PROJECT, DESIGN AND MANAGEMENT

https://www.mlsjournals.com/Project-Design-Management

ISSN: 2683-1597

How to cite this article:
Forte Silva, M. V. & Garat de Marín, M. S. (2023). Método FORTE v. 1.0: una contribución a la gestión de megaproyectos de ingeniería en Brasil. *Project, Design and Management,* número monográfico, 66-80. 10.35992/pdm.mo2023.2114.

FORTE METHOD V. 1.0: A CONTRIBUTION TO THE MANAGEMENT OF ENGINEERING MEGAPROJECTS IN BRAZIL

Marcus Vinícius Forte Silva
European University of the Atlantic (Spain)
marforte@gmail.com - https://orcid.org/0009-0007-0591-728X
Mirtha Silvana Garat de Marín
Universidad Internacional Iberoamericana (Uruguay)
silvana.marin@unib.org - https://orcid.org/0000-0003-3044-8087

Summary. The changes brought about by globalization have created a new reality for the means of production and communication, quality of life and behavior, favoring the emergence of projects all over the world. During the Workers' Party government (2003-2016), Brazil followed this trend, transforming itself into a major construction site, where oil and gas exploration engineering assumed an important role for the national economy. The high world energy demand and the discovery of the pre-salt province would allow the country to become an energy exporter and superpower by 2030, defining the strategic nature of the oil and gas exploration megaprojects in the Santos Basin, São Paulo. The government program in the PT era offered Brazil fertile ground for economic development, but also for illegality, when a new reality brought to light in 2014 by Operation Car Wash unleashed the biggest corruption scandal in Brazil's history. The combination of complexity and corruption led to delays in the delivery of oil to the consumer market and huge financial losses. The situation called for initiatives to support schedule management that are up to the challenge, where the expected response is the application of a schedule analysis method - the FORTE v Method. 1.0 - responsible for the first integrated initiative aimed at compliance, project management and corporate knowledge, adjusted to the reality of large engineering projects in Brazil. The situation required an IT solution with different characteristics - Oracle Primavera P6 - and the result of the initiative is a set of achievements beyond project management, permeating the entire organizational fabric.

Key words: Engineering, megaprojects, compliance, FORTE v. Method. 1.0, Oracle Primavera P6.

MÉTODO FORTE V. 1.0: UNA CONTRIBUCIÓN A LA GESTIÓN DE MEGAPROYECTOS DE INGENIERÍA EN BRASIL

Resumen. Los cambios provocados por la globalización han construido una nueva realidad para los medios de producción y comunicación, la calidad de vida y el comportamiento, favoreciendo el surgimiento de proyectos en todo el mundo. Durante el gobierno del Partido de los Trabajadores (2003-2016), Brasil siguió esta tendencia, transformándose en un gran sitio de construcción, donde la ingeniería de exploración de petróleo y gas asumió un papel importante para la economía nacional. La alta demanda mundial de energía y el descubrimiento de la provincia del presal permitirían al país convertirse en exportador de energía y superpotencia para el año 2030, definiendo el carácter estratégico de los megaproyectos de exploración de petróleo y gas en la Cuenca de Santos,

São Paulo. El programa de gobierno en la era del PT ofreció a Brasil un terreno fértil para el desarrollo económico, pero también para la ilegalidad, cuando una nueva realidad sacada a la luz en 2014 por la Operación Lava Jato desencadenó el mayor escándalo de corrupción en la historia de Brasil. La combinación de complejidad y corrupción provocó retrasos en la entrega de petróleo al mercado de consumo y enormes pérdidas financieras. La situación exigía iniciativas de apoyo a la gestión de horarios que estén a la altura del desafío, donde la respuesta esperada es la aplicación de un método de análisis de horarios – el Método FORTE v. 1.0 – responsable de la primera iniciativa integrada dirigida al cumplimiento, gestión de proyectos y conocimiento corporativo, ajustada a la realidad de los grandes proyectos de ingeniería en Brasil. La situación requería una solución de TI con diferentes características – Oracle Primavera P6 – y el resultado de la iniciativa es un conjunto de logros más allá de la gestión de proyectos, permeando todo el tejido organizacional.

Palabras clave: Ingeniería, megaproyectos, cumplimiento, Método FORTE v. 1.0, Oracle Primavera P6.

Introduction

Project management has been gradually imposing its value on human achievement. From the pyramids of Giza to the conquest of space, a new understanding of the challenges and applicable practices emerges, offering nations a new perception of needs, values and redress of man-made grievances.

The globalization process in Brazil that occurred with neoliberalism in the 1990s imposed important economic, political and social changes, leading to a global system of causes and effects. As consequences, there is fierce competition and reduction of production costs, scientific-technological exchange, increased quality of life and longevity, creation of specialized jobs and demand for professional qualification, universalization of access to the media and, as a highlight, the formation of a global culture that is competitive, collaborative and aware of the weight of innovative, sustainable and culturally diverse ideas (Khan, 2018, p. 8). The new current of thought is influencing the most recent discussions on management, where today's man is presented with a new set of values, opportunities, resources and traits to overcome. Once this perception is broadened, it fuels the concern and need for growth and transformation, demanding projects in the various areas of human knowledge, including the generation of energy through oil and gas exploration. Globalization is a reality with repercussions today, a process that should neither be praised nor rejected, representing only a challenge for which Brazil must be prepared (Sardenberg, 1999, pp. 42-49), profoundly and irreversibly modifying the scenario of public and private projects.

In the governments of Luís Inácio da Silva (2003-2011) and Dilma Rousseff (2011-2016), both from the *Workers' Party* (*Partido dos Trabalhadores, PT*), Brazil followed the global trend towards development, instituting projects in different sectors of the economy throughout the national territory. The discovery of the Brazilian pre-salt province in 2007, a region with oil and gas in high volume and quality standards, added to the high world energy demand in 2014, would allow Brazil to become an exporter and energy power until 2030. The pre-salt province covers an area of 160,000 km2, equivalent to 12 times the area of the city of Rio de Janeiro, extending from the coasts of Santa Catarina to Espírito Santo, in addition to the sedimentary basins of Espírito Santo, Campos and Santos, concentrating 55% of the Brazilian gross domestic product (Figure 1).

Figure 1

Brazilian pre-salt province

Note. Source: G1, 2015.

Oil and gas exploration engineering began to assume an important role in the national economy, where the strategic nature and high complexity of the portfolios required large investments in Research, Development and Innovation (R&D&I), in addition to differentiated management.

Government programs in the PT era offered Brazil economic and social development like never before, despite the strong presence of illegality at all levels. Meanwhile, Brazil's Federal Police launched Operation Lava Jato in 2014, triggering the biggest corruption and money laundering scandal in the country's history. The consequences of the operation drew the attention of the world media, the arrest of top executives of public and private companies, and the impeachment of President Dilma Rousseff.

According to Dan Ariely, professor of psychology and behavioral economics at *Duke University*, USA, the company's growth is expected to continue. The U.S. researcher and director of the *Center for Advanced Hindsight*, in a survey involving more than 40,000 participants from different countries, identified that 70% of the participants cheated, noting: (i) dishonesty is inherent to the human being; (ii) individuals seek to walk on the borderline between the advantages acquired with dishonesty, without damaging the self-image of probity; (iii) the ethical-moral conduct of the individual is influenced by social forces, being inhibited or encouraged by the group to which he belongs; (iv) honesty requires effort and self-awareness; (v) physiological damages (physical and mental fatigue, sleep, hunger, etc.) subject the individual to choose shortcuts or more attractive options that favor dishonesty (passing traffic lights, jumping the queue, etc.); and (vi) the amount of dishonesty does not subject the individual to choose shortcuts or more attractive options that favor dishonesty (passing traffic lights, jumping the queue, etc.).) subject the individual to choose shortcuts or more attractive options that favor dishonesty (passing traffic lights, jumping in line, etc.); and (vi) the amount of dishonesty does not vary with the change in the amount of benefits from the illicit act and the probability of punishment does not have a substantial influence on the amount of illegality. However, as the rationalization (softening) of dishonesty goes beyond the line of morality, the volume of wrongdoing tends to increase (Ariely, 2012).

According to the *Global 2020 Report*: *Cost of Insider Threats*, insider threats to companies are growing worldwide. The report clarifies that 72% of the frauds affecting

companies involve an internal collaborator and half of the companies in the world have already suffered attacks. Employees are classified into 3 types: (i) careless or negligent employees or contractors, accounting for 62% of incidents; (ii) criminal (or malicious) infiltrator with 23% of incidents, costing organizations an average of $755 760 per incident; and (iii) credential thief with 14%, costing each organization an average of US$2.79 million (Ponemon Institute, 2020). In this context, threats can arise from unintentional mistakes by internal employees, targets of external actors in the use of their privileges, or even dissatisfaction, leading to the use of internal privileges to the detriment of the company, personal vendettas, or leakage of data and secrets for personal gain.

Operation Car Wash (Operação Lava Jato) raised concerns in Brazilian society about the impacts of corruption and the direction of the country. The new scenario imposed on Brazilian organizations the adoption of integrity and anti-corruption programs. According to a KPMG survey, in 2015, 57% of the 250 companies interviewed in Brazil reported having ethics and compliance programs and policies. In 2016, the number increased to 76% and, in 2017, it reached 95%. Concern grew over the rigidity of the sanctions and the impacts on the image of the companies involved (Monteiro and Kertesz, 2018, p. 17).

The national corruption scenario reached the oil exploration megaprojects environment, causing significant delays in the delivery of oil and gas to the international consumer market and huge losses for the Brazilian government. As a result, the bar chart - Gantt chart - receives the *status of the most important project document*, a centralizer of information and management decisions. In this sense, the FORTE Method v. 1.0 provides the schedule with quality and compliance for timely analysis to reverse problems in megaprojects. The situation does not require project management, but *project leadership* (Merrow and Nandurdikar, 2018, pp. 14-16), based on technical skills and, mainly, different emotional skills, shaping a *compassionate leadership*. Among the top 5 emotional skills: (i) *Emotional stability* (low neuroticism); (ii) *Openness* to curiosity, new experiences, and breaking paradigms in order to conceive new ideas; (iii) *Scrupulousness* through self-discipline oriented toward duties and goals; (iv) *Extroversion* of positive emotions, tendency toward stimulation and companionship; and (v) *Kindness* through compassion and cooperation with others, respecting individual differences and social harmony (Merrow & Nandurdikar, 2018, p. 33; Goldberg, 1992) (Figure 2).

Figure 2

Project Leader Skills according to Lewis R. Golberg's Big Five (1992).

Objectives

In the scenario presented, in order to guarantee the bar programs - Gantt charts - in quality and compliance for the follow-up and control of Oil and Gas engineering megaprojects, the FORTE v. method was created. 1.0, an initiative for the integrated analysis of schedules according to the Brazilian reality. To this end, the objective was: (i) ensure an accurate analysis of the problems in the schedules; (ii) identify the pillars of the method; and (iii) highlight the contribution of the method to the success of megaprojects, stakeholders and organizational knowledge.

Method

The *delimitation* considered organizational climate analysis and schedule management, taking into account the dependencies (world situation, country, etc.).

The *research techniques* involved action research, projective, applied, mixed, exploratory, exploratory, cross-sectional with time perspective (August 2013 to October 2015) (Figure 3).

Figure 3

Operational cycle of projective research

Note. Source: Adapted from Barrera, 2010.

The *techniques* were applied according to 5 classes of analysis: (i) C1 - Global (energy sector, opportunities, threats, etc.) and Country (politics, economy, society, technology, legal, etc.); (ii) C2 - Organization (mission, vision, values, etc.); (iii) C3 - Organizational environment

(culture, climate, etc.); (iv) C4 - Project, program and portfolio management (structure, model, maturity, problems, etc.); (v) C5 - Method validation (Table 1).

Table 1
Research techniques, types, levels and tools of analysis

Research technique	Class	Level of analysis	Analysis instrument
Indirect documentation: bibliographic research.	C1	Global: sector, ranking of producers and consumers, opportunities, threats, etc.	KISS/ PESTLE/ SWOT
		Country: politics, economy, society, technology, legal, etc.	
Indirect documentation: documentary research.	C2	Organization: general data (mission, vision, values, market share, etc.).	
Direct documentation: combined exploratory-descriptive studies.	C3	Organizational environment: specific data (behavior, culture, climate, etc.).	
Intensive direct observation: asystematic observation.	C4	Project, program and portfolio management: general data (management structure, problems, etc.).	KISS/ SMART/ RASCID/ GUT/ 5 Whys/ Pareto/ Business Process Mapping/ SDCSLA/ etc.
Direct documentation: program evaluation studies.	C5	Validation of the final product: integrated schedule analysis method.	

The *study units* included: (i) Globalization; (ii) Corporate Governance; (iii) Ethics and Compliance; (iv) Organizational Behavior; (v) Psychology and Behavioral Economics; (vi) Project Complexity; (vii) Project, Program and Portfolio Management; and (viii) Project Management Software.

The *bibliographic review* considered the investigative, projective, temporal and multidisciplinary nature of the subject, requiring a longer period of coverage - 1996 to 2022 -, from the scientific construct to the final product, and observed: (i) internal documents; (ii) renowned authors; (iii) professional associations; (iv) specialized media; (v) technical consultancy; and (vi) solution manufacturers.

The projective research learned about the innovation of the proposal, according to technical and behavioral criteria, scoring information from August 2013 to October 2015, namely: (i) project life cycle (pre-project; project initiation; project organization and preparation; project work execution, project closure and post-project); (ii) project management process groups (initiation, planning, execution, monitoring and control, and closure); (iii) project management knowledge areas (integration, scope, time, cost, quality, human resources,

communications, risk, procurement and stakeholders); and (iv) management levels (strategic, tactical and operational).

Results

The FORTE Method v. 1.0 is initially based on the *implementation requirements* and solution pillars. The requirements for implementation were defined according to groups: (i) *Managerial*: top management support; type of organizational structure (preferably projected organization); full access to project information (including outsourcing); and integration of efforts between internal and external teams; (ii) *Technical-process*: use of Oracle Primavera P6 software; centralized database; transparency, process alignment and traceability of actions; continuous improvement; and centralization of organizational knowledge; (iii) *Behavioral*: respect for cultural differences between the countries involved; and (iv) *Promotional*: attention to change management, from implementation to maintenance of the solution. The pillars contemplate 3 stages, according to the implementation model: (i) governance, analysis and qualification of people (skills and competencies), and viable technologies; (ii) operationalization based on structure, processes and actions for compliance; and (iii) return modalities (payback, stakeholder satisfaction, team performance, organizational knowledge, strengthening of corporate image, others) (Figure 4).

Figure 4

Pillars of the FORTE Method v. 1.0.

The FORTE Method v. 1.0 offered a new perspective on schedule management, disseminating values such as ethics, compliance, quality and merit at different management levels, enabling prevention and deterrence at the source of illegalities, according to Donald Cressey's *Fraud Triangle* : (i) inhibiting the *opportunity for fraud* by creating profiles with varying degrees of schedule interference and action traceability; (ii) neutralizing *fraud*

motivation by empowering teams and recognizing gains for the project; and (iii) reducing *fraud rationalization* by the commitment made between leadership and teams to work collaboratively (Figure 5).

Figure 5

Triangle of Frauds, by Donald Cressey (1953).

According to Peter Drucker: - "Culture eats strategy for breakfast", the origin and the answer to illegality is in the organizational culture, i.e. focused on people, the most promising asset and agent of change of an organization, fitting an attentive look at their needs and achievements (Table 2).

Table 2

Adapted from Abraham H. Maslow's Pyramid of Human Needs (1943).

Needs	Personal	Professionals
Self-realization	Realization of personal potential, self-realization, pursuit of personal growth and peak experiences.	Challenges, participation in decisions, growth.
Estimate	Self-esteem: dignity, achievement, mastery, independence.	Responsibilities, recognition, promotions.
	Reputation: status, prestige.	
Social	Friendship, intimacy, trust and acceptance, receiving and giving affection and love, being part of a group (family, friends, work).	Collegiality, interaction with customers, respect for the boss.
Security	Protection from the elements, security, order, law, stability, freedom from fear.	Safe work, compensation and benefits.
Physiological	Air, food, water, shelter, clothing, warmth, sex, sleep.	Working hours, rest, comfort.

The operationalization of the solution adopted research processes at 2 levels: (i) *FORTE v. Methodology*. 1.*0 and organizational climate analysis* identified the company's scenario and the management of projects, programs and portfolios, supporting actions; (ii) *FORTE v. Method*. 1.*0 and the analysis of the timelines*, identified in detail the problems, traces, indications, clues and evidence leading to the conclusion of the event and the causal agents (Figure 6). To this end, in the initial 3 months, the solution pilot ran with 52 Primavera P6 reports, reaching 75 reports for a sample of 26,000 activities referring to the current oil tanker hull construction schedule (9.63% of the universe) , distributed in 2 groups and 6 analysis categories - (i) *quality* (configurations, modeling and logical network); and (ii) *compliance* (measurement, performance, forensic analysis), with a total of 176,000 data recorded in 19,000 pages of weekly research (Table 3) (Figure 6). In order to optimize reading by top management and the teams, a 40-page diagnostic summary was chosen with the main problems, causes, correction guidelines and glossary to standardize communication, referencing the detailed reports for consultation. The method caught the attention of top management and, being requested both vertically and horizontally, intensified follow-up, communication, team training, among others.

Table 3
Sample data from an oil exploration vessel FPSO

Digital files and activities per work package of the project schedule							
EDT	**Current Files**	**Reference Files**	**Total Files**	**Activs. Current**	**Activs. Reference**	**Total Activs.**	**total Activs.**
Helmet	6	6	12	26.000	26.000	52.000	9,63%
Package I	29	29	58	35.000	35.000	70.000	12,96%
Package II	16	16	32	16.000	16.000	32.000	5,93%
Packages III / IV	19	19	38	103.000	103.000	206.000	38,15%
Package V / Integration	15	15	30	90.000	90.000	180.000	33,33%
Total	**85**	**85**	**170**	**270.000**	**270.000**	**540.000**	**100%**

Initial results of the pilot implementation of the method: (i) greater maturity and transparency in management; (ii) compassionate leadership; (iii) better communication and information support; (iv) greater awareness, satisfaction, collaborative work and increased productivity; (v) identification of the causes of errors (impraxis, imprudence, negligence or malice) and of those responsible for corrective educational measures and/or sanctions (administrative, civil or criminal); (vi) greater control over risks; (vii) reduction of costs due to delays, rework, litigation, fines (contractual, union, government agencies, etc.) and others; (viii) reduction of costs due to delays, rework, litigation, fines (contractual, union, government agencies, etc.) and others; (viii) reduction of costs due to delays, rework, litigation, fines (contractual, union, government agencies, etc.) and others.) and others; (viii) gains in corporate knowledge; and (ix) increased credibility.

Considering the results, the objectives were partially achieved. Non-compliance with some items of the requirements did not allow for the expected gains. The event compromised aspects of communication, quality and compliance. For example, there was a reduction of up to 50% in rework in the internal planning team processes. On the other hand, the low authority of the implementation team and the decentralization of information in the contracted work packages made it difficult to access important data for the project indicators. A comprehensive solution to the megaproject problems would require: (i) unrestricted compliance with the requirements of the solution project; (ii) investment of US$ 70 thousand (R$ 355,000); (iii) implementation period of 6 months (220 hours/month); and (iv) specialized multidisciplinary team (Table 4). The solution proved to be economically viable, representing 0.55% of the daily loss due to delays in the delivery of oil and gas to the international market.

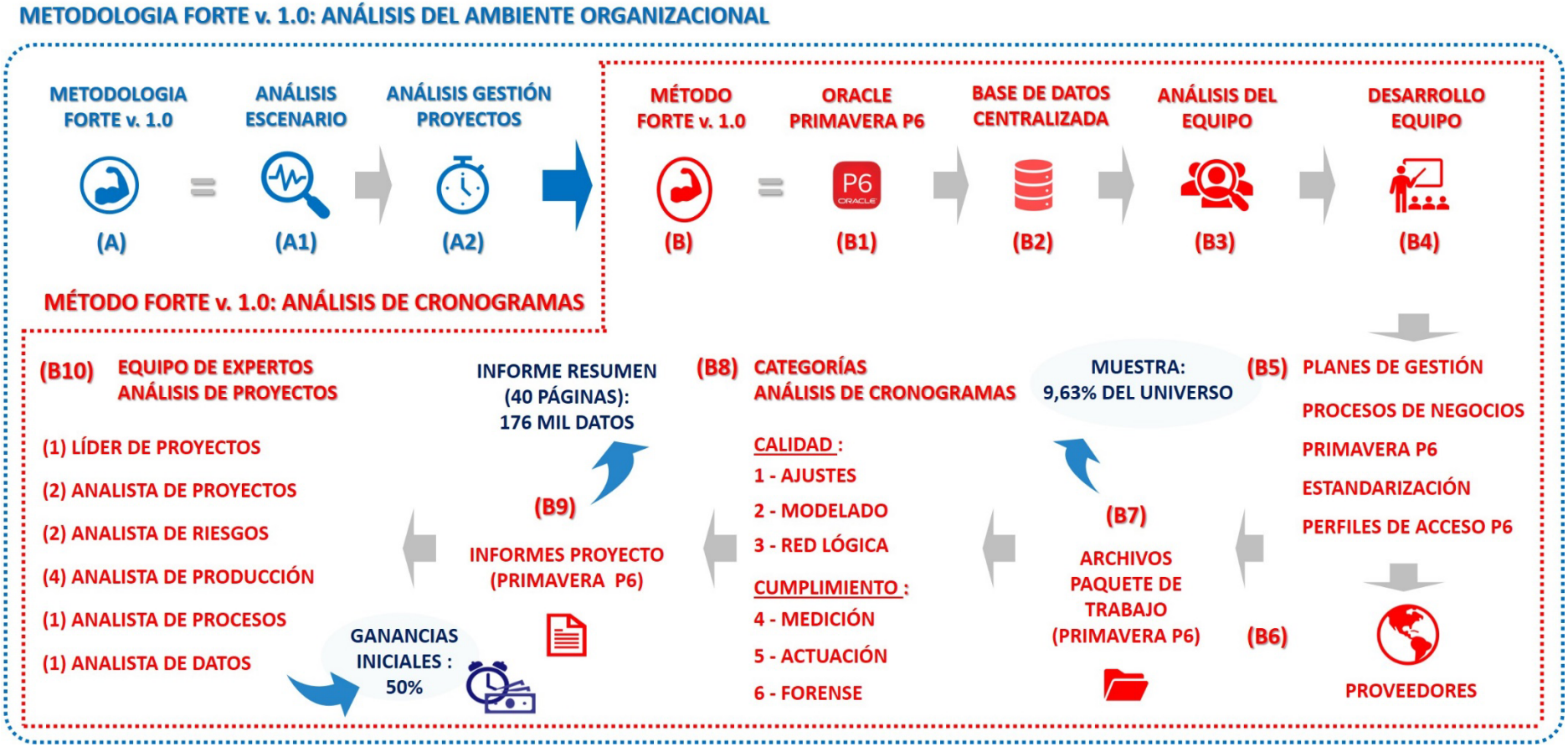
Table 4
Project roles and salaries

Role	Level	Salary/ month	Weekly workload	Wage/hour
Project Management (Contracted)				
Planning and Control Coordinators	Complete	R$ 11.500	44	R$ 52,27
Information and Communication Technology				
Computer Systems Engineer	Complete	R$ 12.500	44	R$ 56,82
Project Management				
Project leader	Master's Degree	R$ 14.500	44	R$ 65,91
Technical Analysis of Projects				
Planning and Cost Engineer	Senior	R$ 13.200	44	R$ 60,00
Risk Engineer	Senior	R$ 13.200	44	R$ 60,00
Production Engineer	Senior	R$ 11.500	44	R$ 52,27
Technical Support for Projects				
OGP analyst, projects and processes	Senior	R$ 6.200	44	R$ 28,18
Business Analytics Intelligence				
Data Specialist	Senior	R$ 13.000	44	R$ 59,09
Business Intelligence Specialist	Senior	R$ 12.000	44	R$ 54,55
Information Security Specialist	Senior	R$ 12.000	44	R$ 54,55
Information Analyst	Complete	R$ 6.100	44	R$ 27,73
Documentation Analyst	Complete	R$ 5.100	44	R$ 23,18
File Manager	Complete	R$ 3.100	44	R$ 14,09
Corporate Education				
Psychopedagogist	Senior	R$ 7.000	44	R$ 31,82
Instructional Designer	Senior	R$ 6.100	44	R$ 27,73

Event Management				
Event designer	Senior	R$ 6.100	44	R$ 27,73
Event Presenter	Complete	R$ 3.500	44	R$ 15,91

Note. The salary surveys refer to January 31, 2022 with quotations for the US dollar (US$) at R$ 5.3568 and the euro (€) at R$ 5.9581. Salaries were adapted to the Brazilian economic context and to the emergence of the solution project. Source: Author, 2022.

Figure 6
Detailed process of the FORTE Methodology and Method v. 1.0.



Conclusions

The *benefits of the method* were recorded in the acronym FORTE: (i) 'F' for *Forecasting* . Make predictions and assumptions of project timelines and costs, allowing for adjustments and better decision making; (ii) 'O' for *Optimization* . To bring about the most cost-effective circumstances for the management, instruments and products of the project; (iii) 'R' for *Reliability (confiabilidade)*. Provide the confidence that project management requires; (iv) 'T' for *Traceability* . Identify indications, traces, footprints, evidence and indications of illegality in the schedules that may lead to evidence and responsible parties; and (v) 'E' for *Enhancement* . To do an excellent and distinctive project management, team training and organizational asset management.

Megaproject leadership is found in the FORTE Method v. 1.0 the ideal support for the quality and compliance required in daily routines, ensuring investigative power, communication and transparency for leadership, senior management, partners and stakeholders in general. It assumes an important role in supporting interface management, agent accountability and continuous training of multidisciplinary teams in projects, where the successful implementation of the method does not allow different interpretations of the established requirements.

The main differential offered by the FORTE Method v. 1.0 is the accurate identification of the source of problems in the schedules, allowing for more realistic and timely corrective actions (Figure 7).

Figure 7
Simplified investigative process of the FORTE Method v. 1.0.

The FORTE method v. 1.0 represents a differentiated solution in a set of achievements beyond schedule management. It permeates the entire organizational fabric and, reflecting the need to bring academia and production closer together, is ideal for conducting international cooperation projects.

References

Ariely, D. (2012). *A mais pura verdade sobre a desonestidade*. Campus/ Elsevier.

Barrera, J. H. de (2010). *Metodologia de la investigación: guía para una comprensión holística de la ciencia* (4ª. Ed.). Quiron Ediciones.

Goldberg, L. R. (1992). *T*he development of markers for the big-five factor structure. *Psychological Assessment, 4*(1), 26-42.

Khan, H. A. (2018). Globalization and the Challenges of Public Administration: Governance, Human Resources Management, Leadership, Ethics, E-Governance and Sustainability in the 21st Century.

Maslow, A. H. (1943). A theory of human motivation. *Psychological Review, 50*(4), 370–396. https://doi.org/10.1037/h0054346.

Merrow, E. W. e Nandurdikar, N. S. (2018). *Leading Complex Projects. A data-driven approach to mastering the human side of project management*. Editora Wiley.

Monteiro, F. & Kertesz, S. (2018). *Doing business in brazil after operation car wash (B)*. https://publishing.insead.edu/case/doing-business-brazil-after-operation-car-wash-b.

Ponemon Institute (2020). *2020 cost of insider Threats Global Report*. https://www.proofpoint.com/us/resources/webinars/2020-cost-insider-threats-global-report

Sardenberg, R. M. (1999). Cenários e perspectivas para o Brasil: o projeto Brasil 2020. *Revista Proposta, 80*.