

## REVIEW

By Prof. Dr. George Dimitrov Mengov

On the doctoral dissertation "Design of a Compensation System for Management Executives  
Using Generalized Nets"

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### **Background**

Aleksander Janusz Kacprzyk is a Polish business professional who seeks the doctoral degree in Communication and Computer Technologies, and in particular in the interdisciplinary area between computer science and human resources management. He was educated in Warsaw School of Economics, University of Minnesota, and MIT's Sloan School of Management. He has submitted a Ph.D. Dissertation to the Faculty of Technical Sciences at University "Prof. Dr. Asen Zlatarov" – Burgas.

Mr. Kacprzyk has accumulated extensive professional experience working for the Polish branches of international companies such as McKinsey and The Carlyle Group, different Polish companies, and an innovation incubator. He is also a Lecturer in Corporate Finance in an MBA programme for healthcare professionals in a University in Warsaw.

### **Scientific Relevance**

Mr. Kacprzyk has chosen an interesting and somewhat unusual subject for his dissertation, which connects the previously unrelated areas of generalized net (GN) modelling and the subfield of human resources (HR) management dealing with the business executives' compensation. This topic is, however, remarkably relevant in today's world where Artificial Intelligence–based applications are eating away thousands of jobs of administrative staff,

accountants, and HR experts. Having read this dissertation one easily imagines why such a technological shift is possible – the answer is, because these jobs lend themselves to precise description and further automation due to carefully crafted algorithms. Exactly that is what Mr. Kacprzyk's text offers.

### **Scientific Competence of the Candidate**

Chapter 3 is composed of a comprehensive introduction to the theory of Atanassov's Generalized Nets and an in-depth discussion of their relation to their predecessor, the Petri Nets, as well as the GNs' variations and extensions. The author is obviously cognizant of the most recent developments in the field. Of all 124 references, about 30 are dedicated to GNs.

All of that is preceded by a short overview of some relevant concepts in control theory and discrete event systems, more precisely discrete-state event-driven systems, somewhat at a textbook level. That approach is more or less justified as one of the stated goals of the dissertation is to present the GN modelling ideas in a form accessible to non-experts in computer science – business professionals in particular. The preceding Chapter 2 offers an equally competent overview on the topic of executives' compensation systems in the light of agency theory, which is the field's classic.

### **Scientific Contributions**

The gist of the dissertation is twofold: (1) The main contribution is Fig. 4.6 on page 83, which presents a GN model of the entire task of determining management compensation in various companies; (2) Two real-life implementation examples based on that figure are presented in the subsequent chapters. The candidate considers as his first main contribution the development of an accessible introduction to GNs for economists, HR managers, and other domain experts. Indeed, Fig 4.6 seems to be comprehensible by such people because it does not describe each and every minute detail of the process of determining an executive's compensation, but remains at a somewhat general level.

A real-life application of the advocated approach – one that would be really efficient up to the point of automating and eating out jobs – would demand a far more complicated GN model. However, the one presented now is quite appropriate for a dissertation as it primarily seeks to introduce conceptual thinking. The two specific examples based on two Polish firms give an

idea how exactly could such a system be implemented in practice, yet they stick to the same more or less general level of detail.

As it often happens with Atanassov's GNs, they deliver the 'modelling product' they promise but seem to be much more valuable for something else, namely for provoking one's thoughts in unexpected new directions. Many years ago this reviewer used them to develop a highly efficient way for solving a particular system of ordinary nonlinear differential equations. Afterwards the GN use was not continued, but the solution would have been impossible without looking at the problem through the GN lens. Now we have a similar situation with Mr. Kacprzyk's dissertation. Once we see his concrete GN model it may look not too impressive, yet we are startled to realize to what extent algorithms can penetrate domains that until recently seemed to be reserved for human judgement only.

### **Publications**

The candidate has presented a list of eight coauthored scientific publications, two of them appearing in influential international journals. Most of the published works belong to the cluster of GN-related scientific outlets. In my opinion, all of this is sufficient for granting the doctoral degree. However, there is no indication how much points are sought by each paper according to the classification of the National minimal standards for a doctoral dissertation and hence, is the threshold met.

### **The Dissertation Synopsis**

In my view the Synopsis adequately summarizes the content, logic, main points, and achievements of the dissertation. Its translation in Bulgarian is 32 pages long which is enough publicity in that language.

### **Critical Comments**

The author's English is perfect and the text is very well written stylistically. Yet, one finds repeatedly throughout the dissertation elaborate statements about GN's being powerful, effective and efficient tool, each time as if they are introduced for the first time.

The control theory part is presented at about a textbook level and the reader is unclear why it is necessary at all, especially in light of the fact that it remains largely unused in the author's main research efforts.

Next, it is not quite clear why the author discusses at length various extensions of GNs, to settle for a relatively simple and ‘reduced’ special case of the method (Fig. 4.6).

The two practical examples are relevant but both deal with middle-sized companies. One could ask what would have been different in the case of a larger company or a multinational.

A stronger discussion could have been offered with regard to comparisons in applying the proposed method to the cases of, e.g., the Chief Financial Officer vs. the Chief Technology Officer vs. the Chief Operations Officer. Would the general model of Fig. 4.6 be somehow different?

The candidate suggests as a potential direction for future research the use of Atanassov’s intercriteria analysis as a mean for factor reduction. A couple of issues arise immediately. That analysis in particular, and fuzzy sets and logic in general (including the intuitionistic ones) are most useful when the data are generally not enough to apply the standard statistical techniques. However, we live in the times of big data and the situation with the compensation packages is hardly exceptional. Today’s job market for highly paid executives is largely international, implying no scarcity of data. If we assume, however, that this is still not the case for mid-sized companies within a country, one is not only left with insufficient amount of data, but one mostly ought to decide on the basis of one’s gut feelings and/ or expert intuition. In such a case the decision method would be unreliable, and the suggested dimensionality reduction would make it even more so. Why a GN should in such a case be used at all?

As stated already, if the dissertation is to be registered in the Bulgarian register for defended dissertations (НАЦИД), an additional calculation would be necessary for the amount of points for each publication, as well as a statement if their sum exceeds the threshold.

## **Conclusion**

The dissertation is 152 pages long and contains 13 tables, six figures, a glossary of terms, 124 references, and a declaration for originality of the results. It presents sufficiently well the ideas, modelling efforts, and scientific accomplishments of the author. The above list of critical comments does not diminish the text’s merits. In my view the dissertation meets the



requirements of the Bulgarian Law for the development of the academic professionals (ЗРАСПБ), The Bylaws (Правилника) for its implementation, adopted by the Council of Ministers of the Republic of Bulgaria, as well as the Bylaws of University “Prof. Dr. Asen Zlatarov”–Burgas.

Therefore, I believe that the dissertation of Mr. Aleksander Janusz Kacprzyk meets all requirements and he deserves the degree Doctor of University “Prof. Dr. Asen Zlatarov”–Burgas. I support giving Mr. Kacprzyk the title Doctor.

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Reviewer: \_\_\_\_\_

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