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Citation: Modic, Dolores and Damij, Nadja (2017) The activity table as an agent-based modeling approach for optimizing patent exploitation processes. WSEAS Transactions on Business and Economics, 14. pp. 458-470. ISSN 1109-9526

Published by: World Scientific and Engineering Academy and Society

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<<https://www.wseas.org/multimedia/journals/economics/2017/a945907-033.php>>

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The Activity Table as an Agent-Based Modeling Approach for Optimizing Patent Exploitation Processes

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Abstract: The focal idea of the paper is to model the Activity table in order to increase the efficiency of the intellectual property management. The modeling is done by looking into activities of individual agents (resources or entities). The article examines - in light of the review of related research literature - how the Activity table technique can be used when focusing on IP processes, especially in smaller companies. This technique may be a useful, comprehensive, holistic, but still relatively simple way for intellectual property protection processes' improvement; allowing to find bottle-necks and ways to avoid them as well as to include a systematic element into processes usually riddled by informality and uncertainty. We highlight the steps and considerations needed to use the Activity table in the exploitation phase and especially on facilitating patent transfers. The article provides two concrete examples, showcasing the use of the Activity table.

Key-Words: Intellectual Property Processes, Activity Table, Process Modeling, SMEs, Patent Transfers

1 Introduction

Much was written on how to accomplish the maximum outputs of Intellectual property rights (IPRs) - and Intellectual Property (IP) more broadly - however the “know-how”, and actual tools to achieve them, seem to still be lacking a decade and a half after Rivette and Kline have written that the patent asset management is (or should be) a new corporate strategy issue and that that world's most successful companies regard patent strategy as a “new core competency of a modern enterprise and an important factor in their success” [1, p. 3].

In particular, for smaller companies the optimization of their intellectual property rights (IPR) processes is still often more of an idea than an actual practice. This is especially true when the intellectual property (IP) is not implemented in their own products and/or (production) processes, but when they try to exploit it in markets for ideas (intellectual property rights markets), which is the narrower focus of this paper. The interplay between value creation (or exploration of new ideas and technologies) and value capture (or exploitation) is also to be pointed out. Focusing more on the first, might cause an insufficient focus on developing and optimizing processes for value capture (that is on exploitation processes).

Although the general purpose of IPRs - patents, trademarks, designs etc - is seen as one of creating incentives for innovation, this notion has been many

times refuted. Today criticisms of intellectual property rights (especially patents, which we are dealing inside this article more in-depth) are diverse and plentiful. Modern economic view of IPRs takes into account the theories of complementarity and tries to encompass issues related to competitiveness. Additionally, some newer IPR theories - for example the signal theory - put into focus various effects of patents; such as signaling future value of the company or helping to attract new funding.

However, patents may be described as probabilistic at best ([2], [3]), since there is a lack of clear correlation between their application (use) and profitability. Thus, it is important to give the organizations sufficient “signposts” that lead them through the transfer processes - especially, should they try to exploit the IP(R) on the so-called markets for ideas - and also allow them to optimize those transfer processes. In the literature, we find several “guidelines” through the transfer of patents or articles shedding light on some issues ([4], [5]) as well as entire volumes dedicated to bring together papers on different issues concerning IP management, such as the Handbook of Technology and Innovation Management [6].

However, there are not so many attempts to develop or adapt different tools to help model and especially re-model and optimize IP processes; with the end goal of facilitating IP processes (please note, some exist and broadly speaking represent an alternative to the Activity table). However, this is

our present attempt. With it, we try to encourage especially smaller firms to enhance their strategic thinking in regard to their possibilities of exploitation of their IP in the IP (especially patent) markets in particular. Something that seems to be “an art” for (at least for more successful) bigger companies, is also coming to the forefront of IP(R) efforts in smaller companies.

To use simulation techniques is important, because it creates an environment to test the process’s behavior similar to that existing in reality. Although this approach is useful inside the whole IPR management process, it is even more so a key element inside the exploitation phase, especially when companies enter with their IPRs into the market for ideas, where uncertainties are high and diverse ([7], [8]). The decision making process is demanding and faces many uncertainties ([9], [10]).

The Activity table helps small companies to remodel and optimize their IP processes, without incurring major costs in doing so. It allows them to find and identify “bottle-necks” that are causing their IP processes in the exploitation phase to be less than optimal (please also note we use terms IP exploitation and patent exploitation interchangeably inside this article, since we shall focus more on the latter). The Activity table is a part of the Tabular Application Development approach to information systems development that consists of five phases (Process identification, Process modeling, Process improvement and innovation, System development and System maintenance).

2 The essentials of using the Activity table

The recent literature offers various definitions of and the extent of a process or process modeling. Throughout the last decades, the fields of business process modeling and consequently business process renovation have been gaining recognition and acceptance. Reasons for such evolution are found in the literature, academic publications and research studies that deal with the topic, as well as in the increasing involvement of consultancy and software development companies. Also some comparative studies that have closely examined methodologies, techniques and tools have been conducted. Furthermore, business process modeling is one of the requirements of the ISO 9000 international standard for quality management and assurance, as well as being one of the key questions

when implementing the majority of information systems.

Successful business process modeling depends on the appropriate selection of available modeling methods, techniques or process flow analyses. There are many techniques or analyses used in this field, such as general process charts, process activity charts, flowcharts, dataflow diagrams, quality function deployment, the integrated definition of function modeling, colored Petri-nets, object-oriented methods, seven management and planning tools and so forth. The Activity table is hence one of the possibilities, that was first developed in [11] and further elaborated in [12].

Process improvement and innovation is a key phase within process management that has in recent years become an essential way of ensuring changes in an organization’s structure and functioning in order to create a better, more competitive and successful enterprise as it is connected tightly with customer satisfaction. Therefore, when the customer is satisfied with the products or services of the organization (and this is also mirrored in the success of the organization), then there is probably no need for implementing changes in the organization’s way of functioning and doing business. If not, then the organization will discover that customers are unsatisfied with its products or services. This fact becomes obvious when it finds a continuous decrease in the sales of its products or services, which consequently causes a major reduction in its profit. When this happens then the business processes of the organization need to be improved or innovated as soon as possible. Process simulation is an iterative approach, which may be repeated a number of times, until the improvement team is satisfied with the solution achieved. So, if the consumer lacks appropriate satisfaction or the organization’s growth and profit are decreasing, then business process management is the right solution that has to be planned and carefully carried out in the organization. We may also see that process improvement is a key element inside IPR management, since IPRs are still seen as inefficient and ineffective way of IP protection.

Both business process modeling and business process renovation are based on the fact that a business process is the key element in the analysis of the organization. Business processes come within our scope in that they potentially add value to the organization and are as such attracting attention (for some examples see [13], [14], [15]). Consequently, business process modeling is on the increase as only a thorough comprehension of the business processes within the organizations can lead to effective,

efficient and value-adding systems. It is the business processes that are the key element when integrating an enterprise. Furthermore, conceptual modeling of business processes is deployed on a large scale to facilitate the development of software that supports the business processes, and to permit the analysis and re-engineering or improvement of them [16]. For the purpose of this paper, the latter use of business process modeling and improvement will be considered.

We elaborate the definition of a process referred to above, the following one is added. A process is defined as structured, measured sets of activities designed to produce a specified output for a particular customer or market [17]. Hence, a process converts inputs by summing their value through various activities into outputs. A business process is a collection of activities that takes one or more kinds of input and creates an output that is of a value to the customer. The input and output, and the entry and exit points also determine the process boundaries within which the relationship between the process and its environment is created through the inputs and outputs. To sufficiently define a process, firstly the process activities need to be identified, and then the sequence order of the identified activities needs to be established. The resources can be different in nature and are exploited within the process but not (necessarily) consumed. As a last feature the information structure determines the availability of necessary information for implementing the activities in the process.

In order to develop a process model that represents a true likeness of the existing reality of the process, the state of the art of the process should be first discovered and understood. The process model represented by the Activity table is developed. This table consists of two parts. The first part provides information about each activity of the process by defining a number of parameters that describe the activities listed. The second part is a tabular-graphical representation of the process discussed. The Activity table hence ensures that the presented process model is in fact the true likeness of the real-life business process. To develop the Activity table, information about process functioning should be gained during interviews that are organized with knowledgeable employees. This is done using the following two steps: the Activity Parameters and Business Processes.

In the columns of part 1 of the Activity table one or more of the following parameters are defined for each activity(i), where i ranges from 1 to the number of activities.

- Description. A short and precise description of what exactly is the work carried out by the activity defined in row(i) of the table.
- Time. The expected duration needed for activity(i) to be processed and accomplished.
- Rule. One or more constraints or rules that must be satisfied in order for activity(i) to be performed.
- Input/Output. Input(s) and output(s) of activity(i).
- Other parameters can be added if necessary.

The process modeling starts by identifying the behavior of the business processes identified. For each process, we create a new Activity table, which represents its "as-is" model of the process. Thus, the name of the process selected is written in the first column of the Activity table, see Table 1. If the process is large and complex, then it may be partitioned into a set of sub-processes, which are in this case listed in the second column of the Activity table.

As was mentioned before, each process consists of a number of work processes, which are defined in the Work Process column of the Activity table. This column is usually the second one; in which all discussed work processes are listed. In addition, for each work process defined, we write in the first row of the table the name of the department in which the work process is performed, see Table 1.

A work process is a process that consists of a set of activities performed within a certain department. To identify these activities, further interviews are organized with the employees of this department. An activity is a micro-process that represents well-defined work performed by one resource. For each work process listed in the Work Process column, we have to identify all activities that are performed within the framework of the work process discussed. These activities are listed in the Activity column, which is usually the third column in the table.

For each activity, we have to identify:

- a) the resource that executes the activity and indicate it in a certain column of the second row under the department in which the work process is defined;
- b) the predecessor and successor activities of the current activity and connect it to these activities by vertical arrows.

Table 1, The Activity table

Parameters	Description	Time	Unit	Inventor																

The Activity table technique uses a small set of flowchart symbols to model a process, such as: \circ , \bullet , \square , \diamond , $|$, \rightarrow , \leftarrow , \downarrow , \uparrow . These symbols have the following meanings:

- Symbol \circ indicates the starting point of a process;
- Symbol \bullet indicates the end point of a process or a certain path of the process;
- Symbol \square in cell(i,j) of the table means that resource(j) performs activity(i), where j ranges from 1 to the number of resources and i ranges from 1 to the number of activities;
- Symbol \diamond in cell(i,j) means that activity(i) is a decision activity;
- Horizontal arrows \rightarrow , \leftarrow are used to connect the activities horizontally;
- Vertical arrows \downarrow , \uparrow are used to link the activities vertically;
- Symbol $*$ in cell(i,j) and cell(i,k) mean that activity(i) could be performed by resource(j) or resource(k).

Alternatively, making the Activity table represent the real world, the activities can be linked firstly horizontally and secondly vertically using letters (as opposed to the above mentioned symbol approach). To indicate horizontal linkage letters S (indicating the source entity) and T (indicating the target entity) are used [18] as each activity is commonly connected with two entities (source and target activity). Secondly, the aim of the vertical linkage is to define the order in which the activities are performed by using the letters P (indicating the predecessor activity) and U (indicating the successor

activity) to connect the activities [18]. Vertical linkage is used only in connection with the internal entities, whereas the horizontal linkage is used to connect the external and internal entities.

However, authors argue employing the diagrammatic approach to using the Activity table technique creates higher added value to the optimization of the patent exploitation processes.

3 Activity table as an Agent-Based Modeling Approach for Optimizing IP processes

Innovation and entrepreneurship are tightly interconnected, since the final desired outcome for companies is profit. Therefore, to achieve this outcome, it is required that innovation be organized as a systematic activity [19], which is especially true for the processes of intellectual property management. The next question we try to answer is what the benefits of using this (in its essence agent-based modeling) technique inside IPR management processes are and offer a contextual look on its use.

Agent based modeling is seen [20] as a (computational) "method that enables researchers to create, analyze, and experiment with models composed of autonomous and heterogeneous agents that interact within an environment in order to identify the mechanisms that bring about some macroscopic phenomenon of interest". The definition for agent-based modeling and simulation (ABMS) is often derived from it; where the possible objectives of ABMS encompass *inter alia* the increasing understanding of the original system and optimizing the system [21]. The latter is the prime objective of using the Activity table in IP processes. However, its application also enhances their understanding, which is important since management of intellectual property (rights) can be characterized as fluid, depending on the rapidly changing market situation and further complicated by complementarity of various protection mechanisms.

Furthermore, entire product development is a problem-solving process [22] and the same can be said for IP processes in general as well as IP exploitation processes - identifying bottle-necks while looking at how actors interact is essential for their optimization.

One of the explanatory advantages of using agent based modeling tools is also that they allow observation and analysis of the model dynamics on

at least two levels; on the level of the local agent (in our case individual employee) and on the macroscopic level (level of the company), which is being generated from the actions and interactions of the former [21]. Because of this, it is important to set up efficient activities that lead to IP (exploitation) processes that allow the companies to take into account different aspects in each case. One of the main advantages of agent-based is also the capability of formulating truly flexible actor behavior. Although we warn – together with others such as [23] - that if the model is too simplistic or the underpinning activities not understood sufficiently, the significance of using agent-based models is diminished.

Finally, one of the advantages lies in the easy visualization of the model. The Activity table is an effective and relatively easy tool that allows us to set up optimal IP processes. Actors and activities - that a human observer is familiar with in the real world - are explicitly captured in the model. The Activity table simplifies the on-look on this complicated system (which is also why authors *inter alia* argued employing a diagrammatic approach), allowing finding bottle-necks and ways to avoid them as well as include a systematic element into processes usually riddled by informality and accompanied with high level of uncertainty.

Agent-based models usually involve at least two main components [20]: the definition or on-look into the environment and the definition of agents. According to [24] an agent is “an entity that is situated in some environment, and that is capable of autonomous action in this environment in order to meet its objectives”. Agents are in our model called “resources”. According to [18] TAD methodology, a part of which is previously described Activity table, defines the term entity (meaning the resource or an agent according to ABMS) as a user, group of users, a unit department or anything of importance in the system’s functioning; thus understanding the entity as any source of information that is part of the system or is connected with the system by some interaction. Therefore, an entity is comprehended from two perspectives: as an internal (inside the system and takes part in the system’s operation) or as an external (not part of the system, but it has one or more interactions with the system) [25].

Organizational scholars have since 1980s successfully argued that there is no one best product development process and that we need to take into account the organizational structure as well as the market environment in each individual case. The same can be said for IP processes. Looking

specifically into patent exploitation processes, we can see that organizational literature has separated firms’ innovation activities into two distinct fields; one of exploration and one of exploitation. The two sets of activities are often described as “rival” [26]. Note that we deal in this paper only with the exploitation activities (though we do acknowledge their – sometimes very tight - interconnection – see also Example 1). More specifically; we see the need for developing more applicable methods and enhance the development of applicable methodological tools in order to allow organizations trying to transfer their patents to develop and optimize efficient exploitation mechanisms.

The internal environment of the organization is not the only one we need to take into account. When organizations consider entering the patent (and other IPR) markets, they must take into account that it employs different strategies and actions as when entering into the goods markets. The benefits of entering into the patent market – or any IPR market are ([27], [28]): a) less potential competitors; b) avoiding potential double R&D costs c) possible joint development or joint co-operation later on; d) enabling retention of high rents inside individual industries; and e) avoiding unneeded investments in complementary resources. On the other hand we can identify at least the following problems ([27], [29], [30]): lack of identified buyers and sellers as well as intermediate actors, lack of efficient market platforms, higher need for (complex) due diligence (procedures), low successfulness of negotiation processes, more complex relationships between buyers and sellers etc.

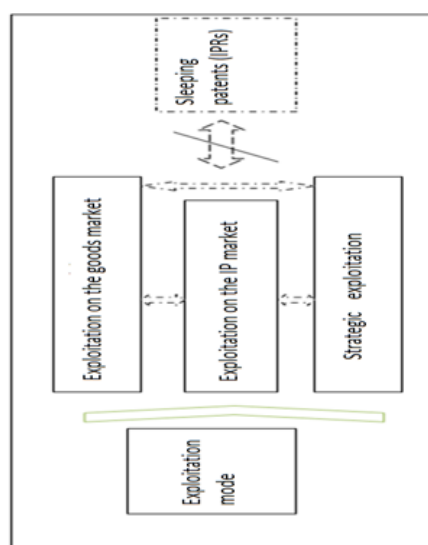
Inside this paper we are specifically looking into situations where a patent transfer is a viable option for the organization. Providing the organization has appropriate patents (or better yet an appropriate patent portfolio), it may contemplate on the usefulness of their potential transfer and on the effectiveness of their IP transfer processes. In order for organizations to be able to successfully optimize their patent exploitation processes, the underpinning activities and considerations must first be understood.

4 Applying the Activity table to IP process of patent exploitation

Companies rarely invest in research and development solely to get the patent, since patents are only IP protection tools. Patents are allowing the

technology to find a sufficient market (share) by limiting other actors' ability to chip some of it away (in this sense they are so-called negative rights). However, a company (or other organization) may also apply for patents that would later on be transferable – even without prior exploitation on the goods market (see Fig. 1). It is hence of utmost importance to create new business model simulation tools to help facilitate patent transfers, since there is no efficient patent market without efficient patent transfer processes of individual organizations active on it.

Fig. 1, Exploitation modes for patents



In the following section we depict standardized (model) processes, activities and other characteristics of the Activity table for the needs of the optimization of the intellectual property exploitation processes. These standardized (model) processes help the companies to identify the inefficiencies of existing processes while using the Activity table in order to re-model and improve the intellectual property exploitation processes.

Knowledge intensive processes – such as IP processes – are characterized by a great degree of human work as compared to traditional ones; and human behavior and interpersonal relationships (knowledge networks) affect them considerably [31]. To develop the Activity table in the field of intellectual property, information about process functioning should be gained during interviews that are organized with knowledgeable employees. These are especially (but not exclusively): innovators, R&D department heads, marketing and/or sales department employees, finance and

management/director, the legal department and/or patent attorney (if existing). There however tends to be a lack of IP protection related knowledge ([32], [29]), which would seem to suggest including perhaps an even wider variety of respondents (extending to those coming from outside the organization).

The business process is the intellectual property exploitation process in its narrower sense (alternatively, we could also make design it as a sub-process, beginning with the step of identifying appropriate patents for exploitation on the IPR markets, with intellectual property process as the business process). In order to use the Activity table following model parameters need to be defined: business process, work processes and defining activities and activity parameters (description, time, rule, input/output).

As pointed out earlier, under-pining steps and activities need to be understood first, hence we are offering an overview of steps (work processes), activities and considerations that are relevant. The exploitation process in general includes eight steps corresponding to work processes:

- Identification of the appropriate patent (step 1)
- Designing the mode of transfer (step 2)
- Valuation processes (step 3)
- Partner (and intermediaries) identification process (step 4)
- Due diligence process (step 5)
- Re-evaluation process (step 6)
- Negotiation process (step 7)
- The finalization of the patent transfer (step 8).

There are a number of non-utilized patents that could be benefited from by being exploited on the markets for ideas (step 1); not only so-called sleeping patents ([33], [34]), but also patents that have been applied for, with the thought of their potential transfer, and patents that have already been integrated (but are eligible for transfer). Particular care must be given to the contemplation of the effects of such an action from the competitive advantage aspect. For example most strategic patents will probably never be sold or licensed. However, some other –sleeping patents (or even strategic) – would be considered for transfer, perhaps due to engagement in cross-licensing agreements, inclusion into a patent pool or some other form of innovation co-operation ([35], [36]). Activities in this step include the following: patent portfolio analysis in the light of their transfer

potential, designing IPR transfer goals and analyzing the general IPR market possibilities. Inside all of these, an organization may find bottlenecks, such as for e.g. slow or in-efficient review processes; lack of knowledge on certain aspects of patents (signaling a need to involve outside experts), etc.

Next, are processes related to different modes of transferring a patent (step 2). The transfer may occur in different ways; most usual being patent licensing. However, selling patents or other modes must be considered (such as patent pooling, mergers and acquisitions, etc.). By transferring the patent, organizations are able to capitalize on their inventions without necessarily producing them and bringing them to the goods market. If we focus on licensing, several options exist: especially exclusive or non-exclusive licenses - where a wide variety of issues must be discussed when deciding on one or another. We point out the usefulness of a prior IP strategy inside the company. The directions outlined in strategies may also be used as general directions for the decisions regarding licensing. On the other hand, incorporating the results generated by the use of the Activity table can provide a feed-back loop for the improvement of the IP strategy. But, one may not underestimate the concrete circumstances of the licensing at hand (such as how many licensees may we realistically expect, what is the present state of the art of the technology involved, what is the situation in the goods market at the moment, etc.). Hence, the activities are *ad minimum*: examination of patent transfer modes possibilities and selecting one of them, as well as defining general characteristics of said patent transfer. Again, several bottle-necks could be identified; one of the most usual ones is a lacking decision-making model for deciding between exclusive and non-exclusive licenses.

Patent valuation (step 3) is one of the most problematic points of IPR transactions. The problem stems from the difficult patent valuation in it-self. Patent valuation methods have been described as “inappropriate, crude, inherently unreliable and a guesstimate” [37]; the evaluation techniques, models and applications usually based on the cost approach, the market approach or the income approach. Additional problems stem from the large subjectivity of patent valuation and low percentages of highly valuable patents ([34], [38], [39], [40]). In accordance with this the valuation process will need to consist of at least the following activities: determining whether an external expert(s) for this

step is needed and finding him, identifying the evaluation methodology and using it, valuating the patent. The role of the external expert is many times vital, due to the difficulties organizations are faced with during the evaluation process. A problem, the Activity table may also point out to, is the need to try to employ a more systematic patent evaluation method.

After establishing a potential object of the transfer and its potential value, the organization needs to look at the actors present in patent markets, so as to escape the IPR markets “black-box” (step 4). During this time the organization needs to determine where and how it will try to transfer the patent (choosing the transfer channel) and find an appropriate buyer (partner identification). In general the following groups are present in IPR markets: so-called patent applicants (patent producers), patent facilitators or intermediaries (such as various forms of non-producing entities, patent attorneys etc.), patent market platform facilitators (with still relative low level of success) and supporting actors (such as agencies, technology transfer offices, incubators etc.). For now (albeit few and fragmented) research shows that personal networks and relations are the preferred intermediary channels for patent transactions [29]. Activities inside the work process of partner and other actor’s identification are: overview of possible transfer channels, choosing the transfer channel and defining general characteristics of the selected channel or platform, identifying the possible partners, choosing the partner(s) to engage with in negotiations and begin preliminary enquiries. The Activity table may provide insight into parts of this process that are inefficient at the moment, for example pointing out the need to foster long-term (personal/business) relationships with specific innovation actors.

A special issue in patent trading is the quality of the patent, which is in general the object of due diligence processes (step 5). In other words we are speaking here of two questions; that of the patent validity (compliance with necessary legal requirements and jurisdiction) and that of patent enforceability (the possibility of upholding the patent in court in case of a potential infringement). Inside the due diligence work process, at least the following activities need to take place: determining whether or not one has sufficient resources (knowledge) to conduct the due diligence on their own, finding an appropriate expert if needed, re-evaluation of the patent attributes (according to the identified partners needs), re-examining the

appropriateness of the selected mode of transfer, partner evaluation and designing the solutions in case of (future) infringement (especially when dealing with licensing). Companies (and other actors) may need to use different experts during the due diligence processes.

We will show an example of using the Activity table in the step of patent re-evaluation (step 6) in the last part of this paper (see Example 2). The patent is often a unique commodity – whose value is determined not only by its technological dimension, but also its economical and legal dimension - in a market where the potential sellers and buyers are often unidentified and where the price is dependant also on the potential competitive or cooperation strategies. The “pricing” is taking place under, at least potential, treat of competition on the market of goods. Furthermore, a rather surprising fact is that the licensing price is sometimes zero. The explanation for this is the use of patents as strategic tools in future innovation co-operations (in form of patent pools or less organized potential innovation co-operations or even joint venture, educational and research alliances etc.). A relevant issue is also one of transaction costs of patent transactions, which tend to be fairly high and envelop: »screening« costs (cost of finding a specific technology related IPR), valuation costs and negotiation costs (those related to due diligence procedures costs as well as (legal) contract requirements costs). The search for the “true” value and price of the patent will often depend on individual IPR transactions and general relations between the transfer agreement parties, as well as on the costs incurred during the transfer process. In accordance with this the organization will usually need to re-evaluate the patent. The process encompasses activities related to the following: identifying unique relations between parties (buyer-seller or licensor/licensee relations) that may affect the price, evaluating the effect of the transfer costs on the price and re-pricing in the light of this potential buyer-seller relations and the transfer costs (consult also Table 2). Here, the role of the manager is put forward, since one needs to determine the new price in accordance to the (relative to the other party or parties) market position of the organization.

The process of negotiation is the next step (step 7) that can also be intertwined with the previous one. The motivation for IPR transactions is according to Bader et al [41] to increase revenue, technology transfer (gaining new technology), increase market share and efficient R&D. Less

important motivation is that stemming from cost-cutting, reputation, building industry network and the enhancement of social welfare. This is all mirrored in the negotiation process. Hence, a variety of elements need to be arranged and agreed upon between the transaction partners. Unsuccessful negotiation process is one of the most important barriers to IPR transactions [41, 42]. Also, actors engage in bilateral agreements; which is retaining high costs and low speed of these transactions. Activities inside this work process are *ad minimum*: negotiation on the relevant points of the transfer, reaching agreement on various relevant points (clauses) of the agreement, drafting the contract, negotiation on the contract draft and making the decision to finalize the transfer of the patent. It is important that the negotiation team is well composed; it should include a business development executive – whose role would usually be to find the potential deal, a scientific-technical expert – providing technical and scientific support – the decision maker – with the authority to commit to the deal at hand - and a licensing attorney or at least a legal expert used to offering assistance in licensing procedures (see also [5]). These issues as well as those connected with (transfer) documentation will often get crystallized with the use of the Activity table.

The finalization of the patent transfer is the last set of activities needed to complete the patent transfer (step 8). The process entails the following activities: concluding the agreement, preparing the final contract, finding appropriate individuals with the power to sign, signing the final agreement, making appropriate changes in the Patent Office databases (if needed), informing other relevant partners of the patent transfer (if needed). Especially the cooperation of the manager and the legal expert is required. The most important output is the signed contract on the patent transfer.

5 Two examples: the use of the Activity table in IP work processes

We show two examples to depict the use of the Activity table in practice. The first is a shorter example of the process of innovation identification (Example 1) – here we are limiting ourselves to depicting the process that leads to an effective use of the Activity table. We have chosen this early phase of the IP management process - that is a pre-step to the patent exploitation phase (we call it the IP preparation phase) - to show the interconnectivity

of IP processes and the need for a systemic approach to optimize IP processes throughout the entire business process.

The second shows a more in-depth application of the Activity table on the work process of patent re-evaluation with a fully developed work process flowchart (Example 2).

Table 2, Outline of the Activity table for work process innovation identification (Example 1)

Activity	Description	Time	Rule	Parameters		Determination		Determination		Determination	
				Input/output	Time	Employees	Management	Employees	Management	Employees	Management
Identify unique relations between the parties of the (potential) transfer agreement that may affect the price, evaluating the effect of the transfer costs on the price and re-pricing in the light of this potential relations and the transfer costs, suggestion and validation of the re-evaluated price of the patent.	Decision on employing an external expert(s), choosing the external expert(s) or finding the members of the patent (re-)evaluation team, establishing contractual basis for experts work or the work of the team, first price input, identifying unique relations between the parties of the (potential) transfer agreement that may affect the price, evaluating the effect of the transfer costs on the price and re-pricing in the light of this potential relations and the transfer costs, suggestion and validation of the re-evaluated price of the patent.	10 min	No suggestion	Decision on employing an external expert(s), choosing the external expert(s) or finding the members of the patent (re-)evaluation team, establishing contractual basis for experts work or the work of the team, first price input, identifying unique relations between the parties of the (potential) transfer agreement that may affect the price, evaluating the effect of the transfer costs on the price and re-pricing in the light of this potential relations and the transfer costs, suggestion and validation of the re-evaluated price of the patent.	10 min	1	1	1	1	1	1
Identify unique relations between the parties of the (potential) transfer agreement that may affect the price, evaluating the effect of the transfer costs on the price and re-pricing in the light of this potential relations and the transfer costs, suggestion and validation of the re-evaluated price of the patent.	Decision on employing an external expert(s), choosing the external expert(s) or finding the members of the patent (re-)evaluation team, establishing contractual basis for experts work or the work of the team, first price input, identifying unique relations between the parties of the (potential) transfer agreement that may affect the price, evaluating the effect of the transfer costs on the price and re-pricing in the light of this potential relations and the transfer costs, suggestion and validation of the re-evaluated price of the patent.	10 min	No suggestion	Decision on employing an external expert(s), choosing the external expert(s) or finding the members of the patent (re-)evaluation team, establishing contractual basis for experts work or the work of the team, first price input, identifying unique relations between the parties of the (potential) transfer agreement that may affect the price, evaluating the effect of the transfer costs on the price and re-pricing in the light of this potential relations and the transfer costs, suggestion and validation of the re-evaluated price of the patent.	10 min	1	1	1	1	1	1
Identify unique relations between the parties of the (potential) transfer agreement that may affect the price, evaluating the effect of the transfer costs on the price and re-pricing in the light of this potential relations and the transfer costs, suggestion and validation of the re-evaluated price of the patent.	Decision on employing an external expert(s), choosing the external expert(s) or finding the members of the patent (re-)evaluation team, establishing contractual basis for experts work or the work of the team, first price input, identifying unique relations between the parties of the (potential) transfer agreement that may affect the price, evaluating the effect of the transfer costs on the price and re-pricing in the light of this potential relations and the transfer costs, suggestion and validation of the re-evaluated price of the patent.	10 min	No suggestion	Decision on employing an external expert(s), choosing the external expert(s) or finding the members of the patent (re-)evaluation team, establishing contractual basis for experts work or the work of the team, first price input, identifying unique relations between the parties of the (potential) transfer agreement that may affect the price, evaluating the effect of the transfer costs on the price and re-pricing in the light of this potential relations and the transfer costs, suggestion and validation of the re-evaluated price of the patent.	10 min	1	1	1	1	1	1

Table 2 shows a possible outline of the Activity table for the work process of innovation identification (partial representation). We see the defined activities, description, time, rule, output and involved employees. The involvement and joint cooperation of the latter is an extremely important feature of all IP processes, since theory suggests that formal education is lacking and that an apprenticeship system is prevailing [29]. Furthermore, one of the problems is that immediate outputs of individual resources they need to generate, are sometimes unclear. However, when conducting IP related activities, innovators and other agents gather formative experience that enhances their capacity and confidence in doing their duties in similar situations [43].

Furthermore, Table 2 shows us clearly that the Activity table is indeed an Agent-Based modeling approach for optimizing patent exploitation processes, since, we can see that to achieve the main goal – to identify the main mechanisms that bring about the macroscopic phenomenon of interest (the optimization of the patent exploitation process), we rely on re-constructing activities of agents (involved employees/resources) capable of autonomous action

and independent decisions. The activity is hence a micro-process that represents well-defined work performed by one resource; which is concurrent with [44], where authors look into Agent-based modeling in technological innovation.

Next step is to put in the flowchart the set of symbols, as have been defined above, in order to model the process. Once this is done the flowchart allows us to see the bottle-necks and inconsistencies: by analyzing the individual parts of the flowchart, taking into account suggestions and comments as made in this article as well as consulting other literature or existing good practices.

In Table 3 we show the application of the Activity table for the processes of re-evaluation of the patent. This example was selected since it is a set of processes that often need to be executed, but are mostly done unsystematically especially in smaller companies. In order to develop a process model that represents a true likeness of the existing reality of the process of re-evaluation, the state of the art of the process needs to first be discovered and especially understood.

The process model represents the Activity Table as developed. We have started with sufficiently defining the process, hence process activities were identified. The work process of re-evaluation of the patent has in our example the following ten activities: decision on employing an external expert(s), choosing the external expert(s) or finding the members of the patent (re-)evaluation team, establishing contractual basis for experts work or the work of the team, first price input, identifying unique relations between the parties of the (potential) transfer agreement that may affect the price, evaluating the effect of the transfer costs on the price and re-pricing in the light of this potential relations and the transfer costs, suggestion and validation of the re-evaluated price of the patent. The final activity is the confirmation of the price.

Along the role of the accounting services and the possible external expert, the role of the manager is put forward, since he needs to validate the new price in accordance to the (relative to the other party) market position of the organization.

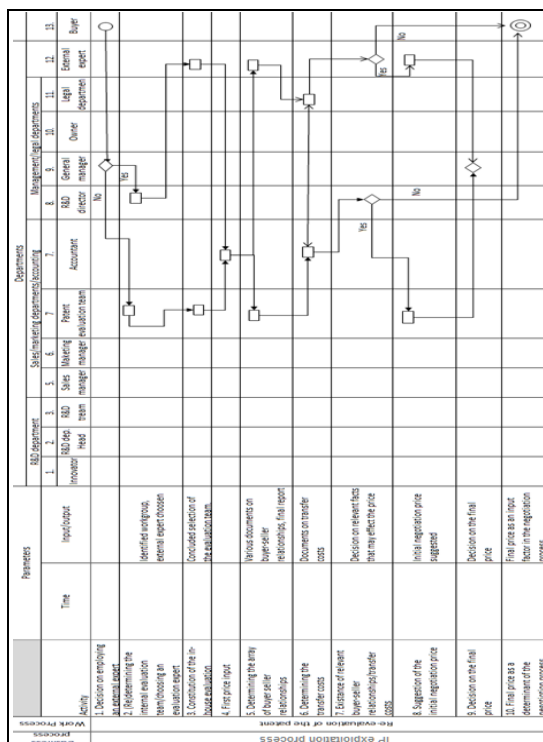
The input into this first step is the price; as was determined in the work process of patent valuation. The first decision is whether an external expert would be employed in this step. If the decision is not to engage an external expert inside this work process, it is prudent to either use the team that has worked in the first patent evaluation process or build a new team. It is also possible to engage individual

employees inside the relevant departments (our example only shows the first two options).

The next activity is identifying the buyer-seller relations or the licensor-licensee relations, which can have an effect in the price. We need to take into account, that there is an array of business (also sometimes non-business) relationships that may be relevant. The input can come from different sources and relevant input by various departments is desirable (from the supply department (is the potential buyer also one of important suppliers of the firm?) to the sales department (is the potential buyer one of the major buyers of firm's goods or is it perhaps a direct competitor in the goods market?).

The next activity is to determine the transfer costs and their effect on the price and who will be liable for them. The last step is to re-determine the price and to confirm the final price; where the manager again plays an essential role. The confirmed price is the final output of this work process and represents one of the main inputs in the negotiation (work) process.

Table 3, Activity table for the work process of the patent re-evaluation (Example 2)



We can see, the use of the Activity table has *inter alia* crystallized the importance of the manager inside this step (and the need for the organization to employ efficient methods of involving other employees), as well as to make a (systematic)

decision on either to include external expert(s) or use internal teams (which are to be build in advance from individuals in the positions as highlighted by the Activity table and should be connected or identical to those involved also in the valuation step in order to achieve a more efficient and unified process of re-evaluation).

6 Conclusion

Changes in today's environment are constant, not only in business processes, but also in intellectual property processes. The need for systemization of activities - or groups of activities within the later - is in demand as both patents as well as other intellectual property rights ought to be carefully designed and thoroughly thought through.

IPRs are sometimes allowing and facilitating "sleeping knowledge", but situations in which knowledge stays locked inside organizations, should be avoided, in order the IPRs not simply to be designated as barriers to innovation. In some cases the scenario of benefiting from the transfer of knowledge embodied in IPR, is not at the forefront of companies efforts But we believe there is still a sufficient amount of IPRs and especially patents that remain unutilized, due to unrealized opportunities, insufficient knowledge, uncertainties and especially IP management processes that remain un-optimized.

As we have seen a process model is a description and logical presentation of a real process, whose development requires capturing all the information needed to create a complete understanding of the functioning of the process within the organization, in addition to identifying the process's interactions with its environment. This knowledge represents a precondition for developing a process model that is a true reflection of the original process. Hence, not only does the utilization of techniques and methods - such as the presented Activity table - allow for the optimization of IP processes, but their use is also conditioned upon the need of those using it, to gain insight into the processes and learn more about them. We have shown why agent-based modeling and optimization models - such as the presented Activity table - are especially useful to achieve this.

This is especially true inside the so-called exploitation phase, especially if the organizations decide to try to exploit intellectual property rights and especially their patents in markets for ideas that are riddled with uncertainties and inefficiencies.

We have presented an overview of the Activity table itself as well as a step-by-step overview of considerations needed to be taken if using the

Activity table in the exploitation phase focusing on examples when a patent transfer is a viable option for the organization (encompassing our methodological contribution). Theoretical and empirical underpinnings of individual steps and activities of IP exploitation and their implications on using the Activity table for optimizing IP exploitation processes are brought to light.

Furthermore, we have presented two examples of using the Activity table (first showing also the inter-connectives of IP management processes and the second providing a more in-depth on look inside the re-evaluation step) in order to further clarify how it can be used. This is our more practical contribution.

Hopefully, the presented technique can be a further encouragement especially for smaller organizations to perhaps try to exploit their patents on patent markets, should they discover they indeed own patents that are suitable for it and especially to entice them to first develop and later on also optimize their processes connected to exploitation of patents on IP markets.

Acknowledgments:

This research has been financed by Creative Core FISNM-3330-13-500033 'Simulations' project funded by the European Union, The European Regional Development Fund. The operation is carried out within the framework of the Operational Program for Strengthening Regional Development Potentials for the period 2007–2013, Development Priority 1: Competitiveness and research excellence, Priority Guideline 1.1: Improving the competitive skills and research excellence.

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