AN ORIGINAL STATISTICAL METHOD OF STRATIFICATED, GENERIC AND FACTORIALLY INDIVIDUALIZED MODELLING

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ABSTRACT

There is no method of modelling with universal valences, a kind of econometric panacea of processes and economic phenomena, whose impact could fully cover economic research. The econometric method evolved from the elasticity model, which was initially physic-mechanistic, where elasticity of demand according to income or price was approached similar to those specific to physical phenomena, diversifying the structures of the population surveyed by means of the taxonomic thinking of statistics, to later attach psychological elements, and even sociological elements, modelling the very opinions and views or attitudes of the actors involved in the economy; thus, economic opinions, and derived from that, economic behavioral decisions became a significant landmark of modern financial econometrization. This article started from a database formed by the opinions of experts in Project Management (PM) project, and develops an original method of layered, generic and factorially individualized modelling, which can be a complex strategic solution if the whole research is well anticipated and phased. The applicative exemplification, or the pragmatism of the method, is given by modelling a criterion or standard used in decision-making by the project manager (MP) to associate aquisitions (procurement) as a PM standard or key success criterion (KSC) with generic classes of critical critical factors (CSF), and later with individual critical factors (CSFs), known especially as key performance indicators (KPIs). The method divides the explanatory factorial reality of a complex process, structuring it and homogenising it initially in generic classes; then, there followed a destructuring process in the individual modelling, and eventually the modelling approach is worked over based on criteria of mitigating, and even eliminating multicollinearity.

Keywords: method, methodology, multicollinearity, Key Criteria for Success (KSC), Critical Success Factors (CSFs), Key Performance Indicators (KPIs), Project Manager (MP), Project Management (PM).

Jel Codes: C46, C51, C52, H43, O22.

1. INTRODUCTION

Both method and methodology are attributes of statistical thinking, recognized in most economic research. Method and methodology describe the path and strategy of any research, being indispensable for both the most simplified and the most complex investigative approach. A method is a veritable magnifying glass, which makes seemingly invisible aspects visible, describes such outlines of macroeconomic processes, which are impossible to identify and trace, and penetrates into the unimaginable, apparently unfathomable micro-universe of micro-economy, and in the details of economic business "in a synthetic, rigorous, argumentative and forward-looking manner" (Dinu, Săvoiu, Dabija, 2017).

The scientific method in research has doubtless Hellenic origins, being etymologically signified as "a way" or "a means" (DEX, 2012), and bringing together essential verbs of scientific research in economics: to structure, to spatialize, temporalize, anticipate, draw or trace, prescribe, act within a certain political, economic and social reality. The classical method has transformed the unifactorial simple determinism, derived from the "desire of wealth of the normal individual", specific to the beginnings of economic research, to instances of repeatability expressed as "a higher gain is preferred to a smaller, or the greatest amount of wealth [is obtained] with as little work as possible" (Georgescu-Roegen, 1971). The modern method then metamorphosed, in a trans-, inter-, cross-, and multidisciplinary manner, by combining entities, activities, occupations, products, services, economic information, mathematically, physically, biologically and organicistically, in statistical taxonomies, only to withdraw, sociologically, psychologically and probabilistically, into human behaviour Becker, 1998), generically flexibilized and streamlined, rationalized, and ultimately reconsidered as the exogenous factor with maximum determination in the specific dispersion of economic phenomena (Dinu, Săvoiu, Dabija, 2016).

The variety of applied methods even redefines statistical or econometric thinking as a set of methods, techniques and tools applied in modern economic research by borrowing the methods used in other sciences (cross-disciplinarity), by generating new methods or by innovating the existing ones, as well as by simplifying the complexity of some of the existing ones. The immediate result of the pragmatic capitalization and valorization of a method becomes methodology, a genuine science of methods (from Greek *methodos* and *logos*), from designing, selecting and capitalizing multiple methods, fundamentally reuniting "specific methods of an investigation field with techniques, procedures and instruments that are characteristic of the selected methods, being more and more clerly assimilated with strategy" (Dinu, Săvoiu, Dabija, 2017).

Developing a new or innovative method in statistics requires strict iterations and a special incubation, with a spectacular intuitive ending, bringing together successive and multiple options related to: i) the investigated population (delimitation, temporality, spatiality, structuring, etc.); ii) identification of relevant logic (anticipatory, heuristic, disaggregative, etc.); iii) phased staging correlated with complementary techniques, procedures and tools; iv) formulating the the hypotheses and the validation/invalidation decision with the highest degree of veracity; v) modelling with the simplification of reality and maximizing the visibility of associations and correlations, thus providing a higher degree of final knowledge; vi) predictive or prospective modelling with minimized error, etc. The new method proposed in the article has two necessary particularities, the first being its modelling or econometric specificity, and the second one being its suitability to the preexisting techniques procedures and tools, with which the actual activity of econometric research is actually carried out in concrete cases, where multiple results and multiple causes are investigated in perpetually structured phenomena.

In this article, a database was compiled and made use of, which comprised the opinions and views of a sample led by 110 foreign PM experts, with relatively weak correlation intensity, and implicitly a low determination, modelling results defined by key success criteria (KSC), by causes defining Success Critical Factors (CSFs) or Key Performance Indicators (KPIs), as they appear in the specific language and content of PMs.

2. THEORETICAL PHASES AND EXEMPLIFICATIONS OR CONCRETE STANCES OF THE NEW METHODS

The phases or steps of this original modelling method, which is generic and individualized factorially, are theoretically detailed starting from the classical type of economic modelling (Săvoiu, 2011, 2013):

- 1. identification and description of the variable of a resulting or endogenous type (with evolutionary detailed description) identification and description of the factorial or endogenous variables (with causal detailing)
- 2. factorial disaggregation or dismantling (excessive factorial individualisation and permanent updating of the residual influence of a number of yet unknown factors)
- 3. generic aggregation or taxonomic recomposition in several classes of factors (structuring of the groups of factors)
- 4. generic modelling of the endogenous or resulting variables (by constructing generic models)

- 5. factorially detailed modelling of the group, or excessive factorial detailing of the model (through the construction of excessively individualized factorial models)
- 6. simplifying models by attenuating or even eliminating the multicollinearity of models
- 7. selecting the efficient or successful, performing models by testing and complete validation of final econometric models

Illustrating, exemplifying or materializing the new method implied its application in the context of aquisitions – procurement = modelling, representing one of the 10 key success criteria in the PM (detailed in Table 1, in relation to Critical Factors Classes (CSFs) of the same successful projects (Q1 - Q6):

		Table
No	Var Sugara Critaria (VSC)	Year of
INO.	Key Success Chiena (KSC)	standardization
1	Harmonization of project activities	1983
2	Area (domain or field) of coverage	1983
3	Time in the project	1983
4	Cost in the project	1983
5	Quality of the project	1983
6	Team (H uman Resources – HR)	1983
7	Communication in the Project	2000
8	Project Risk	2000
9	Aquisitions (procurement) of the project	2000
10	Stakeholders (people interested in the project)	2013

The 10 key success criteria in the PM

10 Stakeholders (people interested in the project) Source: Compiled by authors after PMBOK® Guide, 1983, 2000 and 2013

The KSC hierarchy is an evolution-based one: as can be seen from the previous table, the years actually correspond to the successive editions of the PMI Guide – 1983, 2000 and 2013 (*PMBOK*® Guide 1983; 2000; 2013), thus the criteria become basically the result of a growing international experience in the field of PMs. The Critical Factors of Success (CSF) classes resulted from a survey of a questionnaire administered to a population of 61 experts (Tudoroiu, 2017a, Tudoroiu, 2017b), and their final coding registers six important classes having on average seven individualized CSFs:

Final ranking of CSF classes, and CSFs individualized as part of the classes in the successful project according to the opinions of the 61 investigated experts

Table 2

Code	CSF Classes, and individualized and codified CSFs
Q1.	"Class of political, economic, social and legislative environment
F1.1 F1.2 F1.3 F1.4 F1.5 F1.6 F1.7	Political stability and support in the EU and in the economies involved Economic and social policy based on transparency and honesty in the EU Favourable legal framework in the EU and in the economies involved Stable macroeconomic conditions in the EU and the economies involved Mature and available financial market in the economies involved Public support / community support in the economies involved Government guarantees, and other institutional guarantees
Q2.	Class of the impact of regional convergence and suitability to EU funds
F2.1	Selecting the right program and adequate EU funds
F2.2	Appropriate risk allocation and shared use between EU partners
F2.3	Competitive financial proposals and convergence for EU regions
F2.4	Clear regional objectives within EU programs and funds
F2.5	Clarity of roles and responsibilities between regional partners in the EU
F2.6	Rationality in approving the funding process in the EU
F2.7	Open and constant communication with EU funding institutions
Q3.	Class of clarity of content and substance of the project
F3.1	Clear statement, short design development and shorter deadlines
F3.2	Clear time, budget, and performance aims, goals and targets
F3.3	Firm commitment by the parties in partnership or consortium
F3.4	Accurate, correct and detailed project planning based on realistic expectations
F3.5	Good feasibility based on new technology and innovation
F3.6	Competent staff or team with a real and effective project manager
F3.7	I ransparent and competitive public aquisitions - procurement
F3.8	Favourable environmental impact of the project
Q4.	CSF Class of management standards
F4.1	Excellence in organizing and integrating partners / activities
F4.2	Participatory management of the team and professional counselors
F4.3	Refined financial management, endowed with remarkable entrepreneurial skills
F4.4	Superior performance level during meetings and in communication
F4.5	Subtle monitoring of quality and strategic potential
F4.6	Maturity in domain evaluation and risk identification / allocation
F4.7	Reliability and consistency of standards monitoring

05	Class of management tools under triple constraint
F5 1	Brainstorming
F5 2	Method or analysis by optimization and critical pathway (PERT)
F5.3	Time charts or graphs (logical network, Gantt chart, fishbone)
F5.4	Project software management (planning, teams, monitoring, etc.)
F5.5	Work structure breakdown (wbs)
F5.6	Value added or gained method (application scope, time, cost)
F5.7	Stage-gate model (stage-gate process)
Q6.	CSF class of the status and conceptualization of the successful project
F6.1	Creating new products, services, processes and activities, and markets
F6.2	Satisfaction and motivating incentives for individuals, team, partnership
F6.3	Maintaining the integrity of the baseline on performance measurement
F6.4	Training, education and culture of human resources
F6.5	Improvement in IT, technology, infrastructure, resources, strategy, etc.
F6.6	Success indicators self-defined in/through the project
F6.7	Positive impact on customer and markets" (Tudoroiu, 2017)

Source: Re-synthesized by authors after (Tudoroiu, 2017)

The new original modelling method tries to find a practical answer to the relevance of the importance of the double modelling it presents practically, building a few generic layered models of the KSC as an endogenous variable at the CSF class level, which becomes an exogenous variable. From this first evolutionary stage, the method is oriented towards fully individualized models of KSC at CSF level, at the level of the sample of the sub-population of foreign experts in PM.

Thus, from the KSC single-factor unifactorial generic model, relatively validated, yet with a reduced determination according to a Rsquared = 0.878 (the endogenous *An aquisitions - procurement -* variable being defined by the 58 series) constructed according to the exogenous variable described at the CSF class level (through series 44, i.e. *class of political, economic, social and legislative environment*):

Dependent Variable: SER58 Method: Least Squares					
Included observations: 110 Sample: 1 110					
Variable	Coefficient	Std. Error	t-Statistic	Prob.	
С	7.403913	0.516083	14.34635	0.0000	
SER44 sau Q1	-0.582425	0.180625	-3.224494	0.0017	
R-squared	0.087818	Mean dependent var		6.027273	
Adjusted R-squared	0.079371	S.D. dependent var		3.169404	
S.E. of regression	3.041024	Akaike info criterion		5.080280	
Sum squared resid	998.7652	Schwarz criterion		5.129380	
Log likelihood	-277.4154	F-statistic		10.39736	
Durbin-Watson stat	1.215430	Prob(F-statist	tic)	0.001670	

Software utilizat: EViews

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A completely individualized CSF-level model is obtained, having much better determination (in relation to all the factors included in the respective class, namely Rsquared = 0.324)

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Dependent Variable: SER58 Method: Least Squares					
Included observations: 110 Sample: 1 110					
Variable	Coefficient	Std. Error	t-Statistic	Prob.	
С	-0.801685	1.093370	-0.733224	0.4651	
SER01 sau F1.1	0.019302	0.205925	0.093733	0.9255	
SER02 sau F1.2	0.003653	0.246089	0.014846	0.9882	
SER03 sau F1.3	0.419100	0.309649	1.353466	0.1789	
SER04 sau F1.4	0.155271	0.344238	0.451057	0.6529	
SER05 sau F1.5	0.280026	0.264378	1.059190	0.2920	
SER06 sau F1.6	0.065050	0.262123	0.248167	0.8045	
SER07 sau F1.7	0.254157	0.227644	1.116469	0.2668	
R-squared	0.323875	Mean dependent var		6.027273	
Adjusted R-squared	0.277475	S.D. dependent var		3.169404	
S.E. of regression	2.694041	Akaike info criterion		4.889908	
Sum squared resid	740.3012	Schwarz criterion		5.086307	
Log likelihood	-260.9450	F-statistic		6.979965	
Durbin-Watson stat	1.419708	Prob(F-statist	0.000001		

Software used: EViews

The actual approach leads to renaming the approach as a new method, that is, as *the method of layered, generic and factorially individualized modelling*, if this construction can also generate generic multifactorial models. The example of aquisitions - procurement - modelling in keeping with the class of the political, economic, social and legislative environment, and the class of management tools under triple constraint (classes Q1 and Q5) confirms the applicative qualities of the method, which essentially increases the final model's determination relative to the initial Rsquared = 0.109.

Dependent Variable: SER58 Method: Least Squares					
Included observations: 110 Sample: 1 110					
Variable	Coefficient	Std. Error	t-Statistic	Prob.	
С	5.900835	1.078891	5.469350	0.0000	
SER44	-0.460682	0.195165	-2.360470	0.0201	
SER48	0.306618	0.193668	1.583215	0.1163	
R-squared	0.108697	Mean dependent var		6.027273	
Adjusted R-squared	0.092037	S.D. dependent var		3.169404	
S.E. of regression	3.020032	Akaike info criterion		5.075306	
Sum squared resid	975.9038	Schwarz criterion		5.148956	
Log likelihood	-276.1418	F-statistic		6.524486	
Durbin-Watson stat	1.294078	Prob(F-statist	ic)	0.002120	

Software utilizat: EViews

Then, translating classes Q1 and Q5 into the critical factors (CSFs) that compose them, an efficient model is obtained, at risk of multicollinearity (intermediate Rsquared = 0.380):

Dependent Variable: SER58 Method: Least Squares						
Included observations: 110 Sample: 1 110						
Variable	Coefficient	Std. Error	t-Statistic	Prob.		
C	-2.521889	1.438617	-1.752995	0.0828		
SER01	0.061988	0.209122	0.296423	0.7676		
SER02	0.052221	0.257357	0.202914	0.8396		
SER03	0.178294	0.338267	0.527080	0.5994		
SER04	0.350683	0.368913	0.950583	0.3442		
SER05	0.044693	0.291943	0.153087	0.8787		
SER06	0.077440	0.267374	0.289632	0.7727		
SER07	0.190790	0.236628	0.806284	0.4221		
SER30	0.087220	0.245693	0.354994	0.7234		
SER31	-0.016903	0.293849	-0.057521	0.9543		
SER32	0.426347	0.312203	1.365605	0.1753		
SER33	0.143284	0.276266	0.518645	0.6052		
SER34	0.200694	0.094516	2.123389	0.0363		
SER35	-0.321501	0.253436	-1.268569	0.2077		
SER36	0.041640	0.250195	0.166432	0.8682		
R-squared	0.380296	Mean dependent var		6.027273		
Adjusted R-squared	0.288971	S.D. dependent var		3.169404		
S.E. of regression	2.672521	Akaike info criterion		4.930045		
Sum squared resid	678.5251	Schwarz criterion		5.298293		
Log likelihood	-256.1525	F-statistic		4.164215		
Durbin-Watson stat	1.576781	Prob(F-statist	ic)	0.000012		

Software used: EViews

The disappearance, but more especially the attenuation of the multicollinearity risk, requires that the most important CSFs in each of the previously described KSC classes be successively selected, and the redundant elements are eliminated by sequential analysis of successive patterns determination (Rsquared final = 0.333):

Dependent Variable: SER58 Method: Least Squares					
Included observations: 110 Sample: 1 110					
Variable	Coefficient	Std. Error	t-Statistic	Prob.	
Ċ	-1.258399	1.133058	-1.110622	0.2693	
SER03	0.462398	0.289857	1.595265	0.1137	
SER04	0.109631	0.325991	0.336301	0.7373	
SER05	0.154404	0.270077	0.571703	0.5688	
SER06	0.139292	0.242325	0.574815	0.5667	
SER32	0.422106	0.249228	1.693652	0.0933	
R-squared	0.333273	Mean dependent var		6.027273	
Adjusted R-squared	0.301219	S.D. dependent var		3.169404	
S.E. of regression	2.649404	Akaike info criterion		4.839548	
Sum squared resid	730.0114	Schwarz criterion		4.986847	
Log likelihood	-260.1751	F-statistic		10.39718	
Durbin-Watson stat	1.593230) Prob(F-statistic)		0.000000	
Software utilizat: Elians					

Software utilizat: EViews

The multifactorial model is validated in point of intensity, but has a positive autocorrelation of residual values according to the Durbin Watson

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test, and probably, in extended series as far as the number of respondents is concerned (more populations and larger samples to be taken), one can obtain a fully validated model.

3. CONCLUSIONS

Generally, in pioneering econometric modelling, which also come from samples taken by volunteering, or in other words, guided, from researches aimed at analyzing the opinions of a set of experts, as was the research presented in this article, the originality of the method or the innovation character of the methodology, or the creativity generated by new investigative areas, can contribute to the appreciation of the value of the resulting final patterns. This does not however exclude admitting there are certain limitations of the generic investigation or detailed modelling that is also insufficiently attenuated in point of multicollinearity. Generalized and factorially individualized econometric modelling proves to be a creative solution, even when models are validated without standardizing certain stable links in PM in Romania.

In the perspective of new complex projects bringing together teams of a wide professional and scientific variety, and also various economic and social areas or fields, the generic and factorially individualized layered method and type of modelling can provide additional investigative support in identifying the specificity of the econometric model of the EU-funded successful project in Romania, where the endogenous variable called Key Success Criteria (KSC) is described and quantified by Critical Success Factors (CSFs) or Project Performance Indicators (PKIs).

4. **BIBLIOGRAPHY**

- 1. Academia Română, Institutul de Lingvistică Iorgu Iordan Al. Rosetti, 2012. *Dicționarul explicativ al limbii române.* ediția a II-a, rev. București: Univers Enciclopedic Gold.
- 2. Becker, G., 1998. *Comportamentul uman. O abordare economică*. București: Editura ALL.
- Dinu, V., Săvoiu, G., Dabija, D.- C., 2016, A concepe, a redacta şi a publica un articol ştiințific. O abordare în contextual cercetării economice, ed. I, Bucureşti: Editura ASE.
- Dinu, V., Săvoiu, G., Dabija, D.- C., 2017, A concepe, a redacta și a publica un articol științific. O abordare în contextual cercetării economice, ediția a II-a, rev. Bucureşti: Editura ASE.
- 5. Georgescu-Roegen, N., 1971. *The Entropy Law and the Economic Process*. Cambridge: Harvard University Press.
- 6. Săvoiu, G., 2006. *Proiecte cu finanțare externă*, Pitești:Editura Independența Economică.
- 7. Săvoiu, G., 2011. Econometrie, București: Editura Universitară

- 8. Săvoiu, G., 2013. Modelarea economico financiară. Gândirea econometrică aplicată în domeniul financiar, București: Editura Universitară.
- Săvoiu, G., Tudoroiu, L., 2017. Factori critici şi criterii majore în proiectele de succes, bazate pe finanațare externă, *Revista Română de Statistică Supliment*, vol 3, pp. 3-15.
- Tudoroiu, L., 2017a. Instruments for statistical ranking of the major factors of EU-funded projects in Romania, Romanian Statistical Review Supplement, vol 4, pp.126 - 136.
- Tudoroiu, L., 2017b. Conceptualizarea proiectului turistic de succes şi identificarea factorilor critici specifici în proiectele turistice din România, finanțate de Uniunea Europeană (UE), Iasi: Editura Perfomantica, vol. XXX, pp.112 -120.
- PMBOK® Guide Fifth Edition. 2013. A Guide to the Project Management Body of Knowledge. [on-line]Available at: https://www.pmi.org/pmbok-guide-standards/ foundational/pmbok> [Accessed 10 March 2018].
- PMBOK® Guide Fifth Edition.2013.Poject Management in Glossary of Project Management Terms. [on-line] Available at: http://www.pmgloss.com/about/ Accessed 11 March 2018].