

ATINER CONFERENCE PRESENTATION SERIES No: BLE2023-0315

ATINER's Conference Paper Proceedings Series

BLE2023-0315

Athens, 10 October 2023

**Network Analysis and Control System in Mega Projects: The
Case of PICASP Erasmus Project**

Massimo Bianchi

Athens Institute for Education and Research
9 Chalkokondili Street, 10677 Athens, Greece

ATINER's conference paper proceedings series are circulated to promote dialogue among academic scholars. All papers of this series have been presented at one of ATINER's annual conferences according to its acceptance policies (<http://www.atiner.gr/acceptance>).

© All rights reserved by authors.

ATINER's Conference Paper Proceedings Series

BLE2023-0315

Athens, 10 October 2023

ISSN: 2529-167X

Massimo Bianchi, Professor, University of Bologna, Italy

**Network Analysis and Control System in Mega Projects:
The Case of PICASP Erasmus Project**

ABSTRACT

Network Analysis achieved some significant results in recent years thanks to advances in technology and in the approach to organizational networks. Less exciting were the results obtained with Mega Projects. These projects show high risk with regards to results, to the compliance of the budget and to the realization of the entire project. So far, the response of Mega Projects contracting authorities is to ask those presenting the project proposals to increase the number of controls and connected indexes without obtaining, almost until now, an increase in project performance. The paper examines the proposal to transfer some results of network analysis to the performance monitoring of Mega Projects. Starting from the case of Erasmus PICASP Project for the creation of Pilot courses and new didactics for teachers training in cultural tourism for the development of Caspian Area, the paper proposes an evolutionary model of cycles of simplification and complexification of the networks control systems. Within this model will be applied the approach of Practice Enterprise which allows to the members of the project networks to acquire the practice of teamwork right from the early stages of planning and, once the project starts, in case risks or emergencies arise.

Introduction

Network Analysis in organizations achieved some significant results in recent years thanks due to advances in technology and in the approach to organizational networks. Less exciting were the results obtained with Mega Projects with a budget of 1,000,000 euros and more. These projects show high risk with regards to results, to the compliance of the budget and, sometimes, to the realization of the entire project. So far, the response of Mega Projects contracting authorities is to ask those presenting the project proposals for a higher level of details and to increase the number of controls and connected indexes without obtaining, almost until now, an increase in project performance.

The paper examines the proposal to transfer some results of network analysis to the performance monitoring of Mega Projects. Starting from the case of Erasmus PICASP Project for the creation of Pilot courses and new didactics for teachers training in cultural tourism for the development of Caspian Area paper proposes a transdisciplinary approach to interpret the differences and the evolution of the types of networks through cycles of simplification and complexification of the control systems and try to connect these results to the control strategy of the projects considering the high risk of failure which appears to affect a significant proportion of these projects.

Particularly, as results are connected to the adequacy of control tools, is relevant to consider managerial concepts like the span of control defined as the number of subordinates of a hierarchical position, and the connected capability of networks to maintain the control in complex procedures, particularly when the system is wide and highly interconnected.

To this purpose, the proposal is to apply, in the project preparation phase, the Practice Enterprise approach which allows project network members to acquire teamwork practice from the early design phases and by doing this practice to work together, immediately available, once the project has been approved, financed and started, in case of risks or emergencies.

Literature Review

This paper involves the Literature concerning three main subjects, the Network Analysis, the Project PICASP and the innovative didactical approach of learning by doing named Practice Enterprise applied to Tempus Erasmus Projects.

The Network Analysis

The research on networks started with the interest on links or ties connecting objects and produced the structuralist approach (Freeman 2004). The appliance to social of Network Analysis, codified in the acronym SNA arrived at the study of organizational networks after twenty years (Knoke, Yang 2019) of researches concerning various aspects but only in last times researchers use the

dynamic analysis of links among organizations to examine the development and change of organizational structures over time (Toivonen, Kovanen, Kivelä, Onnela, Saramäki, Kaski 2009).

At the beginning this trend of research consider the organizational evolution from the point of view of the the state of organization development by examining big data from the social media platform (Donna, Ogle, Ramkrishnan, Tenkasi, Brock 2020). This last contribution recognizes that the organizational development is an authonomous field of research using the trans disciplinarity to introduce studies on the complexity of networks facing the need to explain in a coherent process, the evolution of these multidimensional aggregates of ties (Bianchi 2022).

Treur has developed this line of research through the application of network analysis, enhancing its factual aspect and paving the way for an extension of the processes of complexification and simplification to a general and unified model of interpretation (Treur 2018).

The PICASP Project

The PICASP Project was considered in publishing within the action istitutionally forecasted for the project dissemination with some connections with previous projects (Antonini, Bianchi, Favaretto, Kaklauskas, Pretelli 2022).

The appliance of Network Analysis to Project Teams was realized on Research Projects involving more Partners and Researchers (Hicks, Coil, Stahmer, Jonathan, Eisen 2019) and was mainly focused on number of components, diameter, density, and transitivity of the coauthor networks with the aim to analyse the contribution of newtork to the consolidation of a research community.

Anticipatory research on the relevance of link activation in the evolution of networks has posed the problem of the tools to implement in practice a management of uncertainties and emergencies already posed in the study of risks (Hurlbert, Haines, Beggs 2000).

The Practice Enterprise

Concerning Practice Enterprise its initial definition was expressed as Practice or Experimental Economy (Greenblat 1988) and only in last years was defined as Practice Enterprise (PEN Worldwide 2020a). As a learning by doing it was considering an innovative didactical tool but to be distinguished from business games and a simple practical exercise for classrooms of business economics (Gorman, Hanlon, King 1997).

Practice Enterprise received a strong institutional boost in 1993 as European project funded by the European Social Fund and the German Federal State of North Rhine-Westphalia to connect the different networks around the world in an international non-profit association named EUROPEN. Since 2021, the international association became PEN Worldwide.

In last years its growing diffusion in universities has represented a significant result compared to the previous, prevalent dissemination in higher institutes (PEN Worldwide 2020b).

Furthermore, Practice Enterprise could be proposed as a tool to apply the transdisciplinary approach as a bridge between science and action, to highlight the problems and pitfalls associated with its employment (Renn 2021).

To be mentioned that, in analyzing recent trends of megaprojects, the personnel training is not a major research problem (Chen, Xiang, Jia, Guo 2020).

The Method

On the one hand, both project management theory and practice had to take note of the high risk that mega-projects fail to achieve their intended goals or cost much more than expected (Söderlund, Sankaran, Biesenthal 2018).

As far as project clients are concerned, this growing risk over time, also due to the increase in the number of mega-projects to be evaluated and organised, has translated into the request for a more stringent and analytical control strategy in order to prevent catastrophic deviations from objectives and budgets (Virtuani, Barabaschi, Cantoni 2022).

All this happened by complicating somewhat the project descriptions and the indexes to propose in the submission of projects to the commitment (as happened, for example, for the European projects Tempus, then Erasmus) and by increasing the number of parameters and indexes required in the submission phase.

To analyze the question, the use of indexes for project control should be seen not as a reference to the current moment in which the control of project performance, given the disappointing results, is proposed as an increase in indexing, but as a phase in the development of the network organization within recurring cycles of simplification/complexification.

Two questions arise: from a theoretical point of view, the question is whether this ongoing evolution has reached its maximum to turn towards simplification in perspective. From a practical point of view, the problem derives from the increasing performance expected from the surge of controls applied to improve the performance of the project without, with this, burdening the control structure and, consequently, the execution of the project itself (Barabaschi, Cantoni, Virtuani 2020).

We will try to answer the first question by tracing an evolutionary model that explains the evolution of networks through cycles of complexification/simplification using that transdisciplinary approach recently proposed for mega projects (Cantoni, Favari, 2019).

As it concerns the second topic, we will describe the proposal to apply a different way of carrying out project management using a preparation of the project teams through learning by doing with Practice Enterprise and applying a combination of MOOCs for the preparation of Teachers, with Practice Enterprise for the simulation of Project Management structures.

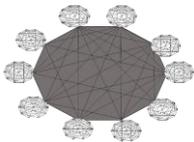
One of the target of this approach is to reduce and to prevent the failures or difficulties in the realization of the project that often led to an increase in costs and to a reduction in results.

The Project Networks

The partners of a project, generally grouped in a consortium, correspond to a network of reciprocal relationships that can be analyzed through dedicated software such as those applied by Social Networks Analysis (SNA) and namely: NetMiner II, MultiNet, StOCNET, GRADAP, JUNG, KliqFinder, MatMan, Pajek, PermNet, PREPSTAR, SNA, SNAP, SNOWBALL, STRUCTURE (Parise 2007) with the result of highlighting structures characterized by great complexity, however smaller in size than those typical of social or technological-computer systems which can be characterized by millions of component elements.

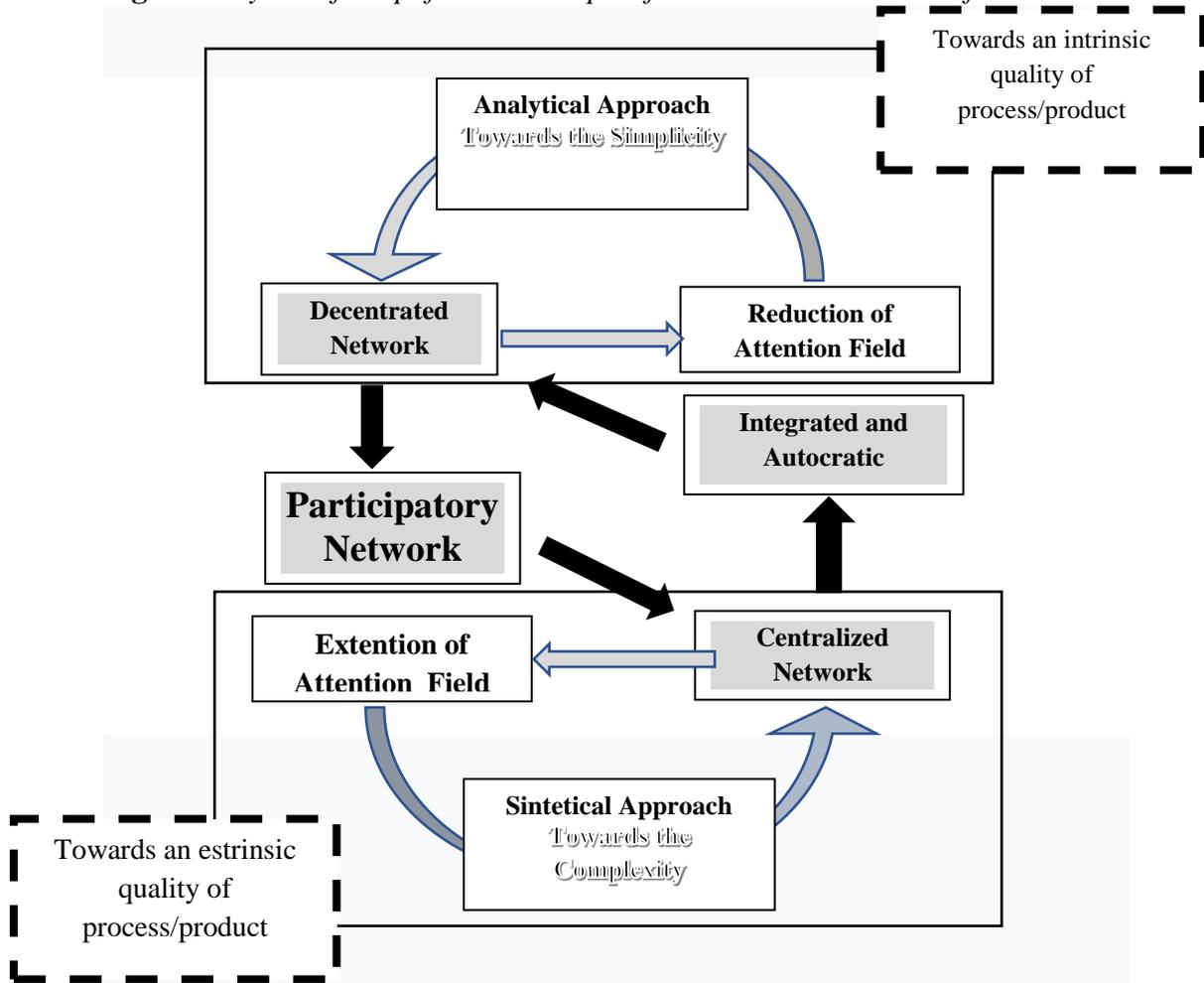
To this purpose we can reduce the variety of Networks to four basic typologies (Figure 1).

Figure 1. *The Basic Typologies of Network*

Structure Typology	Integrated and Autocratic Network	Decentrated Network	Participatory Network	Centralized Network
Macro Structure				
Main Features	Large Dimensions with Integrated Internal Functions	Small, middle and large dimension with specialization induced by the externalization of leader organizations	Small and middle dimensione organized in network without a leader organization	Prevailing leader organization distributing specializations owing its developmental strategies

These typologies includes the Integrated and Autocratic Network in which internal functions are realized with an extreme specialization. This network could evolve into a decentrated one in which some functions are externalized to independent units dedicated to the sub supply. These units, over time, may evolve into independent entities not necessarily linked to the mother company and establishing a Participatory Network. Within this network a unit can assume a leadership acquiring a dominant position and possibly a larger dimension which, over the time, absorb the other units with a structure of Centralized Network, bringing the evolutionary cycle back to the original typology of integrated unit of the various functions. This kind of analysis, applied recently to personal networks, would be extended to networks of organizations without increasing the parameters used in the analysis (Bidart, Degenne, Grossetti 2018).

Figure 2. *Cycles of Simplification/Complexification in the Evolution of Networks*



Considering these typologies, we can hypotize also an evolutionary process based on cycles of symplification/compllessification (Figure 2) in which, the core of the model composed by examined typologies evolves continuously according with exigencies to ensure the quality of product/services requested by the market and social development (Serrat 2017).

In the core of the model we have the four typologies which are hypothesized to evolve according to two different self-feeding processes. A complexification process aimed at extending the attention paid to the product/service and to the context in which the network operates Towards the Complexity.

At the other side we have a simplification cycle in which the attention is concentrated on the intrinsic qualities of the product/service and in which the network operates inside the organization, towards the Simplicity.

This implies that the Decentrated Network and the Centralized One are stable configurations while the Integrated and Autocratic Network is less stable together with the Participatory One, both considered transition states.

Figure 3. *The Examined Cases of Project Management in Tempus/Erasmus*

Project Acronym	Project Subject	Project Grant Holder	Countries involved	Period	N° of Partners	Distance Learning
BECK	ERASMUS - BECK Integrating Education with Consumer Behavior Relevant to Energy Efficiency and Climate	Vilnius Gedeminas Technical University Vilnius (LT)	Bangladesh, Italy, Lithuania, Russia, Sri Lanka, United Kingdom.	2019-2022	14	Simulimpresa/Practice Enterprise - Moocs
HEIPNET	ERASMUS + Inclusion of Innovative Work-Based-Learning and Business Partnerships in HEI Curricula Development	University of Pavia (IT)	Austria, Germany, Italy, Lithuania	2020-2022	5	Simulimpresa/Practice Enterprise - Moocs
PICASP	Pilot Courses and new didactics for teachers training in cultural tourism for the development of Caspian Area	University of Chieti (IT)	Azerbaijan, Italy, Kazakhstan, Lithuania, Poland, Russia	2021-2023	11	Simulimpresa/Practice Enterprise - Moocs

This enforces the hypothesis that simplification and complexification cycles, as also observed in the evolution of supply chains, is only a phase of network management. To this purpose, an implicit assumption of researches on current supply chain integration is that the results obtained from product supply chains can be directly extrapolated to service supply chains and this equivalence makes the transition from internal to external integration compatible with the idea that both configuration are structural but contingent (Yuen,Thai 2017).

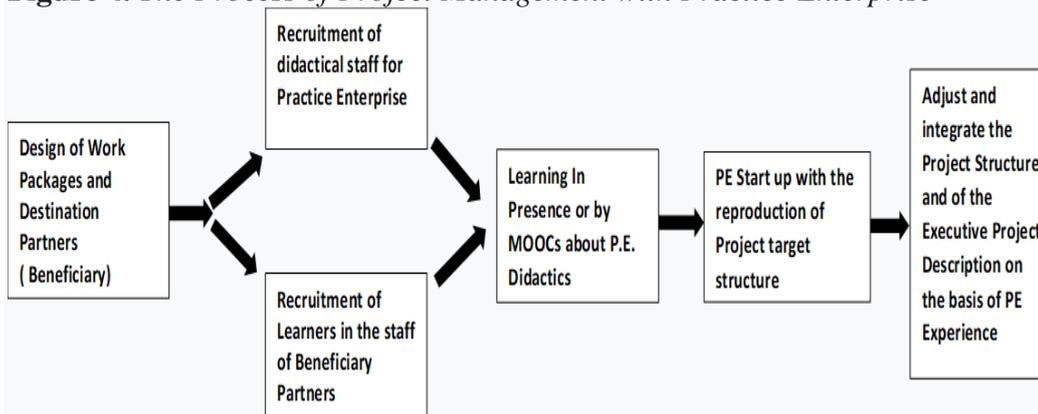
Considering the Networks involved into the process of Project Management we can try to apply this evolution to the project processes, examining the trend of complexification individuated in the present of Project Management, and some hypothesis to support the perspective of simplification of controls according to the exigencies of more adequacy of the project management applied to some projects in progress.

The PICASP Project and the Tempus/Erasmus Program

Last experiences in Tempus/Erasmus Projects with the use of Practice Enterprise and MOOCs involves many Consortium Networks on different subjects (Figure 3).

In recent Erasmus calls, the integration of MOOCs and PE was practically proposed in three Projects involving the partners from the very beginning of the planning which took place according to the process shown in Figure 4.

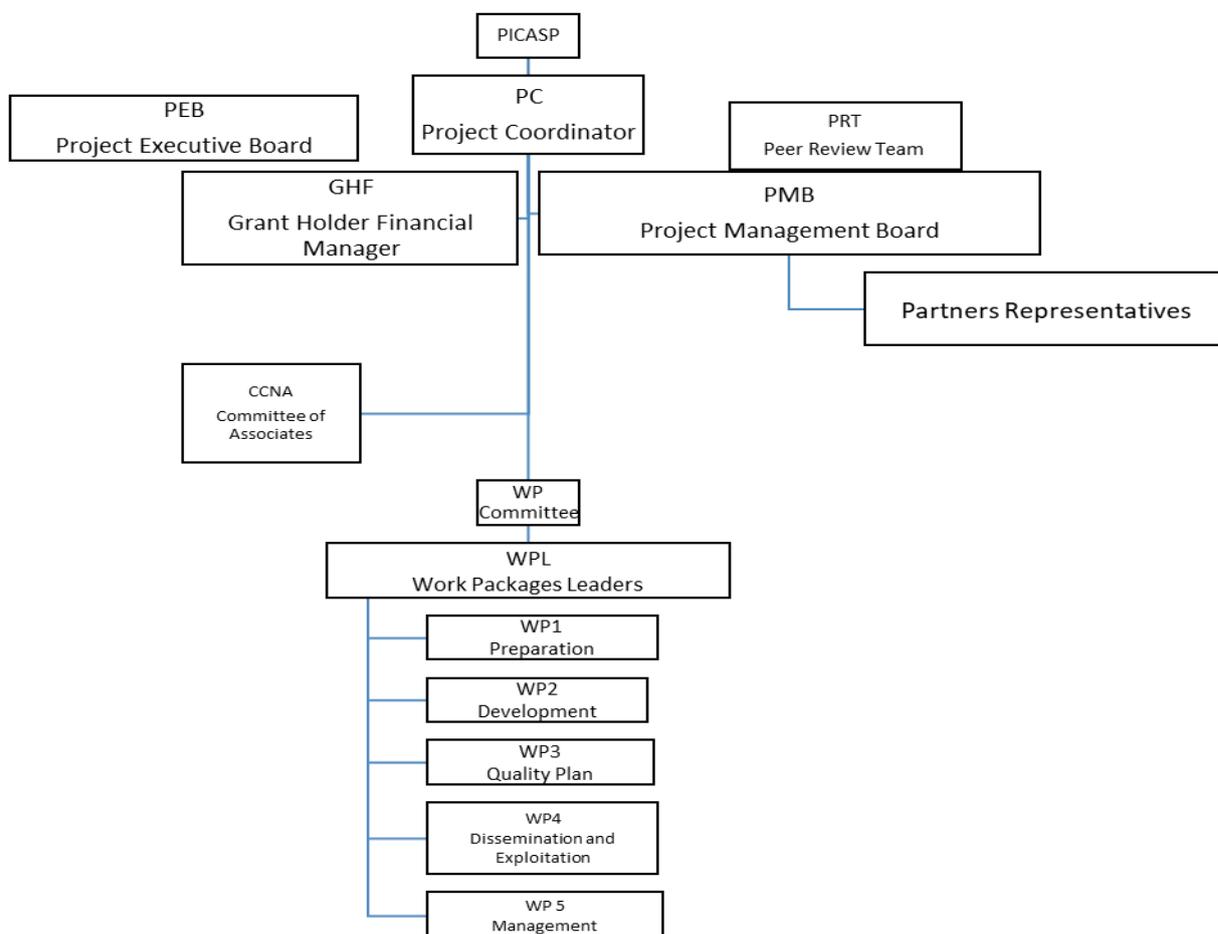
Figure 4. *The Process of Project Management with Practice Enterprise*



Particularly in PICASP Project the main objectives were mainly connected to the development of new teaching methodologies as Practice Enterprise applied to the Developing courses in Entrepreneurship and SME Management and to the enhancing of the exchange of best practices with EU partners through mobility of academic and technical staff; Other purposes were the enforcing of stakeholders' involvement in curriculum development and graduates placement together with the stablishing of standards and providing quality assurance in didactics with a sustainable maintaining of results after the project end. The main sector chosen was the entrepreneurship relate to the cultural heritage.

The network of universities for the implementation of these Pilot Courses had the purpose to verify the possibilities for its dissemination in other partner countries. As it concerns the PICASP Project, still in progress, this will be positive not only in the field of Economic Activities but more generally among the partners how to design higher education, according to UE Standards. Furthermore, it will have a positive impact in the perspectives, for the Caspian Area, triggered by policies to implement Sustainable Development related to the Silky Road.

Figure 5. *PICASP Project Organizational Chart*



Of note, with the position of Grant Holder represented by the University of Chieti-Pescara, the contribution of Europen-Pen, manager of the international network of practice companies, registered in the project as an Associate Partner with the ICA, Italian Central Institute of Archaeology. The role of the Associate Partner, not having assigned budgets, is to collaborate with their own professional and institutional resources in the implementation of the planned activities, in particular as regards the dissemination and sustainability of the project activities, after its conclusion.

In this way the need to verify the collaboration among partners has two topics, the one is concerning the establishment of the Project Structure with its different positions (Figure 5).

The other topic is concerning the realization, in single beneficiary partners, of a structure having the purpose to start Modules, Courses and Mini Masters with the appliance new didactics represented by MOOCs and Practice Enterprises. Like the ones programmed in PICASP (Figure 6). Particularly Courses having Practice Enterprise as method were undertaken in Kazakhstan by the University of

International Business of Almaty and by the Caspian State University of Technology and Engineering in Aktau.

Figure 6. *Courses with Practice Enterprise Programmed in PICASP Project¹*

Country Area	PC	Short Courses	Curricular Courses 1st, 2nd Level	Teachers	Tutors	Mentors	Students
AZ	ATMU	2	1	3	6	3	50
	KHAZAR	2	1	3	6	3	50
RU	ASU	2	1	3	6	3	50
	VSTU	2	1	3	6	3	50
KZ	CSUTE	2	1	3	6	3	100
	UIB	10	5	15	30	15	300

This approach was the subject of a previous applicative research concerning the introduction of an Agency on Volga River, as a structure similar to AIPO, The Agency for Po River in charge to the coordination of interventions on river basin (Bianchi 2011), (Bianchi, Tampieri 2012), next proposed in a project originated from the 7th Framework Project on European Big Rivers of 2013.

The Didactics with Practice Enterprise and Moocs

The Practice Enterprise was introduced, with the name of Simulimpresa, in 2001 by the University of Bologna as first experience in Italy of these advanced didactics in university courses.

In October 2001, with the creation of the simulated company Perting srl, the activity of the Laboratory of Practice Enterprise conducted by Daniele Gualdi was launched on an experimental basis, within the Business Organization course (Massimo Bianchi) and with the support of the Cassa dei Risparmi di Forlì Foundation.

Perting srl, operating in the field of organizational and network consultancy and in the sale of ICT products, was the first certified Business Simulation Unit, set up at an Italian University.

Also in 2004, the Forlì Business Simulation Laboratory participates, as a remote support center for business initiatives, in its first international project of "Training and technical assistance for the development of SMEs in the port district of Durres" financed by the Ministry of Foreign Affairs - General Directorate for

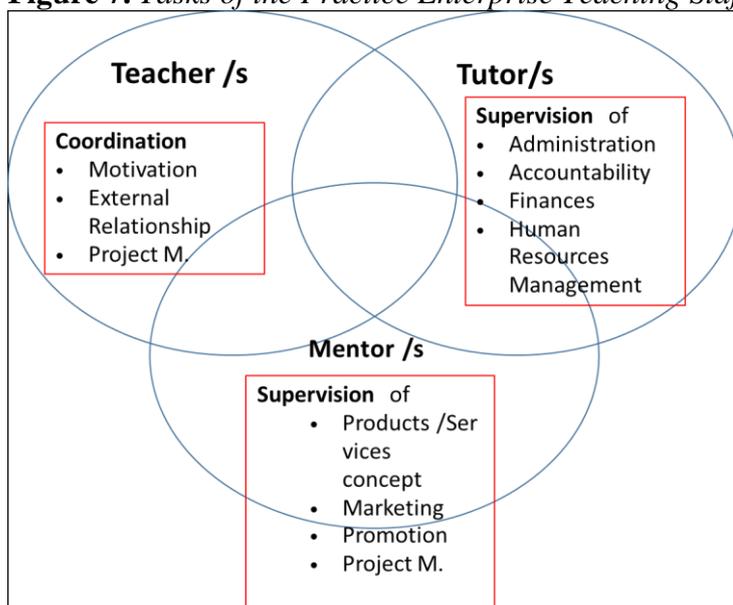
¹ATMU Azerbaijan Tourism Management University; KHAZAR Khazar University; CSUTE Caspian State University of Technologies and Engineering; UIB University of International Business. (ASU: Astrakan University; VSTU Volgograd State Technical University; Partners excluded in 2022 by EACEA from PICASP Project, owing the Ukrainian War).

Economic Cooperation. During the project, the first Simulation Unit abroad is created: KK Personal Robe by Shkoder.

In the following years this activity continued with refinements of the approach and through the simulated company Perting SrL.

Preparatory to these activities was the education of Teachers, Tutors and Mentors (as showed at Figure 7), these last ones coming from the entrepreneurial and managerial sector, to the applying of new didactical technologies like Practice Enterprise. Until today MOOCs were used for the preparation of teaching staff in condition to promote and manage courses oriented to the start up of SMEs and to the modernization of the existing ones.

Figure 7. Tasks of the Practice Enterprise Teaching Staff Components



Also in this case was essential, for the fulfillment of the project, the preparation of The Teaching Staff (Teachers, Tutors and Mentors) with a particular attention for the coaching activity having the purpose of creating a real team and an adequate network among the staff, an attitude that was replied in the project management applied in PE Courses.

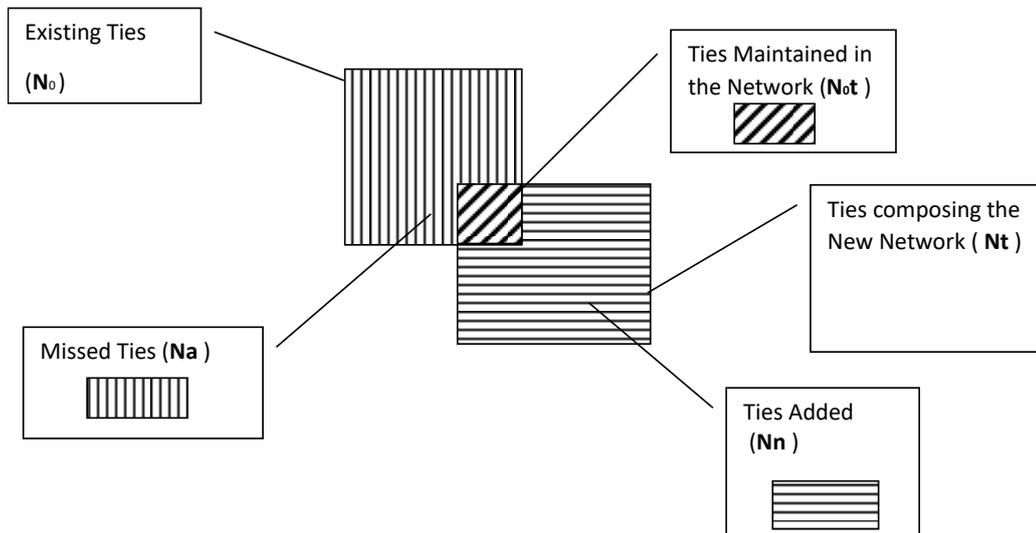
To be mentioned, among difficulties that the appliance of Practice Enterprise to the Project Management wants to prevent and reduce, is the observation of many project manager with a traditional approach to Mega Projects. In these projects, in most cases, the Chief Project Manager or its organization, centralizes the project management as the sole position having the acquaintance and he is in touch with the most partners. It means that most of the partners, during the preparation of the project and its presentation, are not used to work together. Even more, once the project has been approved, they do not have a common group experience in dealing with unexpected events and emergencies.

The appliance of Practice Enterprise contributes to overcome these shortcomings which subsequently translates into significant difficulties when the realization of the project does not go as planned.

The Renewal Process in the Evolution of Business Ties

As it concerns the Renewal Process and the evolution of business ties the model which expresses main parameters involved is represented at Figure 8.

Figure 8. *The Model of Ties Renewal*



The same model can be represented by the formula of Renewal System:

$$[1] \quad C_{o_n} = C_{t_0} + e - u$$

in which:

C_{t_0} = Initial consistency

C_{t_n} = Final Consistency

e = Input

u = Output

and with the connected basic Indexes:

Time	Turnover	Variation Index
[2] $T = (C_{t_0}) / u$	[3] $V = e / C_{t_0}$	[4] $E = (C_{t_n} - C_{t_0}) /$

at their turn connected with the relationship:

$$[5] \quad T = 1 / (V - E)$$

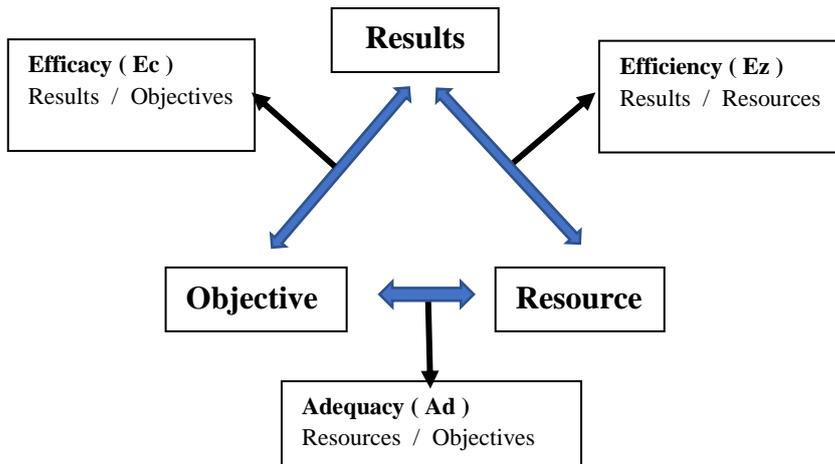
It is clear that this model relating to the dynamic behavior of networks is connected to the performance that network organizations produce and, having the objective of evaluating the relevance of the indices applied for this purpose

from a methodological point of view, it is necessary to think about the formal aspects of the performance with particular regard to the measurement of Objectives, Resources and Results.

The Performance of Networks

As it concerns the performance of the process that transforms Objectives and Resources in Results, we can distinguish three typologies of basic indexes:

Figure 9. Main Typologies of Basic Performance Indexes



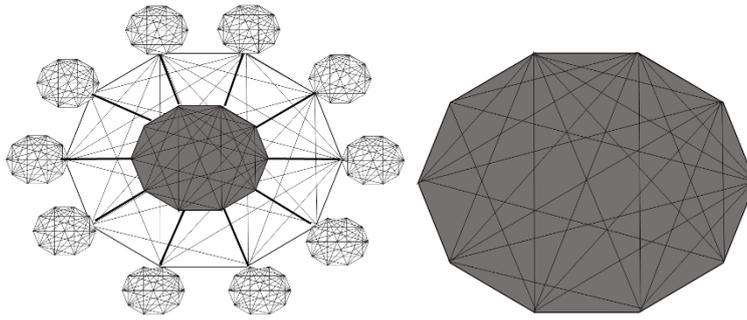
The representation of Figure 9 can be also considered as the one of a system of indexes each of them with its own characteristics but, at the same time, related with reciprocal interdependencies that produce the following:

$$[6] \text{Adequacy} = \frac{\text{Resources}}{\text{Objectives}} = [7] \frac{\text{Efficacy}}{\text{Efficiency}} = \frac{\cancel{\text{Results}}}{\text{Objectives}} \cdot \frac{\text{Resources}}{\cancel{\text{Results}}}$$

If we unify the formulas [5] and [7] in a single transform, by setting $E_c = 1$, i.e., on the condition that the Results coincide with the Objectives, we can obtain:

$$[8] \text{Adequacy} = \text{Efficacy} / \text{Efficiency} = 1/(V-E) = T$$

Figure 10. *Project Management Structures*



Traditional Project Management Structure
by Practice Enterprise Simulation

Project Management Structure Fully Interrelated

In this considering that, when the Efficacy is hypotized as 1, the Efficiency corresponds to the difference $(V - E)$ between Turnover and Variation Index, and the Adequacy is exclusively related to the Time of fulfillment of Results.

This can be a very restricted condition but, examining problems connected to most of projects, Time is the most diffused critical condition. This transform connects the calculation of Network Performance with its dynamics represented by the numerical evolution of links.

Particularly, if we consider the traditional structure of the project management in a consortium of participants , focused normally, as the practice told us, on the project manager or on the partner in charge to the project management, and compare it with a network deriving from the appliance of Practice Enterprise as demonstrated in empirical studies (Tampieri 2013) the dynamics of the links differ greatly.

Table 1. *Comparing the Potential Evolution of Project Management Networks*

n° of Partners	n° of Links with centralized Project Management	n° of Links with the fully Project Management
5	4	120
6	5	720
7	6	5040
8	7	40320
9	8	362880
10	9	3628800
11	10	39916800
12	11	479001600
13	12	6227020800
14	13	87178291200
15	14	1,30767E+12

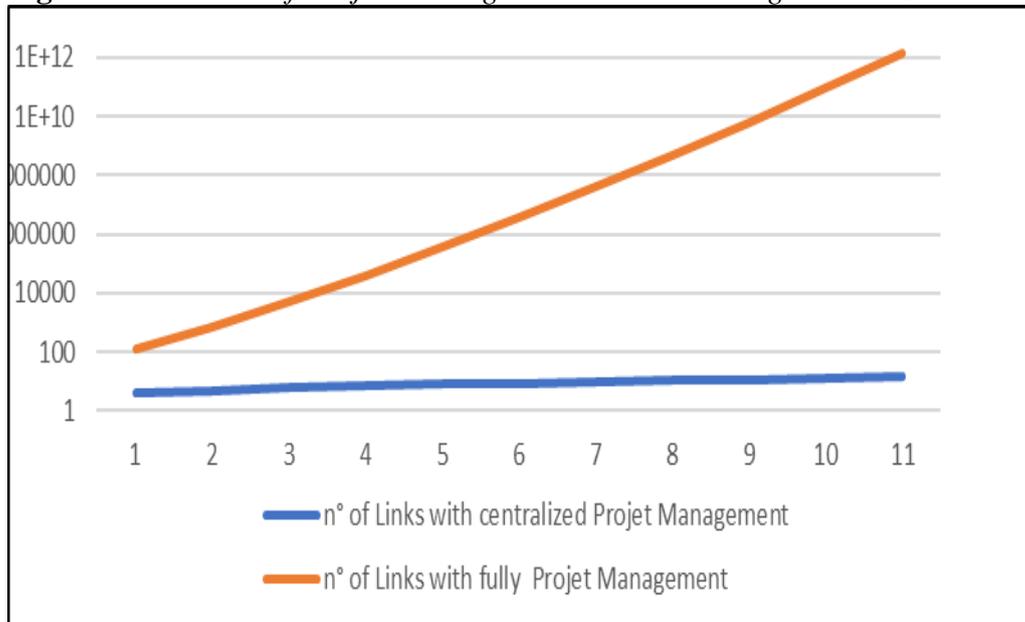
Moving from centralized Project Management to the fully exchange of the planning trough Practice Enterprise applied to project partners (Figure 10) , the results of the performance indicators change significantly. Starting from a minimum of five partners we can simulate the evolution of Network Links in the two different structures as compared at Table 1.

Both typologies of Network allow us to highlight the intrinsic limits regarding coordination. The traditional ones have the limit concerning the classic Span of Control defined by Graiciunas (1937). According the Span of Control principle, a manager couldn't coordinate more than 7-8 partners, although this limit can be raised to 15-20, if the coordination position is represented by an organization with several project managers (Bianchi, 2000).

The fully networked project management within 5-7 number of components assumes soon, after a few steps, a number of possible connections out of control, entering in the domain of hyperlinks.

Obviously not all links will be activated, during the planning of a project, but the design carried on by a project network in which different subjects are involved from a managerial, administrative and technical point of view requires an interfunctional and interpersonal dynamics that cannot be taught without practical application like the one experienced by Practice Enterprise as fully project management team.

Figure 8. *Evolution of Project Management Network in Logarithmic Scale*



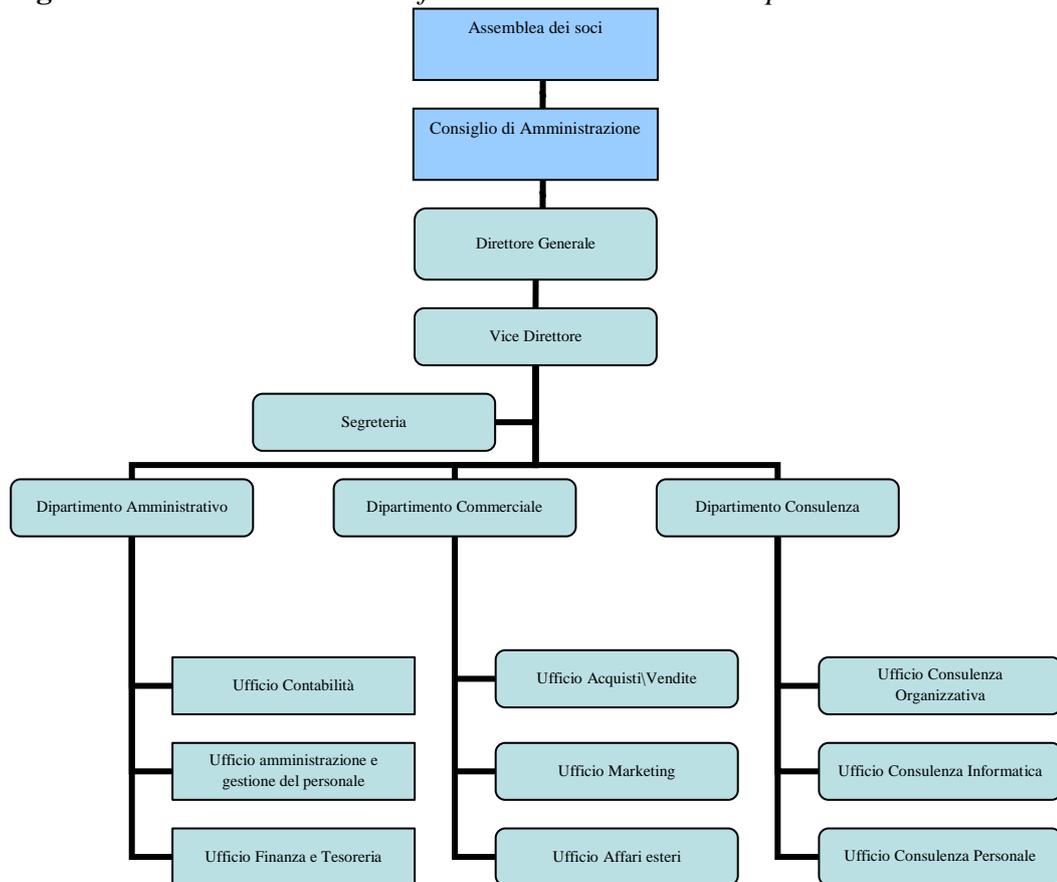
According to this condition for a convenient Adequacy of the project performance, the recommended maximum number of learners or participants to each initiative of Practice Enterprise is around 10th-15th and to this purpose the basic organizational structure normally applied is the one at Figure 9. This structure represents the Organizational Map of Perting, the Practice Enterprise created in 2002 by the University of Bologna, Campus of Forlì (AAVV 2012).

Conclusions

Studies on project performances with the application of Practice Enterprise are at the beginning (Bianchi, Fernandez-Lara, Gualdi 2015; Bae, Qian, Miao, Fiet 2014).

The problem is to transform the organizations business model by making choices that yielded three rigid consequences: entrepreneurs participants' high sense of ownership, feelings of accomplishment, and trust. The choices implicit in the teaching model have to eliminate the hierarchy, decentralizing decision making, focusing on teams to get work done, and having participants own the assets.

Figure 9. *The Macrostructure of PERTING Practice Enterprise*



Also, in project management the mission is to break down barriers among network partners introducing initiative like Practice Enterprise to prepare people to work together before the project starts, from the first steps of the project design. This allows to face adequately eventual distances of results and costs from the ones programmed and enforce the collaboration to maintain the project organizational structure of governance once the project starts.

References

- AAVV. (2012) *Il Laboratorio di Simulazione d'Impresa di Forlì e l'Attività di Perting SrL Impresa Simulata 2003-2008. [The Forlì Business Simulation Laboratory and the Activities of Perting SrL Simulated Business 2003-2008]* Official Handouts Campus of Forlì, University of Bologna.
- Antonini E., Bianchi M., Favaretto G., Kaklauskas A., Pretelli M. (2022) *The combination of different knowledge within the BECK project: between architectural disciplines and economic sciences. Journal of the Italian Society for Architectural Restoration*, Intrecci .n. 1, 2022 <https://sira-restauroarchitetonico.it/intrecci/numeri/anno-i-2022-n-1/>
- Bae, T. J., Qian, S., Miao, C., & Fiet, J. O. (2014). The Relationship between Entrepreneurship Education and Entrepreneurial Intentions: A Meta-Analytic Review. *Entrepreneurship Theory and Practice*, 38(2), 217–254. <https://doi.org/10.1111/etap.12095>.
- Barabaschi, B., Cantoni, F., Virtuani, R., (2020) Rethinking leadership in megaprojects. Results from a preliminary investigation, in *Cantoni, F., Favari, E. (ed.), Megaprojects. Multidisciplinarity as the key to successful management*, Giappichelli Editore, Torino, 97- 104 <http://hdl.handle.net/10807/165886>
- Bianchi, M. (2000). Inter-company relationships in the survey and assessment of organizational boundaries. In *Proceedings of the XXIII Convegno Italian Academy of Business Economy* (pp. 211-212). McGraw-Hill.
- Bianchi M. (2011) - Increasing performance of network building throughout virtual reality and organizational simulation. The case of the Interregional Agencies for Po and Volga River *Value, Innovation and Partnership XV IRSPM Conference*, Dublino 11th-13th April 2011
- Bianchi M. (2020) The E-Learning of entrepreneurial skills through Practice Management and MOOCs. *Projects, Perceptions and Perspectives in Impresa Progetto*, Electronic Journal of Management, n. 2, pp. 1 www.impresaprogetto.it, ISSN 1824-3576.
- Bianchi M. (2022) Practice Enterprise and MOOCs in the design and implementation of megaprojects. Some lessons from European Projects, *Proceedings of MERIT 2022* Milano 9-10 Nov. 2022, Springer book series
- Bianchi M, Fernandez-Lara A.B., Gualdi D., (2015) The contribution of virtual enterprises to competence-based learning: an assessment from the students' perspective: Case study *Journal Technology Innovation Education*, ISSN 2197-9855), Springer, 1:4, pp. 1- 16.
- Bianchi M., Tampieri L. (2012) Simulated Management in the start up of new Public Organizations. The case of AIVO, Agency for the Governance of the Volga River. *Transforming Governance, Enhancing Innovation, IRSPM Conference* Roskilde (DK) October 29-31 2012.
- Bidart C., Degenne A.,Grossetti M.(2018) Personal networks typologies: A structural approach, *Social Networks*, Vol. 54, July , pp.1-11, <https://doi.org/10.1016/j.Socnet.2017.11.003>
- Cantoni F., Favari E., (2019) Introduction - A multidisciplinary approach to embrace complexity and sustainability, in Cantoni, F., Edoardo Favari, E. (eds.), *A multidisciplinary approach to embrace complexity and sustainability - Megaprojects Research Interdisciplinary Team Workshop*, Giappichelli Editore, Torino VI-VII, <http://hdl.handle.net/10807/159648>
- Casadeus-Masanell, R., Ricart, J.E. (2011). How to Design a Winning Business Model. In: *Harvard Business Review*, 89 (1) 100-107

- Chen D., Xiang P., Jia F., Guo j.(2020) A systematic review of current status and trends of mega-infrastructure projects, *Ain Shams Engineering Journal*, Science Direct, Volume 13, Issue 6, November <https://doi.org/10.1016/j.asej.2022.101773>
- Donna L. Ogle, Ramkrishnan O. Tenkasi V., Brock W.B. (2020) The Social Media Presence of Organization Development: A Social Network Analysis Using Big Data, *Research in Organizational Change and Development* ISBN: 978-1-83909-084-4, ISBN: 978-1-83909-083-7, 31 July.
- Freeman L.C. (2004), *The development of social network analysis a study in the sociology of science*, BookSurge, LLC North Charleston, South Carolina ISBN 1-59457-714-5, p. 2
- Gorman, Gary/Hanlon, Dennis & King, Wayne (1997). Some research perspectives on entrepreneurship education, enterprise education and education for small business management: a ten-year literature review. *International Small Business Journal*, 15 (3), 56–79.
- Graiciunas, V. (1937). Relationship in Organization. In L. Urwick & L. Gulick (Eds.), *Papers on the science of administration*. Institute of Public Administration Bianchi, M. (2000). Inter-company relationships in the survey and assessment of organizational boundaries. In *Proceedings of the XXIII Convegno Italian Academy of Business Economy* (pp. 211-212). McGraw-Hill.
- Greenblat, Cathy S. (1988). *Designing games and simulations: An illustrated handbook*. Newbury Park, CA: Sage.
- Hicks D.J. Coil D.A., Stahmer C.G., Jonathan A. Eisen J.A. (2019), Network analysis to evaluate the impact of research funding on research community consolidation, Retrieved from <https://doi.org/10.1371/journal.pone.0218273>,
- Hurlbert J.S., Haines V.A., Beggs J.J.(2000) Core Networks and Tie Activation: What Kinds of Routine Networks Allocate Resources in Nonroutine Situations?, *American Sociological Review*, American Sociological Association., Vol. 65, No. 4 (Aug., 2000), pp. 598-618 , <https://doi.org/10.2307/2657385>.
- Knoke D., Yang S. (2019) *Social Network Analysis 3rd Ed.* SAGE Publications, ISBN 1506389295, 9781506389295
- Parise S. (2007) *Knowledge Management and Human Resource Development: An Application in Social Network Analysis Methods Advances in Developing Human Resources* SAGE Publ. 2007; 9; 359 DOI: 10.1177/ 1523422307304106,
- PEN Worldwide (2020a). *About us*. Retrieved from <https://www.penworldwide.org/about-us/concept/> (30.03.2021).
- PEN Worldwide (2020b). *The Association*. Retrieved from <https://www.penworldwide.org/get-to-know-our-association/> (30.03.2021).
- Renn O. (2021), Transdisciplinarity: Synthesis towards a modular approach, *Futures*, Elsevier, Volume 130, June 2021, <https://doi.org/10.1016/j.futures.2021.102744>
- Serrat, O. (2017). *Social Network Analysis*. In: *Knowledge Solutions*. Springer, Singapore. https://doi.org/10.1007/978-981-10-0983-9_9
- Söderlund J., Sankaran S., Biesenthal C. (2018) The Past and Present of Mega Projects, *Project Management Journal*, December 2017/January
- Tampieri L. (2013), *La valutazione delle performance nel project management*, CEDAM, Wolters Kluwer, ISBN 978-88-13-32913-6, pp. 151-192
- Toivonen R., Kovanen L., Kivelä M., Onnela J.P., Saramäki J, Kaski K. (2009) A comparative study of social network models: Network evolution models and nodal attribute models, *Social Networks*, Volume 31, Issue 4, October, Pages 240-254
- Treur, J. (2018). Network reification as a unified approach to represent network adaptation principles within a network. In C. Martín-Vide, M. A. Vega-Rodríguez, D. Fagan, & M. O'Neill (Eds.), *Theory and Practice of Natural Computing: 7th International*

Conference, TPNC 2018, Proceedings (pp. 344-358). (Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics); Vol. 11324 LNCS). Springer - Verlag. https://doi.org/10.1007/978-3-030-04070-3_27

Virtuani R., Barabaschi B., Cantoni F., The Human Side of Megaprojects: Leadership Style and Traits to Face Growing Levels of Complexity and Uncertainty (2022) in Cantoni F, Favari E., (Eds) *Sustainability and Megaproject Development*, Routledge, London, <https://doi.org/10.4324/9781003305750>

Yuen, K.F. and Thai, V.V. (2017) The influence of supply chain integration on operational performance: A comparison between product and service supply chains, *The International Journal of Logistics Management*, Vol. 28 No. 2, pp. 444-463. <https://doi.org/10.1108/IJLM-12-2015-0241>