What to do if a project doesn't go as planned or expected? (Let's also ask Chat GPT-4) [1]

Marco Caressa and Massimo Pirozzi

ABSTRACT

The decision support tasks are evidently of primary importance in project management, since all the actions and/or approvals and/or refusals and/or changes that are relevant to the projects, including the management of the proposed modifications and/or corrective actions, are based on decisions. However, decision support issues are quite rare in project management literature and almost missing in project management standards, perhaps because they are considered specific of each project and, then, difficultly generalizable. Nevertheless, it is possible to individuate a certain "commonality" among projects in terms of both the results of the control processes and their relevant possible causes, which may be worthwhile to deepen in order to gain more effectiveness and efficiency. This paper gives an overview about the typical deviations that may occur in the projects and about some relevant good practices to manage them, proposes an innovative data-driven framework to support those decisions that are characteristic of project management, and shows some cues about how the artificial intelligence (AI) Chabot GPT-4 might empower decision support tasks in project management.

TYPICAL PROJECT DEVIATIONS AND THEIR POSSIBLE MANAGEMENT

The typical causes of project deviations are quite diverse, although the effects on the project progress may be similar, to the point that the possible indicators that are used in project management control processes may be common to different typologies of deviations. The basic drivers that may be effectively considered depend on the nature of the work to be performed, which corresponds to the influences that are internal or external to the project team and includes:

- **Work that is performed by internal manpower** (internal influence)
- **Work that corresponds to the procurement of goods** (external influence)
- **Work that corresponds to the procurement of services** (external influence)
- **Obtainment of permissions, authorizations, etc.** (external influence)
- **Perceived work** (external influence)
- **Integration work** (internal influence).

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In general, although the project team usually has just a limited control on internal resources and/or factors, and has not control at all on external resources and/or factors, the project efficacy and efficiency can always be improved via **a better and more complete structuring, planning, monitoring and control system** and, above all, **a better relationship management system**.

Actually, if we consider the trends of the project performances in a ten-year period (Fig. 1), it is evident that there were and still there are **systematic lacks in terms of project structuring, planning, monitoring and control**, which in part are due to critical issues that are under evaluated – and therefore not taken into account properly, or not taken into account at all – and in part derive from oversimplifications of complex processes and behaviors. In fact, the today's situation of project performances is that, approximately, with regard to efficacy, 30% projects did not meet original goals/business intents – i.e. did not meet the stakeholder expectations –and, with regards to efficiency, 55% projects were not completed on time, 40% projects were not completed within original budget – these last data are probably related with a 30% projects that experienced scope creeps. It is interesting to notice that the organizations find in any case convenient to complete the projects also in almost the half of cases in which the constraints in terms of time and/or cost are not respected, thing that seems to indicate that delays and cost overruns are considered structural ("constraints that do not constrain"?). In general, definitively, above huge negative figures in terms of efficacy and efficiency, and, in addition, the evidence that overall improvements in 10 years were just about 10% lead us to confirm that the lacks in terms of project structuring, planning, monitoring and control are not episodic, but systematic.

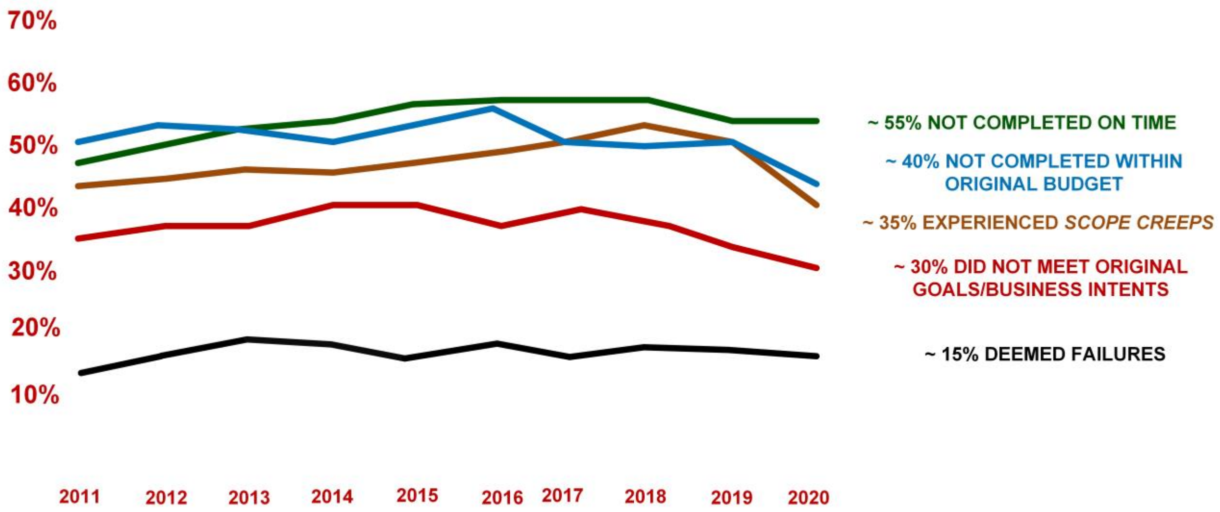

Fig.1 – Project performances trends (Data source: PMI, 2018 and 2021)

Which can be the above systematic structuring, planning, monitoring and control lacks? For sure, there are **two basic domains** that often are **not systematically measured** – or not measured at all –, which correspond to **the stakeholder relationships** and to **the**

integration activities, and which are the basic drivers of the **perceived value** and of the **delivered value**, respectively. In fact, on one hand, while the community of project managers and their executives states that the first five causes of project failures are relational (Project Management Institute, 2018) – i.e. change in organization's priorities, change in project objectives, inaccurate requirements gathering, inadequate vision or goal for the project and inadequate/poor communication – a systematic monitoring and control of the stakeholder relationship effectiveness is rather uncommon. On the other hand, it is quite unusual the use of specific KPIs related to integration – as e.g. the earned value at the level of subprojects and/or the control accounts, which is also a good indicator in the cases of non-critical work packages that become critical and generate a "snow ball" effect at a higher WBS level – because in the analytical WBS-based approach, since the integration activities are not represented on the WBS, we **tend to oversimplify the situation**, and to consider that the project deliverables coincide with the sum of the work packages' deliverables, rather than with their integration, as it is actually evident in a systemic approach.

In more detail, a **systemic view** (Fig.2) – valid for the elements at the different levels of project breakdown, including the project, the subprojects, the phases, the control accounts, and the work packages – can be applied to the stakeholder perspective (Pirozzi, 2017), in order to highlight – visually too – the importance of both the perceived value and the integration activities (Caressa and Pirozzi, 2022).

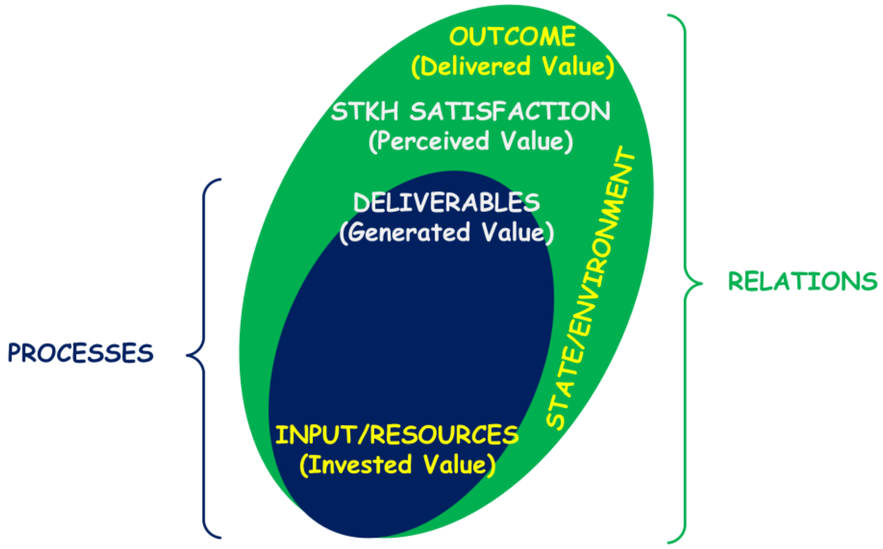

Fig.2 – A Systemic View of a Project

Indeed, for each project element, **the outcome is the result of the integration of the processed inputs with the relations**, i.e. the integration of the generated value due to the deliverables with the perceived value due to the stakeholder satisfaction (Caressa and Pirozzi, 2022). In each project element, the width of the "green" gap represents the incidence on the results due to the relations with respect to the "blue" incidence due to the processes, and corresponds also both to the level of systemic non linearity and, therefore, to the level of complexity. Definitively, the "green" domain corresponds to the integration work, which is a responsibility of the project manager, while the "blue" domain corresponds to a delivery work, the responsibility of which is of the team members/leaders who are entitled to realize the different work packages by respecting the given constraints.

In general, all the diverse type of value can be measured, monitored and controlled via appropriate KPIs (Caressa and Pirozzi, 2022). The Earned Value is quite effective to monitor and control the generated value, which correspond to deliverables, and is the most commonly used KPI; it may also be integrated with other project management KPIs, e.g. percentages of work packages completed on time and/or within budget, number of requests of modification etc. On the other hand, the **perceived value** (Pirozzi, 2019) – which, despite being the basic driver for pricing in the market is the "great absent" in the project management standards – requires "subjective" KPIs as e.g. the perceived value itself, the stakeholder satisfaction, the perceived quality, the perceived internal climate, the perceived innovation etc., which have to be managed by interacting with the stakeholders. Ultimately, the delivered value may effectively require business/social value-related KPIs, and, in general, KPIs that can be the monitoring and control parameters at an integration level. Definitively, an **appropriate set of KPIs** that can target the diverse types of value may be a powerful tool to detect the deviation before they occur, so enabling a timely analysis of the causes and an appropriate decision support.

In the case of work that is performed by internal labor, the deviations are mainly indicated by a SPI<1, and/or, in some cases by a CPI<1 – in fact, the practice says that often additional costs lead, sooner or later, to time delays. A first possible cause to be investigated is that whether there have been underestimates in the baseline (if, after a check, there have been earned value under/overestimates, they have obviously to be corrected in advance); in fact, an early recognition of underestimations with a consequent re-planning is generally a very cost-effective action to be proposed for a project sponsor decision, also in the case that additional resources (internal and/or external) are needed. An eventual lower productivity of the team that is involved in work package development may be due to individual and/or teaming reasons: in both cases, it is essential to evaluate the perceived internal climate to understand if there are management issues that may be solved (basically these actions are almost no-cost, although might require a certain time), and, after that, estimate if the time estimated to complete the work package may be compressed, and, only if strictly necessary, propose the recruiting of additional resources (in general, external procurement may be faster than the addition of internal resources, which on turn may often be cheaper).

In the case of work that corresponds to the procurement of goods, the delays are mainly indicated by a SPI<1 together with a CPI>1, because in general the cost occurs just once the goods have been delivered/invoiced, and, then, a delay corresponds to an apparent cost saving. This case is probably one of the most risky, since eventual time shifts may be detected too late for possible alternative effective actions, and then become frequently critical. The insertion of milestones (e.g. related to stock availability) and associated KPIs is then preferable. The main actions that can be proposed may include alternative and/or additional suppliers.

In the case of work that corresponds to the procurement of goods, the delays are mainly indicated by a SPI<1; the situation is less risky than in the case of the procurement of goods, because the services have shorter time lifecycles, and then are more frequently monitorable and controllable. The main actions that can be proposed may include alternative and/or additional suppliers in this case too.

Obtainment of permissions, authorizations and similar are often improperly considered as "natural consequences" of delivered work packages, while, because of their potential criticality, their management as separate work packages – each one associated to a budget and an expected duration – is recommended, and the insertion of some milestones to be controlled is highly preferable. In general, eventual deviations indicate misalignments with stakeholder expectations, and may be detected via perceived value KPIs. Immediate actions that may be suggested include a verification of the project requirements, and their alignment with stakeholder expectations, the results of which might target a new version of the baseline with eventual additional adequate corrective actions included.

While the deliverables are the basis for the exchange of value among the stakeholders, it is the perceived value of the work packages, the control accounts, the phases, the subprojects and, ultimately, the project, which make above exchange possible and, then, successful. The perceived value in its various typologies – e.g. perceived business value, perceived social value, perceived technical value, perceived quality, stakeholder satisfaction etc. – is generally monitored and controlled via systematic direct questions and/or questionnaires addressed to the stakeholders, the results of which have to properly and carefully analyzed. If deviations beyond a certain agreed threshold are detected, actions that may be suggested include, also in this case, a verification of the project requirements, and their alignment with stakeholder expectations, the results of which might target a new version of the baseline with eventual additional adequate corrective actions, in this case too.

In each project, we can identify three different typologies of integration: the integration among project processes, which originates the generated value/deliverables, the integration of the stakeholder relationships, which originates the perceived value, and the integration between the generated value and the perceived value, which generates the delivered value/outcomes (Fig.2).

Since the processes interact via their inputs and outputs, but also via a common context/environment, and are in any case realized by people, their relations turn out to be **complex and non-linear**, and, therefore, the monitoring and control of integration activities – which, by the way, are the primary "direct" activities of the project managers – is not immediate. In fact, for instance, when we measure the Schedule Performance Index at an integration level (e.g. at the level of a subproject, a control account, a phase, or the project itself), the result is a weighted mean, which may be falsely reassuring, because, on one hand, there could be a certain compensation deriving from the diverse work packages "behaviors", on the other hand the maximum "weight" is that of the more costly work packages, while the major deviations may be generated by the critical work packages (of any cost).

Actually, the critical work packages might generate delays and extra costs even much greater than those that may be calculated in an Estimate to Complete (ETC), e.g. in the frequent cases in which resources that have been necessarily allocated/purchased in advance remain idle for a period that corresponds to previous delays. Ultimately, an appropriate prioritization of the modifications/ corrective actions to be proposed is suggested in accordance with the level of criticality of the correspondent work packages, and this is an essential action in the direction of a greater efficacy and efficiency. In addition, still at an integration level, a certain numerosity of work packages that are characterized by a SPI <1 may indicate management (or project management) open issues to be faced at the same level, e.g. via a proposal of reorganization.

In the case of the integration of the stakeholder relationships, the deviations become generally evident from the stakeholder satisfaction KPIs; it is then suggested to collect systematically appropriate feedbacks. The actions to be proposed generally target the improvement of the relationships with stakeholder, and an increase of effective communication.

Definitively, in the case of the integration between the generated value and the perceived value, which generates the delivered value/outcomes, the deviations "from the right path" are usually detected via a subset the specific business and/or social KPIs that are generally used to measure the project performance during the product/service lifecycle. The main action to be proposed at this level may include a verification and/or review of the project requirements, and their alignment with stakeholder expectations, the results of which might target a new version of the baseline with eventual additional adequate corrective actions included.

Ultimately, **the effectiveness of all above considerations may be enhanced by adopting appropriate frequencies of monitoring and control, and/or more adequate project structuring approaches**. Indeed, the semantic gap between the project requirements and the stakeholder expectations may be reduced via more frequent verifications, and this may be valid a fortiori, if project is structured in hybrid or adaptive life cycles. In fact, a structure in shorter and time-boxed phases (e.g. iterations, sprints etc.) may increase the phase gates and shorten the feedback cycles, then making corrective actions and related decisions more timely through a principle of "late decision" – i.e. deciding at the last useful moment when the best set of available information will be available.

AN INNOVATIVE DATA-DRIVEN FRAMEWORK TO SUPPORT DECISIONS IN PROJECT MANAGEMENT

Making decisions in project management cannot ignore the systematic use of data. Thanks to digital transformation, projects today are capable of generating much more data than in the past. The increasingly pervasive use of software platforms to support the project lifecycle results in a progressive *end-to-end* virtualization of processes and a faster decision-making process.

Consider, for example, the advantages of integrating semantic and spatial data in a construction project through the use of GIS (Geographic Information Systems) and BIM (Building Information Modeling) platforms, which lead to more aware decisions and greater efficiency in all project phases. Both GIS and BIM support planning decisions through 3D visualization of the project area and building (for presentation and better understanding of the project), more accurate estimate of construction times and costs, advanced analysis on lighting, energy consumption, structural resistance, early detection of potential clashes and interferences between structural elements and MEP (Mechanical, Electrical and Plumbing) systems. Decisions during the execution of the work and the monitoring and controlling of the construction of the building are also supported. 4D modeling (space + time) allows monitoring progress against schedule, GIS analyses improve site logistic and safety management, GIS and BIM model facilitate information sharing among project stakeholders (designers, contractors, owners) and, finally, the BIM model supports decisions related to the management and maintenance of the building even after the completion of the construction project.

More broadly, the digital transformation of projects is itself data-driven. Services and platforms (apps, web, social, IoT, wearables...) generate data (Big Data) from which to derive information (analytics) based on which the course of actions is decided, whether by human or artificial decision-makers (Cognitive Services, Machine Learning, and AI). Adopting a data-driven framework to support project decisions means measuring aspects of interest to derive information and management automations from project data. The following figure illustrates the process scheme of the framework.

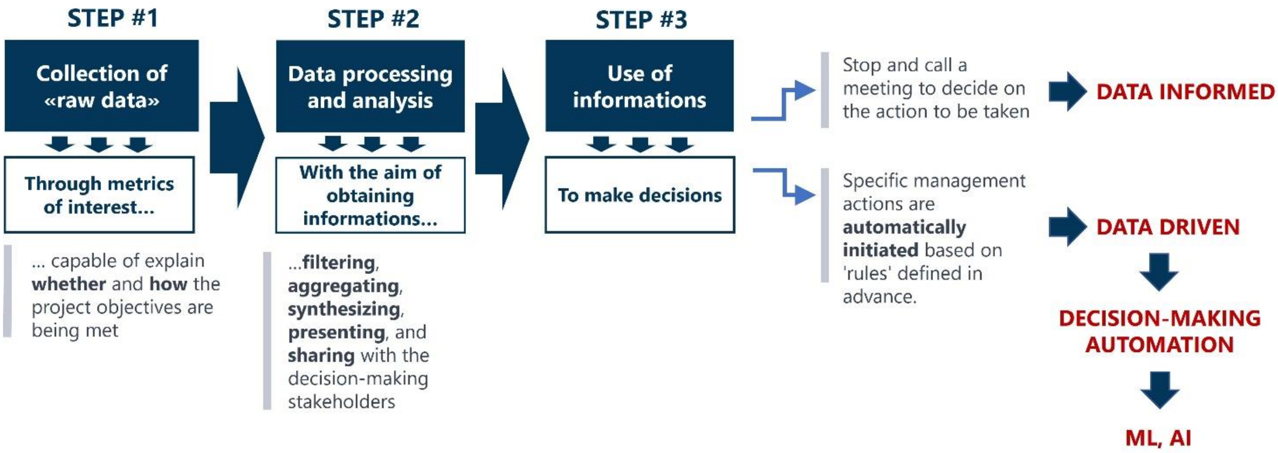

Fig.3 – Data-Driven framework to support project management decisions

The first step involves collecting raw project data (**work performance data**) through measurements conducted on a carefully selected set of metrics. The project measurement metrics are of different types:

Predictability Metrics: These are used to **measure deviations** between the actual project progress and the planned progress (baseline). An example is the metrics from the Earned Value method (Planned Value, Earned Value, Actual Cost) that allow for the calculation of the SPI and CPI performance indicators.

Responsiveness Metrics: These are used to measure the **response speed and problem-solving time** regarding project stakeholders. Help desk systems can be used, which open a 'ticket' in relation to a problem or an issue and track its resolution process. Alternatively, a simple issue log and/or problem log can be used where processing and resolution times are tracked.

Product Quality Metrics: These are used to detect **defects or non-compliance with requirements**, such as the number of defects identified in project deliverables, grouped by status (e.g., open, deferred, closed, fix available, etc.) and their trend over time.

Project Quality Metrics: These are used to detect **defects or non-compliance in the management process**, such as adherence to project/phase timelines, expressed as the difference between the planned delivery date of a deliverable/outcome and the actual delivery date. Delays beyond a certain threshold (absolute or percentage) or a number of delays exceeding a predetermined minimum may result in observations with potential contractual penalties.

Productivity/Efficiency Metrics: These are used to assess the **use of available resources**, both human and material, such as the ratio between planned effort and effort (e.g., in person-days) spent on the project, obtained from specific reporting systems, like activity tracking timesheets.

These concepts are applicable to both predictive and adaptive/agile scenarios. For instance, in an agile context, **Burn Charts** (Burndown & Burnup) represent predictability metrics (user stories/features yet to be implemented or already implemented), making the team's progress visible and facilitating completion forecasts for the individual work iteration or the entire project. The **Velocity -** a measure of the team's work capacity for a single iteration **-** is a typical agile productivity metric.

The second step involves analyzing and processing the data collected based on the chosen metrics to derive useful information (**work performance information**) through filtering operations, aggregation, and the application of specific calculation algorithms. The goal is both to understand the current project situation (**analysis**) and to identify patterns and trends and develop predictive models of events and behaviors (**data analytics**). The calculations can be statistical, relying on 'probability distribution functions' for which Project Management offers various usage scenarios. An example is the Monte Carlo simulations used to construct predictive models related to project timeframes and costs to answer questions like, 'What is the probability that the project cost will be within a predetermined budget?', or 'Which budget gives us a 90% probability of completing the project?', or even 'What is the probability that a deliverable, which is the culmination of N activities, will actually be released by a certain date?'. Calculations can also be algebraic, as in the **AHP** (Analytical Hierarchy Process) method, a decision-making support technique in multi-criteria contexts, where the decision depends on multiple factors. AHP helps decompose the general decision-making problem into a hierarchy of sub-decisions that can be analyzed independently and reassembled in a weighted manner using linear algebra techniques.

The information derived from the data is then the input for step 3, where decisions are actually made, but distinguishing between two possible scenarios:

- **Data-informed** decision-making scenario: in this case, once the information is available, one stops and decides, for example by convening a meeting, the action to take. Given other equal conditions, this is the most common situation.
- **Data-driven** decision-making scenario: in this case, on the other hand, the available information automatically triggers specific management actions based on rules defined in advance.

In practice, in a data-driven project, the action strategy based on the information derived from the available data is expressed by rules that implement 'decisions already made', with two main advantages:

- **#1:** The reaction to change is quicker because, for the specific context that arises, the decision has already been made in advance.
- **#2:** There is greater effectiveness of the Project Manager's action who, freed from operational details, can focus on the bigger picture.

Below is an example of the difference between a data-informed and data-driven approach for a software development project, in relation to the 'if and when' to authorize the release of features in a testing environment based on the number and type of bugs found.

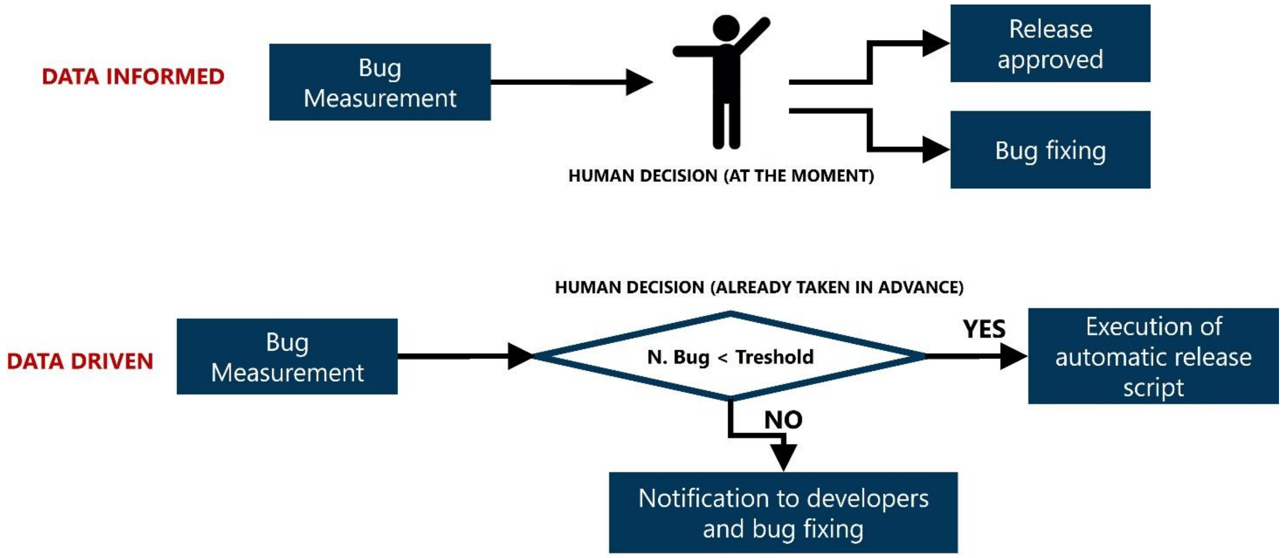

Fig.4 – Differences between Data-Informed and Data-Driven

In general, however, in this value chain of project decisions, the principle dear to computer scientists "**garbage-in, garbage-out**" applies. There is a higher likelihood of making sound project decisions based on as relevant and complete information as possible, which in turn depends on the collection of meaningful datasets from reliable sources.

WHAT HAPPENS IF WE TRY TO ENGAGE CHAT-GPT4 IN PROJECT MANAGEMENT DECISION-SUPPORT PROCESSES?

As projects grow in complexity and stakeholders demand faster turnarounds, the role of AI, and in particular, Large Language Models (LLMs) like chatbots, becomes increasingly vital, giving great support to timely and accurate decision-making. Below are some areas where the support of AI and LLMs in enhancing and streamlining the project management process through chatbot interactions can be most significant.

- **Instantaneous Knowledge Retrieval:** LLMs can swiftly search through vast amounts of data, be it project documentation, guidelines, or best practices, and provide relevant information in real-time. This can significantly reduce the time project managers spend searching for information.
- **Task Automation:** routine tasks such as scheduling meetings, sending reminders, or even compiling regular status reports can be automated with the help of AI-driven chatbots. This allows project managers to focus on more strategic aspects of the project.
- **Risk Management**: through predictive analytics, LLMs can forecast potential risks by analyzing patterns from past projects and current data. These predictions can enable project managers to take preemptive action.
- **Stakeholder Communication**: LLM-based chatbots can serve as the first point of contact for stakeholder queries, providing instant responses based on project data. This ensures stakeholders are always informed and reduces the communication burden on the project team.
- **Decision Support:** By analyzing vast amounts of data, LLMs can provide insights, recommendations, and even simulate outcomes based on different decisions. This aids project managers in making informed choices.
- **Learning and Training:** new team members can interact with LLM-based chatbots to get up to speed with project guidelines, best practices, and even historical context, ensuring a smoother onboarding process.

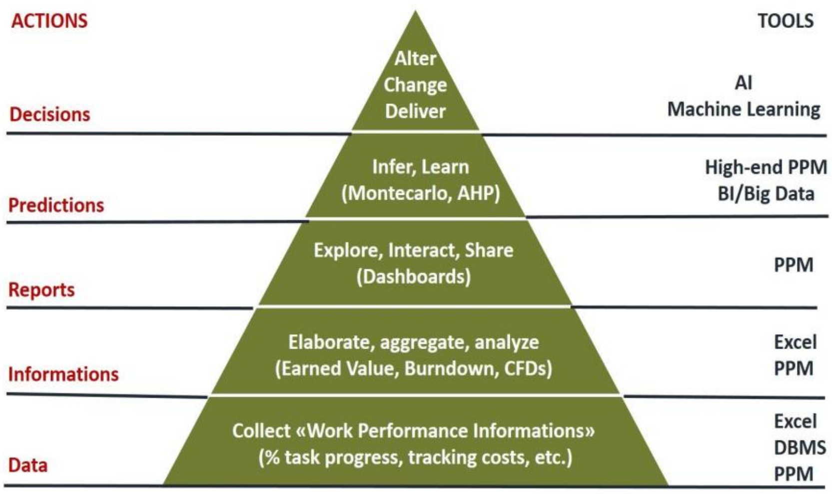

Fig.5 – Project decision data value pyramid

In delineating a data-driven framework tailored for project decision-making, we identified three pivotal stages: the collection of work performance data, the extraction of work performance information through processing, and the determination of management actions contingent upon the available insights. Delving deeper, we envisage a 'data value pyramid' (as illustrated in Fig. 5). This pyramid epitomizes the escalating value as we transition from rudimentary data to increasingly abstracted information.

At the lowest level of the pyramid, we find the "raw data", which are directly derived from measurements using the selected metrics. An example of this would be the data reporting time and costs of project activities. These are structured data that can be stored and managed with a spreadsheet, databases, or Project & Portfolio Management (PPM) software solutions. Ascending the pyramid, we encounter information, derived from the aggregation of raw data, such as the proxy measures of the Earned Value method (variances and performance indices), as well as "burn charts" and CFD (Cumulative Flow Diagram) in agile and lean contexts. Information management tools are analogous to those of the underlying level, including spreadsheets and dedicated PPM solutions.

Progressing further, the ensuing tier is dedicated to reportage, encapsulating synthesized and filtered data perspectives. The primary objective here is to furnish stakeholders with salient insights, thereby facilitating informed decision-making processes. Transitioning to the penultimate echelon, one is introduced to the realm of "forecasts". This domain is underscored by the prowess to extrapolate and interpret project trajectories and performances, achieved through the meticulous application of statistical methodologies, exemplified by Montecarlo analyses, or algebraic techniques such as AHP (*Analytical Hierarchy Process*). Such an advanced repertoire of functionalities is typical of advanced PPM platforms, offering simulation tools to support activity scheduling. Lastly, the apex, the decision-making echelon, **can be mechanized using AI and Machine Learning algorithms**.

Presently, to which echelon and with which tools can you ascend the project's 'data value' pyramid? The decisional aid proffered by LLM systems, amalgamated with their conversational mode of interaction — maximally interactive in essence — is revolutionizing these systems, elevating them from mere sophisticated instruments to prospective project stakeholders. Undoubtedly, these systems are devoid of the emotional and behavioral nuances innate to tangible stakeholders. Nevertheless, interacting with an LLM resembles liaising with a project team member or a Subject Matter Expert.

PV (Planned Value) data — Time now (between Week 7 and Week 8)

WBS Cod	Task Name	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
1.1	Analysis and definition	1000	1500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500
1.1.2	Data logical model	0	500	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1.1.3	Functional requirements	500	1200	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
1.1.4	Non-Functional requirements	0	400	800	800	800	800	800	800	800	800	800	800
1.2	Design	0	500	1300	2200	4200	4200	4200	4200	4200	4200	4200	4200
1.3	Setup of environment and infrastructure	0	0	700	2700	3700	4500	4500	4500	4500	4500	4500	4500
1.4	Development and testing	0	0	200	800	1800	3300	3300	3300	3300	3300	3300	3300
1.5	Rework iteration and consolidation	0	0	0	0	700	1200	2200	3000	3000	3000	3000	3000
1.6	Release and closure	0	0	0	0	0	0	0	700	2700	3700	5700	6700

EV (Earned Value) data

WBS Cod	Task Name	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
1.1	Analysis and definition	700	1800	3100	3500	3500	3500	3500					
1.1.2	Data logical model	0	400	800	1000	1000	1000	1000					
1.1.3	Functional requirements	500	1000	1700	1700	1700	1700	1700					
1.1.4	Non-Functional requirements	200	400	600	800	800	800	800					
1.2	Design	0	1050	1260	2520	3150	3780	4200					
1.3	Setup of environment and infrastructure	0	0	1125	1800	2250	4500	4500					
1.4	Development and testing	0	0	0	0	825	2640	2970					
1.5	Rework iteration and consolidation	0	0	0	0	0	750	900					
1.6	Release and closure	0	0	0	0	0	0	500					

AC (Actual Cost) data

WBS Cod	Task Name	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
1.1	Analysis and definition	900	1800	3000	3500	3600	3600	3600					
1.1.2	Data logical model	0	500	800	1000	1000	1000	1000					
1.1.3	Functional requirements	600	800	1500	1800	1800	1800	1800					
1.1.4	Non-Functional requirements	300	500	700	700	800	700	700					
1.2	Design	0	900	700	1200	1700	1700	1700					
1.3	Setup of environment and infrastructure	0	0	300	300	1250	1500	1500					
1.4	Development and testing	0	0	100	600	1500	2200	2600					
1.5	Rework iteration and consolidation	0	0	0	0	400	1000	1500					
1.6	Release and closure	0	0	0	0	0	0	500					

Time now

Fig.6 – Earned Valued raw data for a two-level WBS

We embarked on experimental trials with Chat-GPT4, activating its beta 'code interpreter' functionality, in the realm of project monitoring and controlling via the Earned Value method. We furnished the LLM with an Excel worksheet encapsulating the cumulative metrics of PV (Planned Value), EV (Earned Value), and AC (Actual Cost) as documented for a bi-level WBS (Fig. 6).

Upon successful validation of data upload by Chat-GPT4, we commenced a comprehensive interactive analysis session to evaluate the current project status. One of our primary inquiries was to discern the potential critical tasks as of the conclusion of the project's seventh week. Then we asked LLM to produce a linear graphical representation (Fig. 7), commonly referred to as 'S curves', and the subsequent computation of the SPI and CPI performance metrics.

In the final stages of our session, we directed the LLM to curate a project status report capturing the findings up to the seventh week. This report, meticulously structured, encompassed a title, an introductory segment elucidating the EV methodology employed, the subsequent procedural steps for calculations, graphical visualizations in the form of S curves, an in-depth analysis of the critical tasks, prospective remedial strategies for these tasks, and a concluding section highlighting the overarching findings and future trajectories. Notably, this report was rendered in a downloadable HTML format, optimized for seamless integration into potential project websites or portals. Its design ensures it acts as an 'information radiator', offering stakeholders a comprehensive overview at a glance.

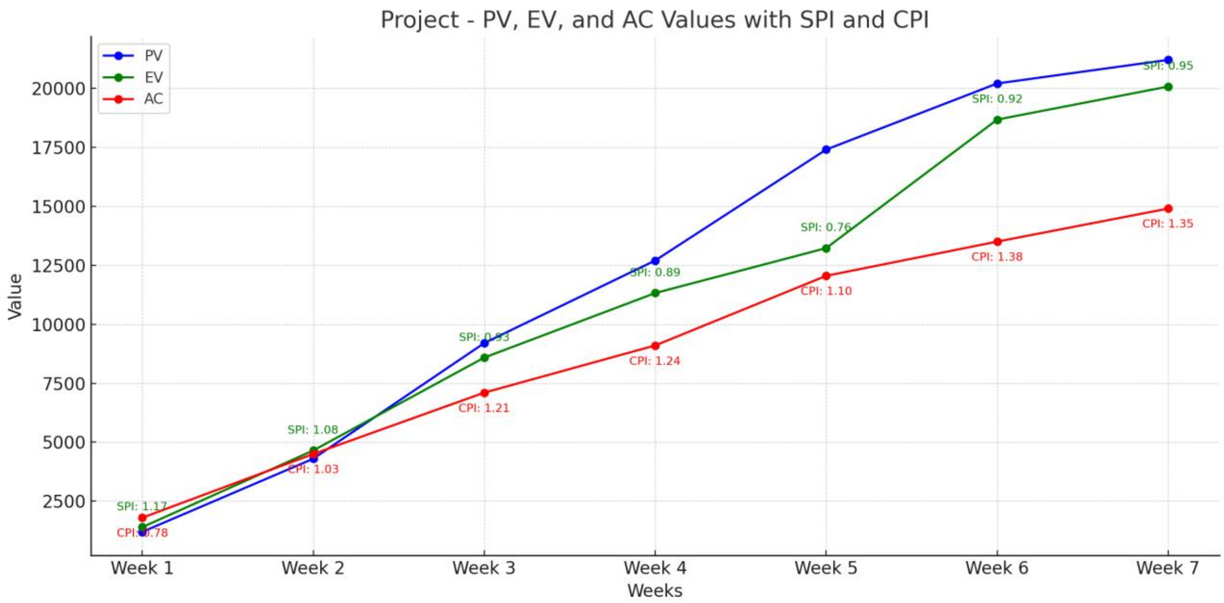

Fig.7 – "S-curves" chart for PV, EV and AC with SPI and CPI generated by Chat-GPT4

The conducted experiment has yielded results of significant interest. The meticulous analysis executed by the LLM proved to be fundamentally accurate and invaluable in facilitating potential rectifying or managerial actions pertaining to distinct project tasks. The modality of conversational interaction emerges as the most revolutionary aspect, attributed to its inherent user-friendliness and the capability to dynamically redirect the discourse towards intricate elements not initially foreseen. On a broader spectrum, there is a prevailing anticipation that such a user experience modality will supersede and become the predominant interface in all forthcoming business intelligence and data analytics systems, relegating pre-defined dashboards and reports to obsolescence.

In conclusion, the integration of LLMs is unequivocally advantageous. Chatbots like Chat-GPT4 offers a seamless and interactive way to integrate AI capabilities into the project management process. This not only streamlines operations but also brings a level of precision and foresight previously unattainable with traditional methods. Better results could be obtained by setting up and training a Large Language Model (LLM) on a private project management knowledge base, which requires significant computational resources. Consider leveraging cloud platforms or specialized ML hardware for efficient training. Also, always be cautious about data privacy, ensuring that sensitive project information remains confidential.

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About the Authors

Massimo Pirozzi

Rome, Italy

Massimo Pirozzi, MSc cum laude, Electronic Engineering, University of Rome "La Sapienza", Principal Consultant, Project Manager, and Educator. He is a Member of the Executive Board and an Accredited Master Teacher, of the Istituto Italiano di Project Management (Italian Institute of Project Management). He is certified as a Professional Project Manager, as an Information Security Management Systems Lead Auditor, and as an International Mediator. He is a Researcher, a Lecturer, and an Author about Stakeholder Management, Relationship Management, and Complex Projects Management, and his papers have been published in U.S.A., in Italy, in Switzerland, in the UAE and in Russia; in particular, he is the Author of the innovative Book "*The Stakeholder Perspective: Relationship Management to enhance Project value and Success*", CRC Press, Taylor & Francis Group, Boca Raton (FL), U.S.A., October 2019. Due to the acknowledgement of his comments on stakeholder-related issues contained in Exposure Draft of The Standard for Project Management - 7th Edition, he has been recognized as one of the *Contributors and Reviewers of The PMBOK® Guide - Seventh Edition*, and he received the *Certificate of Appreciation for Excellence for his volunteer contributions to the Project Management Institute and the project management profession in 2020*.

Massimo Pirozzi has a wide experience in managing large and complex projects, programs, and portfolios in national and international contexts, and in managing business relations with public and private organizations, including multinational companies, small and medium-sized enterprises, research institutes, and non-profit organizations. He worked successfully in several sectors, including Defense, Security, Health, Education, Engineering, Logistics, Cultural Heritage, Transport, Gaming, Services to Citizens, Consulting, and Web. He was also, for many years, a Top Manager in ICT Industry, and an Adjunct Professor in Organizational Psychology. He is registered as an Expert both of the European Commission, and of Italian Public Administrations.

Massimo Pirozzi is an Accomplished Author and an International Editorial Advisor of *PM World Journal*. He received three 2020 PM World Journal Editor's Choice Awards for his featured paper "*Project Management for Evidence Based Medicine*" (co-authored with Dr. Lidia Strigari), for his Article "*Project communications 1.0 and 2.0: from information to interactivity*" and for his report from Italy titled "*The fight against Coronavirus disease (COVID-19) from the perspectives of projects and of project management*". He received also two *2019 PM World Journal Editor's Choice Awards* for his featured paper "*Stakeholders, Who Are They*?", and for his report from Italy titled "*PM Expo® and PM Maturity Model ISIPM-Prado®*", and a *2018 PM World Journal Editor's Choice Award* for his featured paper "*The Stakeholder Management Perspective to Increase the Success Rate of Complex Projects*". Massimo can be contacted at max.pirozzi@gmail.com.

Marco Caressa

Rome, Italy

Marco Caressa, MSc cum laude, Nuclear Engineering, University of Rome "La Sapienza", IT Manager, Project & Program Manager, Consultant and Trainer. He is certified as a Professional Project Manager according to the UNI 11648 and UNI 11506 Italian standards, compliant with the ISO 21500 "Guidance on Project Management".

Marco Caressa has more than 25 years of experience in software coding and design, enterprise and digital systems architecture, big data, research and management for Engineering Ingegneria Informatica SpA. He has extensive experience in managing large and complex digital business transformation projects and programs.

Currently, he deals with supply engineering through the proposition of digital solutions and innovative technologies in different market areas, including Engineering, Public Sector, Industry, Insurance & Finance. PMP®, PMI-ACP® , PRINCE2 Practitioner, Scrum Master, enthusiast of traditional and agile Project Management. Blogger and columnist for trade and web magazine, trainer, mentor and coach. He is active on social networks, for 3 years with his LinkedIn page and for 1 year with a YouTube channel he has been working as a popularizer of managerial disciplines.

Marco Caressa has intervened in various training events, webinars (PMI, Project Management Institute; ISIPM, Istituto Italiano di Project Management) and as keynote speaker at conferences, including the last two editions of PMExpo, the largest Italian event on Project Management, organized and promoted by ISIPM (Istituto Italiano di Project Management).

Marco Caressa has collaborated as a professor of Project Management for several Italian universities, including:

- Master in Project Management (LUISS, Libera Università degli Studi Sociali di Roma)
- Second Level Master in Data Science (University of Perugia)
- Course of planning and management of European funds (University of Rome Tor Vergata)
- First level Master "Industry 4.0" (University of Pisa)
- First level Master "Scalability: digital technologies and company growth" (University of Pisa, Scuola Superiore S. Anna of Pisa)

Marco can be contacted at: marco.caressa@pm.me or through his LinkedIn page (https://www.linkedin.com/in/marcocaressa/) or his YouTube channel (https://www.youtube.com/c/MarcoCaressa)