

SCIENTIFIC REPORT

Mariia Kozlova, Ph.D. student
School of Business and Management
Lappeenranta University of Technology
+358 50 463 6186, Mariia.Kozlova@lut.fi

Subject Short Term Scientific Mission
Reference COST Action IS1304
Host institution: University of Palermo
Period: 01/11/2016 to 30/11/2016
Reference code: COST-STSM-ECOST-STSM-IS1304-011116-080178

7.12.2016

PURPOSE OF THE STSM

The carried work has been designed for one month aiming to collaborate with the team of Associate Professor Giovanna Lo Nigro (University of Palermo) to study the *modeling and the effect of biases on strategic decision-making* in biopharmaceutical R&D project management to provide better understanding of the biopharmaceutical reality.

DESCRIPTION OF THE WORK CARRIED OUT DURING THE STSM

During the STSM, firstly, I got acquainted with the design of the biopharmaceutical alliance game, which has been previously studied by team of prof. Lo Nigro (Lo Nigro, Morreale, Robba, & Roma, 2013).

Based on their previous research the first version of system dynamic model for studying biopharmaceutical alliance games was constructed. The model development took the bulk of the time spent in Palermo and the result of several workshops and discussions. The features of the system dynamic model include the "continuous" modeling of decision-making (in contrast to the two decision points used in the previous models), ability to relax (many) assumptions made in the previous model, and greater flexibility regarding the design of the game. The players' ability to base their decisions on the forecasted behavior of the other players has remained - and the modeling the forecasting can be enhanced with the new model by introducing expert judgment into the stochastic processes used in the forecasting. This can also mean using different "tailored processes" for each participant separately.

The model is a representation of a game-situation in the context of bio-pharmaceutical research business, where two biotech (research) companies exist on the markets and compete to sign an alliance with a pharmaceutical company – a three player game. We posit that the pay-offs of each player are influenced by the actions of the other players. The game set-up is such that the first-moving biotech company (B1) is first offered a mutually exclusive alliance (AB1) by and with the pharmaceutical company (the pharmaceutical company will only ally with one biotech-company) and if an alliance is not contracted the remaining second biotech company (B2) is offered a similar deal (AB2). If no alliance is settled during the first time-step the offers are repeated in the following time-steps, the game set-up is visible in Figure 1. This kind of a set-up has been observed to exist on the bio-pharmaceutical research markets (Wakeman, 2007).

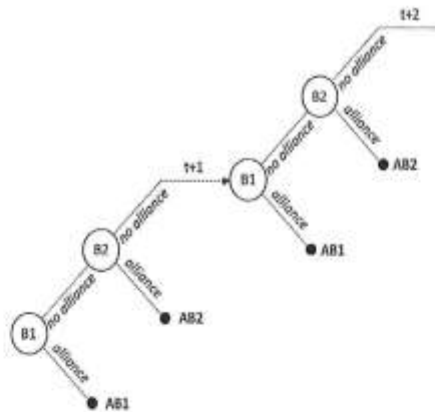


Figure 1. The simple game setup

The players' payoffs depend on the development of the R&D project market value, modeled (originally) by using geometric Brownian motion. The conditions of allying are defined simply by each player's consideration of their pay-off in the case of allying or not allying, each player makes the decision based on the highest pay-off. The result of the model simulation shows if there are alliances formed, which alliances are formed, the timing of the alliance decisions, and the overall profit for all players. These help in formulating and understanding the optimal strategy. It is clear that when the processes that govern the expected value of the underlying research-project value change the outcomes will change and the effect of having (better) information can be quantified. In the future we are interested in "tuning" the used parameters by way of observing the real world alliance behavior of bio-pharma companies.

Another interesting and actual issue for further research (further construction of the model) is the direction of including in the model the subjectivity of expert judgment and biases in player risk perception. Behavior, such as "overconfidence" and difference in risk perception among biotech companies (risk-averse) and pharmaceutical company (risk-neutral) are interesting points to study and to model.

References

- Lo Nigro, G., Morreale, A., Robba, S., & Roma, P. (2013). *Biopharmaceutical alliances and competition: A real options games approach*. *International Journal of Innovation Management*, 17(06).
- Wakeman, S. (2007). *Contracting and intellectual property issues in biotech commercialization strategy*. Ph.D. dissertation, University of California at Berkeley, USA.

DESCRIPTION OF THE MAIN RESULTS OBTAINED

The most important result of the STSM is the construction of the new system dynamic model for the bio-pharma alliance game. The model has been constructed with the Matlab-software, specifically the Simulink tool of Matlab. The model allows the easy testing of how a variety of (stochastic) processes, including processes that include expert judgment, affect the alliance decision-making and the pay-offs for the players.

The preliminary simulation results with the model show that the model succeeds in illustrating the effect of "information availability" on the bio-pharma alliance decision-making. In fact, it seems that the game dynamics change significantly when assumptions about the available information are changed. This was not an un-expected result, but corroborates our preliminary hypothesis that underlies the construction of the new model. It is clear that there is a place for further research into including expert information in the modeling of bio-pharma alliance decision-making.

FUTURE COLLABORATION WITH THE HOST INSTITUTION

This one-month STSM has been pivotal in establishing a strong connection with the research team of prof. Lo Nigro at the University of Palermo and the researcher (myself). I am a young researcher and this is one of the first research collaborations I have for "myself" and one that I hope will continue for a long time. Future visit of prof. Lo Nigro to Lappeenranta University of Technology (LUT) and visits of other team members from LUT to Palermo have already been planned and discussed.

FORESEEN PUBLICATIONS/ARTICLES RESULTING FROM THE STSM

An extended abstract describing the research has been submitted for The Young Academics on Real Options (YARO) Workshop to be held in March 2017.

A journal article that presents and outlines the new system dynamic model and introduces some first results obtained with the model with regards to different "information availability" is on the writing board. We intend to send the article for publication within the next six months.

Consecutive papers will discuss the effect of including expert judgment into the modeling from various points of view that is, in the modeling of the "expected price processes" and in modeling the decision-making behavior of the players.

OTHER COMMENTS

I am very grateful for this opportunity. Apart from productive and interesting working days, I have familiarized myself with a different reality in terms of "how a university functions" and with a different academic culture. I have made new friends and enjoyed new places that will remain long after this STMS is over.

Yours sincerely,
Marlia Kozlova

