLIO AND TO THE GENERAL KNOW-HOW?

In our view a specific development platform is required which enables Universities to foster new projects, to manage work projects and doctoral theses, to seek protection for intellectual property and to promote the commercialization of the "intellectual by-products" of research and development. Innovation management is considered to be a key aspect. PhD these are important sources of information and contain valuable information which needs to be controlled and, if required, which calls for protection.

A so-called PLATIN development platform is being developed which is meant to serve as a general tool for Universities. This platform is going to be designed so that the different Universities can modify and adapt it according to their specific needs.

PLATIN is a virtual instrument which is designed in order to enable users to find information regarding a planned research process or project. PLATIN is going to provide access to information contained in patents and in specialty literature and it will support the user when finalizing the research process or project by obtaining patent protection, if desired. PLATIN is designed as a platform having four main systems, as illustrated in Fig. 3, which independently generate their own results. The user can virtually use the whole system or only some of its components depending on the purpose.

The following four components of PLATIN are depicted in details in Fig. 4:

- SINTACTIC➔ The syntactic system for information retrieval;
- SEMANTIC ➔ The upgraded analysis and optimizing information system;
- INOVAC ➔ The computer assisted innovation system;
- E-PLATIN ➔ The e-learning education system in inventions.

The PLATIN software carries out three main functions:

- information search and refinement using the internet or special databases to which the user has access;
- the computers' support for defining a possible patentable solution;
- education in the field of innovation management and using the platform.

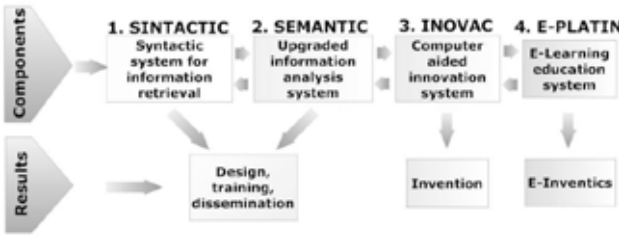

Fig. 3. The basic component of the PLATIN platform.

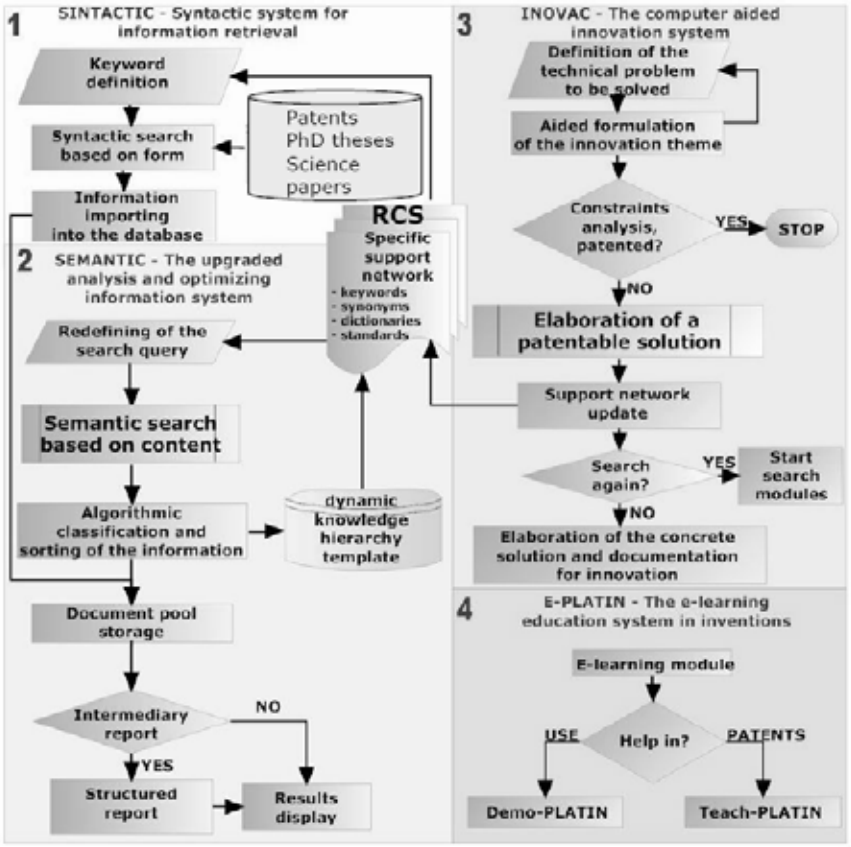

Fig. 4. The general concept of PLATIN.

The PLATIN platform offers a large degree of flexibility, being designed to be used by any researcher. It will be structured in such a manner that it will give any user the possibility to personalize and improve the contents of the system with new information of their own knowledge and experience. The user will thus supply the development of the platform in the said direction by making variants for their own workplaces, departments or their Universities.

The platform can be used for the following activities, illustrated in Fig. 4:

- design for finding the up-to-date patented or Internet-related solutions;
- R&D for study documenting and development regarding results published in a field of interest;
- training and dissemination for documenting in regard to the development of educational material;
- running through the step-by-step patent pending algorithm with computer assistance;
- training for learning the way to use the platform and the base knowledge needed in patents.

In the following sections, a short description of PLATIN's components is given.

4.1. SINTACTIC – The syntactic system for information retrieval

This component is helping the user to find information, much easier than through classic search engines (Google, Amazon, Yahoo Search etc.). The first thing to define is the specialty field of interest and then the keywords. This operation will be assisted by the software and the user has the possibility to choose from a "Specific support network" (SSN) special keywords or other terms which he finds appropriate for the search. After this, the platforms' search engine will perform the search of every bit of information on the Internet or other user-stated sources (patents, specialty data bases etc.). Finally, the information can be stored in a data base called "Documents pool" for future analysis, and the user will receive a structured report in which a list of documents ordered by the number of keywords, and/or using other criteria is presented.

4.2. SEMANTIC – The upgraded analysis and optimizing information system

The SEMANTIC component will refine the information gathered by the SINTACTIC component for every document in the Documents Pole data base. The user can redefine the search task by means of synonyms and other terms based on his experience or of other experts, after which, this will be again stored in SSN. The documents are scanned and their content, analyzed semantically in the "Semantic research based on content" module. The information obtained will be indexed and later-on processed in the "Algorithmic classification and sorting" module, and then introducing the sense of the words, the peers and groups of words, the connection between them and the frequency of appearance in the "Dynamic knowledge hierarchy template".

If this processing will determine new keywords, they can improve the SSN and thus the search task of both SINTACTIC and SEMANTIC components, making a new search more relevant. The ratio in which each

document complies with the search task is mathematically quantified by a "mark" tagged to the document. The result of the SEMANTIC search is the identification of those documents (patents, science papers etc.) which compiles the best with the search task, storing the data into the Documents Pole and editing the results by means of Structural Reports.

4.3. INOVAC – The computer aided innovation system

INOVAC helps the user to accomplish all the stages of preparation of a patent application and finally the filing of a patent application, preferably in collaboration with a qualified patent attorney, in order to enable the user of the software to seek protection for the technical solution he has come up with. The first step is the assisted definition of the technical problem and the innovations' subject into a recognizable form for the PLATIN platform. For this, the specialty field of interest is identified after which is created or run-through the Specific Support Network which will help build the search task needed for the SINTACTIC and SEMANTIC modules. These two modules will run until existing patent documents which respond the best to the search task will emerge. The next step is analyzing the innovative constraints with which the subject in hand is dealing with, generated mainly by other patents already found in the previous step. If there are no constraints, the subject may be considered to be patentable and a short abstract is developed, defining this way, the claims of a possible patent application. The specialty keywords can enrich the SSN, making it possible for the user to define a new search using SINTACTIC and SEMANTIC to be sure that for the subject matter of his innovation nobody else has filed a patent application. If such earlier patent applications do not exist, the draft of a patent application can be developed.

4.4. E-PLATIN – The e-learning education system in inventions

This module will help the user to:

- understand how the PLATIN platform works by using the DEMO-PLATIN module. This module will show how a search is conducted, how to construct, personalize and use the Specific Support Network and how to use the SINTACTIC and SEMANTIC modules. Also the way to use computer assisted innovation methods with INOVAC components.
- gather knowledge in innovation management regarding steps to develop the documentation for obtaining the patent. In the TEACH-PLATIN module, the dissemination through education is used and is compatible with all potential users: researchers, PhDs and students involved in the research field.

4.5. The advantages of PLATIN

This software offers a number of advantages, as there are:

- improving the search time by optimizing the search algorithm;
- the increase of research yield and scientific throughput of research groups;
- enabled for any field of interest;
- know-how transfer by means of a common SSN data base used by both young and experimented researchers in a research group;
- the possibility to find innovating solutions quickly in one field of interest and apply it in another one.

4.6. Knowledge transfer at universities

Universities possess an enormous amount of information and a huge knowledge base. Thus the following question comes up. How are these intellectual assets being transferred out of a University into the productive (industrial) sector?

In the following some scenarios are outlined:

- Different projects which are handled at a University (e.g. EU funded projects) are carried out on behalf of the industry. Typically the competent persons who grant the funds have no possibility to judge whether a project is useful and whether the amounts asked for are appropriate. By using an appropriate development platform, the decision makers will be put in a position to make better judgments and decisions in this respect.
- Typically a lot of internal knowledge leaks out if students or professors leave a University to work in the private sectors. It is almost impossible to stop this flow of information since one cannot prevent a person to apply residual knowledge somewhere else. But one could seek patent protection for certain aspects of the work that was done at a University to get at least some return on investment. A respective development platform tool could also help to improve the situation here.
- The selection of a PhD theme should be done based on objective criteria. By means of a search in relevant fields and after having calculated a relevance coefficient, the PhD and the resultant inventions are going to be positioned in the most interesting and promising field.
- An ongoing orientation should be provided while working on the subject matter of a PhD so that added value can be derived.
- A concept for a standardized presentation scheme of PhD theses with patents as model is to be developed so that this scheme can be implemented in a database. The respective information can be retrieved from the database when conducting prior art searches, for instance.

5. CONCLUSIONS

The model for solving the innovation management using the PLATIN platform, as described above, is based on the observation that an invention in many cases is the result of combining components and solutions which have already been discovered by someone else somewhere else [2]. Approximately 80% of the inventions are based on existing innovations [3].

PLATIN gives the researchers:

(i) The possibility to know the actual state of evolution of the idea starting from the first patent filing request;

(ii) The possibility to propose new and original solutions. The main difference between classic methods (TRIZ or CBR) and PLATIN is that:

- the classic methods are abstracting the idea for a comparative analysis with similar solutions with high degree of abstractness and;
- updating is performed so that there are no conflicts. Abstractness and adaptation are leading most of the time to non-technological solutions which cannot be applied or conceiving inconsistent requests.

The PLATIN project elaborates for the first time the integration of innovations proposing the connection between innovation management and the rapid development of products.

The strong point of the PLATIN platform is the Specific Support Network which contains information specific to each field of interest. It is easy to build, based on existing definitions in reference standards, in the index of specialty books and from the experience of the researchers. SSN is responsible for an assisted research of relevant information from a specific field including synonyms and provides a consistent help in identifying some of the original solutions for solving the problem (the invention).

The various search possibilities and options starting from the simplest ones based on form onto the more complex based on the possibility to make use of the semantic connections processed on high speed and based on original algorithms.

Compared to the actual solutions offered by specialized companies, PLATIN should be the first integrated system which offers the user three main advantages:

- search and information storing solutions;
- assistance for elaborating the patent, and
- education in the field of innovation management.

6. ACTUAL INTENTIONS, PROPOSAL

- Designing a cover PhD page like the cover page of a patent [1].
- Phrasing a title by using the keywords.
- Providing, if possible, an index of contents based on the structure of a patent.
- Creating dictionaries with technical terms of the field of the PhD, including also synonyms.
- For a PhD conclusions are to be drafted which are comparable to the claims of a patent (independent claim and subsequent claims).
- The PLATIN platform should be developed to support all these activities.

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