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Establishment of Automatization as a Requirement for Time Management Input Modules in Project Management Information Systems for Academic Activities – A Game Theory Approach

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Abstract

Academics are expected to engage in several works in several different domains, namely research and development, general management and services to the community, while lecturing a set of courses. Academics might differ in their preference for some of these activities and also in their corresponding performance. Quality assurance in academic institutions implies monitoring performance, what is frequently done by measuring a set of quantitative results at the end of a certain period. Project Management best practices can change this frequent practice, introducing, for instance, the concept of cost efficiency, allowing for objective comparisons between different types of activities. For this to happen there is a need to monitor the time spent by each academic in each activities or, at least, in each set of activities of the same type. The challenge is to know how to do that. Game Theory has been studying decision making in competitive environment, which is increasingly the case in academic institutions. Therefore, there is a primary need to verify if a relevant percentage of the academics have a perception that there is an incentive to lie in their timesheets, due to competitive thinking. This paper presents a pilot study that allowed concluding that time management input modules in project management information systems for academic activities must be automated, eliminating the human factor in timesheet fillings.

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1. Importance of collecting/managing time/effort in high education institutions

The issue of quality assurance in higher education is a complex matter, with multiple dimensions [1] and the approaches to some type of management have also been quite disparate. Depending on the context, focus might be, even inside the same organization, sometimes in the publishing productivity, in students' satisfaction or in financial aspects. For instance, in the United Kingdom, managers started in the mid-80s to, slowly, adopt Activity-Based Costing (ABC), which can include several sources of input, like surveys, workshops, interviews and timesheets [2], but in 1998 only 9% of the universities add introduced ABS and 16% intended to do so [3].

Cropper [3] has identified two main reasons for the limited success of costing initiatives: the insufficient attention of high education organizations to the allocation of staff time to the activities; and the lack of consequences of a detailed cost analysis, namely in the price of commercial activities. Cropper also noticed in his study that academic staff might have some hesitations regarding time management, namely due to the shift in the organization paradigm, ending with the "self-validating" while simultaneously requiring extra effort (registering times), something that they sometimes have difficulties in doing with rigor. Authors have also found evidences of an association between less transparent regimes and less efficient management with out-of-date technologies [4].

Academics are expected to engage in several works in several different domains, namely research and development, general management and services to the community, while lecturing a set of courses. We can find authors arguing that an academic has responsibilities that can be classified in up to sixteen different types [5]. Some of them can easily be imputed to some of the "commercial activities" of a high education institution (teaching and industry paid research). But many cannot. Research is part of the development of the staff but also of the organization. How can research not included in financed projects be imputed? What about general management? These issues remain open but whatever model comes to impose itself, accurate measurement of the staff's effort (time) must be achieved in order to allow for correct initiation, planning, execution, control and closing of the academic projects that, together, make a high education institution's set of activities. This is even more relevant when several studies show that academics tend to work much longer than the contracted hours [5] [6].

While it is known that the development of management tools demands for a development in information systems [6], it is not clear on what aspects that development must occur. This paper focus on the times input modules, which either can be manual (staff will fill their timesheets) or not. If not, an automated system must be developed before hoping for an accurate management of high institutions. Game Theory provided the authors with the background concepts of competitive strategy, allowing to clarify if such a need exists, as described in the following section.

2. Game Theory

Game Theory studies the interaction between intelligent agents in a competitive environment. The name comes from the concept of game, where the players try to make the correct decisions, under the rules of the game, to win. For that, they need to anticipate the other players' decisions, assuming that they also want to win, even if their concept of winning is a different one. According to Leonard [7], the theory emerged over seventy years ago, in 1944, when John Von Neumann (that also created the Von Neumann Computing Architecture, which established the foundations for computation) and Oskar Morgenstern published the book "The Theory of Games and Economic Behaviour" [8].

The theory developed further more along the years, first with John Nash's work, namely the one that introduced what today is called as Nash Equilibrium [9], and later with the work of many others [10][11]. It is this work from John Nash that is on the root of this work, once it shows that in some situations the actions (movements) of the agents in a competitive environment (the players) will differ from those that would maximize their utility of the game, namely if they cooperate instead of competing. A Nash Equilibrium is a position from where none of the players has benefits in deflecting from if the other players don't change their strategy.

Just as Nash did [9], the authors will present the relevant part (to what concerns this paper) of the Games Theory using an example. Consider two competing sellers that are trying to decide whether or not they should increase the price of their product. They know that if both of them increase the price, both of them will benefit more (assuming that the consumers don't have a choice but to buy at any price); one of them will gain market share if only the other

increases the price; and none will benefit more than what they do now if they both decide to maintain their prices. Their utilities matrix is presented in table 1.

Table 1. An example of an utility matrix.

	Seller 2 increases the price	Seller 2 maintains the price
Seller 1 increases the price	+4 \ +4	-6 \ +6
Seller 1 maintains the price	+6 \ -6	0 \ 0

In this example, both the sellers would be better off if they would both raise their prices. But in that case they would both have an incentive not to raise the price in order to gain the other seller's market share and, therefore, win even more. The result is a Nash Equilibrium in the strategy where both sellers do not increase their price (therefore ending with utilities of zero).

The present paper does not try to model/anticipate the behavior of academics when presented to the need to inform management levels of their time dedication to the several domains of academic work, but only to anticipate the possibility of a relevant percentage of the academics end up lying on their timesheet reports. The problem is to try to understand the perceived sign of the variables presented in Table 2.

Table 2. This paper's utility matrix (text presented in the perspective of the inquired academic).

	Other (competing) academics lie	Other (competing) academics do not lie
I lie	$a_{1,1} \setminus b_{1,1}$	$a_{1,2} \setminus b_{1,2}$
I don't lie	$a_{2,1} \setminus b_{2,1}$	$a_{2,2} \setminus b_{2,2}$

To achieve this goal, a survey was made, as described in the next section.

It is important to notice that the analyses of these approaches must stand on the grounds of one of the several existing justice theories. For once, the utilitarianism, a philosophical approach to the concepts of "justice" and "good", which was developed by Jeremy Bentham in the late 18th century [12] and supported by other relevant thinkers like John Stuart Mills [13]. But also libertarianism, that argues that each person is worth for himself and has the right to seek what best suits him without external moral constraints, as Nozick argued [14]. Should one do what maximizes the utility for the society ("the greatest good for the greatest number) or maximize is own happiness?

Therefore, conclusions regarding the "fairness" of the obtained results are always questionable. This work will avoid such type of conclusions and remain focused on its purpose: to verify if Project Management Information Systems have as a requirement that its time input modules are not human dependent.

3. Results

The method used for this study was an inquiry, sent through digital means to several high education institutions, both private and public, in the beginning of the academic semester in October 2014. The form accepted answers throughout that first semester of the 2014/2015 academic year.

The first five questions are related to how the inquired faces several scenarios, with the time's control implemented, where:

- a colleague works more hours per day
- a colleague works more hours per day on scientific research but less in another component
- a colleague works more hours per day in community service provision but less in another component
- a colleague works more hours per day in teaching activities but less in another component
- a colleague works more hours per in management activities but less in another component.

Question 6 considers that the registration system of working hours is based on the statements of the academics themselves, who register the time spent working in each of their activities, and it is inquired if the person answering considers to be likely that the total of the times would be registered incorrectly. Question 7 is similar to question six

but it's about the registration of the times for each type of activity. Finally, Question 8 was made to evaluate the condition(s) in which the inquired assumes that he is willing to lie.

According to the answers to Question 8, 62.82% of the inquired academics are not willing to lie in any situation and 37.18% are willing to lie if their career progress depends on that and/or they knew that lying in the time's registration was a widespread practice and/or their job depends on it.

In the 37.18% of the inquired willing to lie there are:

- The inquired academics who would be willing to lie due to having a payoff for doing it;
- The inquired academics who would be willing to lie if lying was a widespread practice;
- The inquired academics who would be willing to lie but have a perception that they don't have a payoff for doing it .

So three groups can be considered:

- Group 1 – the inquired academics that are not willing to lie in any situation
- Group 2 – the inquired academics that are willing to lie and have a payoff to do it
- Group 3 - the inquired academics who would be willing to lie but don't have a payoff to do it

The group of the inquired academics that are willing to lie and have a payoff to do it (Group 2) results from the sum of the inquired academics who would be willing to lie and answered differently from "That would be indifferent to me" at least at one question from Questions 1 to 5 (existence of a perception that a payoff for lying exists) and the inquired academics who would be willing to lie if lying was a widespread practice in simultaneous with the answer "Yes, intentionally it will be, sometimes, displacement of times from one activity to another or even some excess of times registered" to Question 7 (perception from the inquired that others will lie intentionally on the times registration).

The inquired academics who would be willing to lie but don't have a payoff to do it (Group 3) answered "That would be indifferent to me" at all Questions 1 to 5 and the answer to Question 7 was that the times will be correctly registered or it will not be registered correctly but without intention from the academic (existence of a perception that a payoff for lying does not exist).

8.97% of the inquired academics are willing to lie but, from the analysis of answers to Questions 1 to 5 and 7, they have a perception that they don't have a payoff to do it, so, possibly, they wouldn't lie because it's indifferent to them if colleagues work more or less hours than them, and they believe that their colleagues will register correctly the times, or incorrectly but with no intention to do so (Fig. 1).

28.21% of the inquired academics are willing to lie and their answers in the previous questions indicate that they have a perception of having a positive payoff in doing so.

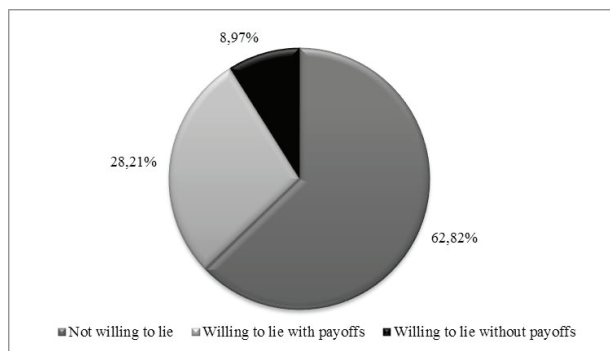


Fig. 1. Percentage of inquired academics that are not willing to lie, willing to lie with payoffs to do it, willing to lie without payoffs to do it.

The credibility of project management information systems for academic activities depending on the registration of times spent made by the academics themselves was evaluated by the analysis of the answers to Questions 6 and 7. Question 6 asks if the inquired believes that academics will register properly the total time relating to their activities. Question 7 puts a similar question but referring to the registration of the times for each of the activities.

It was considered that the inquired academics who answered at least at one of the questions that they believe that the register of times will be done incorrectly (with or without an intention) do not trust this time control system. 76.92% of the inquired academics believes that the times will be incorrectly registered (Fig. 2)

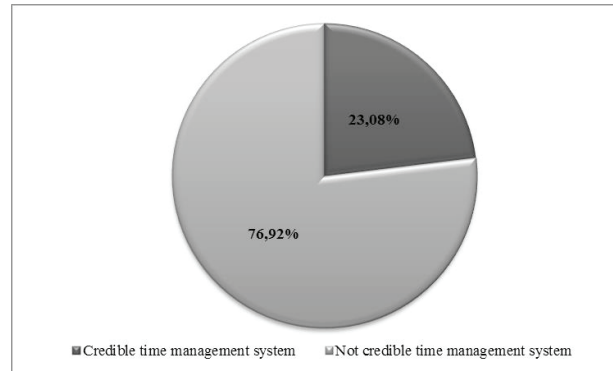


Fig. 2. Percentage of inquired academics that believes that this time management input processes would be credible or not credible.

23.08% of the inquired academics consider this time management input process would be credible.

4. Conclusions

The presented results suggest that a relevant percentage of academic staff has the perception that there are incentives to lie when reporting the time spent in their different activities. That could be visualized in a matrix where the Nash Equilibria is in lie/lie (table 3).

Table 2. This paper's utility matrix (text presented in the perspective of the inquired academic).

	Many other (competing) academics lie	At most only an irrelevant number of (competing) academics lie
I lie	$0 \setminus 0$	$a_{1,2} > 0 \setminus 0$ (but not likely)
I don't lie	$a_{2,1} < 0 \setminus b_{2,1}$	$a_{2,2} \leq 0 \setminus 0$ (but not likely)

The results have also indicated that there will be a considerable disbelief in the collected times if they depend on the academics reports.

Therefore, one must conclude that Project Management Information Systems designed for the academic environment have an important requirement: their time input modules cannot depend on human factors.

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