The Prediction of Success in Project Management –

Predictive Project Analytics

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In the changing global economic landscape it is vital for organizations to stay competitive and reduce costs. Replacing outdated technology, improving business processes and implementing new programs are examples of activities that organizations undertake to face these demands. The increased pressure to deliver capital, business and technology projects within budget, specifications and schedule makes it necessary to avoid or at least soften risks and challenges that could compromise the desired outcomes of projects. Capabilities to manage project risk and guarantee effective governance, supported with insights from powerful analytical techniques, are needed to enable project and business transformation success.

This article summarizes typical challenges which business and technology projects currently face, and how Deloitte's Predictive Project Analytic approach can help to address these. The different phases of the approach are introduced briefly and benefits are illustrated with a real client example.

1. Introduction

Success and growth in business is often tied to an organization's ability to effectively manage major capital investment projects, streamlining business processes and the implementation of new technologies. Project management has gained importance in order to address the ongoing concern of value creation for organizations. Complex social, economic, and business issues have raised project management to a new level of strategic importance and delivered a new set of challenges that organizations need to face. Yet, despite the inherent strategic importance of projects, cost overruns, outcomes that don't meet agreed requirements, or even entire project failures are experienced frequently.

>> For readers in a hurry

Over 60 percent of projects experience failure, resulting in higher costs, time overruns, or shortcomings in the desired outputs. Effectively no tools exist that allows forecasting which projects will fail and what can to be done to counteract risks. Predictive Project Analytics addresses these issues and allows organizations to better understand project complexity against maturity of existing governance models and control mechanisms in order to identify and avoid sources of failure.

The yearly CHAOS research of the The Standish Group [1], covering 50.000 company projects, illustrates that over 60 percent of organizations experienced failure. Drilling down into more detail reveals that time overruns are the primary issue that 74 percent of the challenged projects face, followed by shortcomings in developed features (69 percent) and higher costs than planned with 59 percent. Bloch, Blumberg, and Laartz (2011) confirm these as the key challenges organizations experience and add that in some cases project failed so badly that they threatened the existence of the company [2].

There are diverse reasons for project failure, ranging from the constant pressure of in-house teams to deliver in less time and at lower cost, poorly defined requirements, and lack of access to specialist resources. Due to the potentially repercussions of failure, organizations have always searched for ways to keep projects on track and improve their performance. As an example, academic research provides insights on factors affecting success and failure, but cannot provide methods or tools to predict the outcome of particular projects or individual phases. Traditional risk assessment, on the other hand, is based on expert knowledge but lacks the ability to pinpoint specific control gaps that can cause a project to go off the rails. And virtually no tools exist that allows the prediction of which projects will fail and what needs to be done to get them back on track.

Even in large and complex projects, risk management does not receive sufficient focus as part of project management, until the risks materialize as issues. Potential risks identified by risk analysis in early stages are typically filed away and not actively checked and monitored. In later phases of the project, when potential risks emerge, mitigation and remediation strategies are used to counter these risks, but their impact on the project as a whole is often not comprehensively considered [3]. Risk management can further be hampered in global and large-scale projects as the high number of resources, activities, stakeholders, and deliverables involved, adding even more complexity to the situation. In combination with conflicting objectives and priorities among stakeholders, scenarios can be created that lead to projects with high expectations but little success. Such projects often come with an increased likelihood of cost and schedule overruns [2].

There is a demand for new approaches to assess the health and reliability of projects and transformation initiatives, better equipping project management to deal with large and complex projects. Predictive Project Analytics (PPA) is a project risk assessment methodology that

originates from data analysis and predictive analysis. It allows the forecasting of potential risks at project kickoff, and identification of pre-emptive risk mitigation actions for ongoing programs.

2. Predictive analytics in project management

Since the 1950s, project management has played an essential role in steering organizations through the intricacies of getting work done. To adapt to changing environments and in order to face new sets of requirements, project management has evolved steadily with every decade. Figure 1 shows high level examples of key accomplishments over the major decades. Early generation of project management integrated time management approaches with project planning, control, and management. A pioneer in project management was the National Aeronautics and Space Administration (NASA) who was driven by the persuasive need for a framework to contain project risk and scope [4]. In the 1980s, competitive burdens urged organizations to implement PM approaches and solutions for product development. For example, through developing breakdown structures which allowed practitioners to break down projects into discrete work elements and allowed to better organize and define the work and scope of projects [5]. As the need for project management methodologies arose in areas other than manufacturing and engineering, a number of competing approaches, such as the Project Management Body of Knowledge (PMBOK) and International Project Management Association (IPMA) emerged to put structure to the PM discipline. Project management processes became distinct and separate from product development processes, and methodologies underpinned the business management methods of the day, including business process reengineering and total quality management [6]. In the early 1990s the discipline of project management was finally recognized as a core capability for organizations. Procedures, tools, applications, templates, and guidelines were widely distributed through corporate information channels. Practices from project management were also adopted by the change management discipline, which was officially introduced in 1994 with the publication of the first "State of the Change Management Industry" report in Consultants News [7]. Over the past decade, strategic project management has

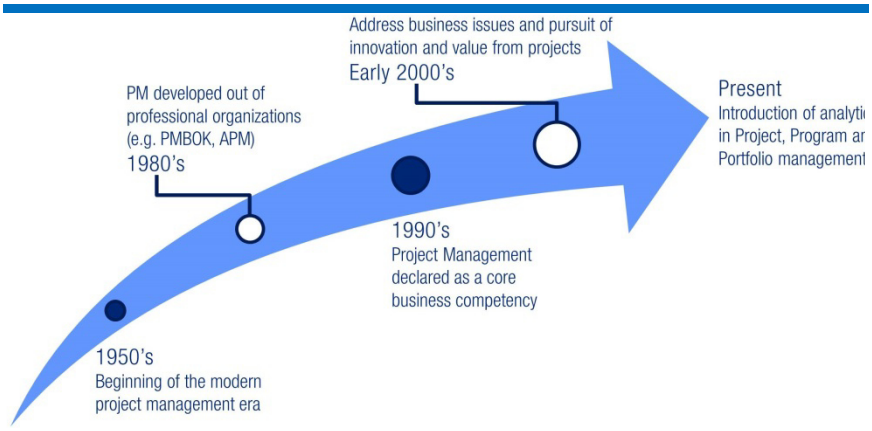


Figure 1: The Project Management Journey

emerged in order to address ongoing concerns about value creation within organizations. Inconsistencies between project management and corporate strategy, as well as the need to address business, economic, and social concerns has elevated the strategic importance of project management, but also delivered a new set of challenges [8]. In current economic times, organizations have an increasing need to rein in their costs and extract value from projects. The introduction of analytics and the leverage of intelligence in project management promise a way to cope with low tolerance for project failures by an increased focus on execution. In particular, predictive analytics promises to be a valuable complement for project management due to its ability to leverage project data and predict the possible outcomes of future events.

Predictive analytics itself is not a brand new concept. It is widely known as a subset of Business Intelligence (BI) and related to data science disciplines such as data mining, discrete event simulation and statistics. Predictive analytics is acknowledged as a technology that learns from data to uncover relationships and patterns in order to predict the outcomes of behavior and events. Unlike other business intelligence technologies, the focus or predictive analytics is on looking forward other than reporting or analyzing the past or the current situation (see figure 2). Focusing on the future promises more valuable insights for business or the project as it allows adequate reactions to upcoming challenges. Currently available BI technologies already offer simple predictive models that allow analysis of causative trends and

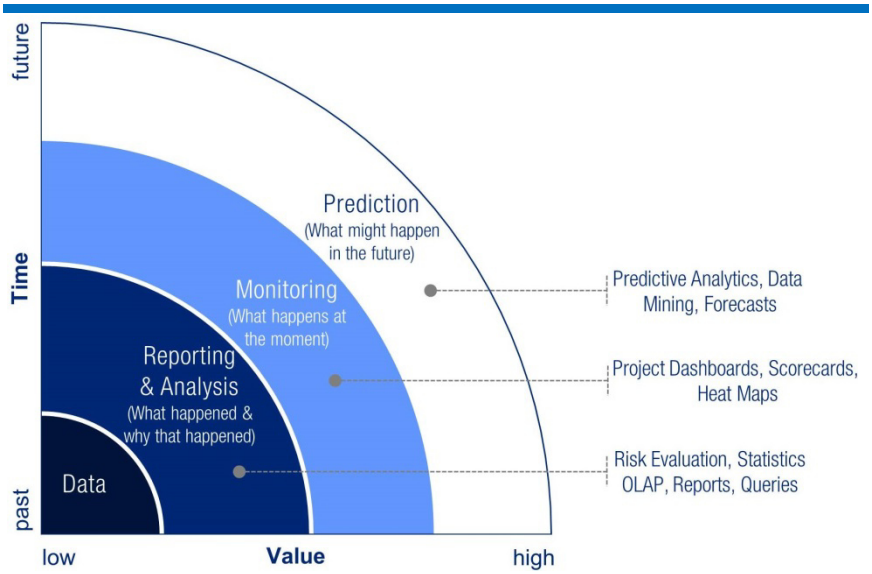


Figure 2: Prediction provides the most value for projects but also is more complex than other technologies. Source: Based on Eckerson (2007, p. 7), Ogunleye (2014, p. 2)

are mainly designed to present valuable information for the management or operational level. However, unlike predictive analytics, they often lack the ability to link together available data with business decisions, stakeholder experience, and other actions that comes along with the predictive insights [11]. Predictive analytics excels in linking these different aspects in order to provide higher value than traditional monitoring, reporting or analysis techniques. This higher value of predicted analytics is also reinforced by the survey of Eckerson (2007), where two-thirds of respondents who have already implemented predictive analytics, state that it provides "very high" or "high" business value.

Predictive analytics has been already utilized successfully in the retail and financial industry sectors. However, the recent pressures emerging with the phenomenon of big data, coupled with the desire of organizations to predict future outcomes is raising the appreciation of predictive analytics in other sectors. The motives for this high level of attention are easy to explain - enterprises that can predict future outcomes with high levels of confidence are able to get competitive advantages, for example retaining and serving their customers in a better way than their competitors. The main concept behind predictive analytics is simple to understand. Individuals have to make millions of decisions every day in order to determine whom to contact, what to approve, what is worth investigating, which functionalities requires testing, and much more. Predictive analytics aims to drive decisions empirically and supported by hard facts [12]. In answering this huge number of minor questions, predictive analytics may support the answering of bigger questions, such as how to improve the effectiveness of the project as a whole, or which potential risks can arise.

At its core predictive analytics is used to determine the likelihood of a situation or the most feasible future outcomes of events. It is a subset of the widely known data mining discipline and covers the part of predicting future probabilities and trends. These insights are obtained by analyzing large amounts of data containing a huge number of variables, through techniques such as regression modeling, decision trees, neural nets or generic algorithms. Predictors, variables that represent what should be measured in order to predict the upcoming performance of an entity or individual, are the core elements of every predictive analytic activity [12]. For example, in project management an organization may take into account project team size, financial costs, the level of accountability and project structure to determine the risk factors that can hamper the outcome of a project. The combination of multiple predictors, such as those above, is called a predictive model and is used to predict future probabilities within acceptable reliability levels. General steps of predictive modeling include the collection of data, cleansing activities, the creation of statistical models, the actual prediction and conducting validation as soon as additional data is available. The production of future insights is only possible through the combination of business knowledge, statistical and analytical techniques, and business data. This combination enables decision makers to better understand behavior and outcomes of events [13], [14]. Combining multiple related prediction models allows supporting even more complex areas such as risk management or business case validation. Predictive analytics goes beyond to indicate what needs to be done – it also shows the how and when and allows the creation of "what-if" scenarios [15]. However, it is important to note that predictive analytic models are not able to make definitive predictions. They more likely turn uncertainty in projects, transactions or other events into probability that can be used by individuals to shape their decisions. Because the predictions are not completely definitive it is important utilize the insights in conjunction with other decision support approaches to increase the likelihood of project success[15], [16].

Especially in risk management, policies and regulations generally need to be comprised for the risk decision creation, which define how risk assessment itself can be set up or might even constrain the decision. Generally, risk can be assessed judgmentally with the help of experts. However, data-driven approaches, such as predictive analytics, are generally preferred whenever possible as they provide empirical and fact-based justification. Furthermore, it is important to be able to fully explain risk decisions. Only explainable predictive analytic models that clearly show what is behind the prediction are acceptable [17]. Therefore, the use of predictive analytic models to forecast the risk of a particular project or phase will likely become a core activity in project management [16].

3. Deloitte's Predictive Project Analytics Approach

Predictive Project Analytics (PPA) is a project risk assessment methodology that offers the possibility to predict potential risks at any stage of the project and identify areas where fixes for projects, transactions and programs are needed. It is based on quantitative, fact-based analysis of common attributes, allowing foresight of the likelihood of project success through predictive analysis of key project and organizational characteristics. This clearly supports the identification of struggling projects and therefore avoids consequences such as the costs associated with late or failed projects.

The technology behind Deloitte's PPA approach is a predictive analytics engine that is coupled with an analytics database based on research carried out over several years by the Helmsman Institute in Australia. A wide range of over 2.000 projects, categorized by product type, complexity, management approach, and outcomes across multiple industry sectors are stored in a single database and allows comparing characteristics of the investigated project with previous ones. By combining these quantitative methods together with a database of empirical project data, PPA

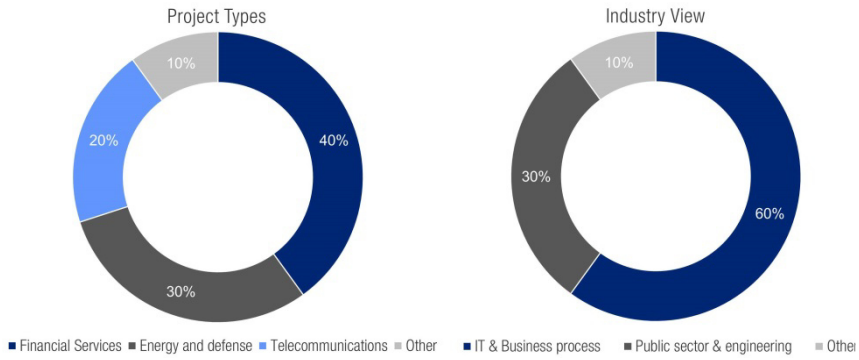


Figure 3: What makes up the PPA database?

can provide an objective assessment of the inherent complexity and specific management characteristics. A key part of the analytics engine is the Helmsman Complexity Scale, which measures the complexity of projects across multiple domains and industries in order to predict potential risk throughout the project lifecycle. Additional sources of data, methodologies, and benchmarking information are utilized together with business and analytics expertise to increase the accuracy in predicting project complexity and risk. The approach itself focuses on early value, as especially early stages of projects benefit from an antecedent analysis of complexity and the required levels of control critical for project success. Results can be prioritized as PPA can tell which characteristics would be most closely correlated with an increase in the likelihood of success and allows the realization of efficiency gains by reducing or eliminating unnecessary project controls in uncritical areas. Using Predictive Project Analytics allows organizations to better understand project complexity against maturity of existing governance models and control mechanisms in order to identify and avoid sources of failure. This can result in strengthening attributes that positively impact project success while minimized productivity, financial or reputation-based losses.

The practice of predictive project analytics requires a methodology to help ensure the proper management of risk and the highest value return from the project. The methodology guides the organization through the project lifecycle and provides an objective and independent assessment of program or project issues and risks for management, regulators, executive board, and other key stakeholders. Furthermore, investment can be protected by identifying gaps in existing governance models and by validating that the project is aligned with business needs. The main goal of Predictive Project Analytics is to predict a project's potential pitfalls and clearly identify ways to manage project risk and costs. This takes place across five constitutive stages, which progress from risk and complexity assessment to reporting (see figure 2).

Unique Project Complexity Fingerprints

A combination of *+250 million permutations of unique project complexity profiles are possible*

Predictive insights linking project'(s) complexity fingerprint to its required performance execution controls.

Research was able to correlates complexity to project outcomes. Each project dictates its own degree of:

- project management/governance
- skilled teams and
- control levels

Step 1 Interviews and structured document review

The first step starts with interviews and document reviews to gather the first insights about the project. This step aims to develop a deep understanding of the project and organization itself. A series of meetings with core project team members is conducted to cover the internal perspectives of the project. Key stakeholder interviews are further used to get additional details about the external requirements of different stakeholder groups, as well as how each group adds value to the project. As an additional source of information, detailed reviews of core documents, including project plans, schedules, budgets, reports, and logs are taken into account to complete the picture.

Step 2 Inherent Risk and Complexity Assessment:

The next step of Predictive Project Analytics focuses on a deep evaluation of complexity against a predefined set of risk categories, based on the insights and data gathered in Step 1. In total, this step is based on an assessment of 29 variables within the five categories (1) stakeholder, (2) social factors, (3) ambiguity, (4) technical factors, and (5) project management. Stakeholders cover the number of stakeholder groups, stakeholder alignment and power of stakeholders. Social factors focus on the types of user that impact the project outcome and also the breadth of change across the organization. Uncertainties of the used approach, the needed assumptions and decisions as well as clarity of project scope and cost estimations are covered with the Ambiguity category. Technical factors, covers all risk factors that are related to

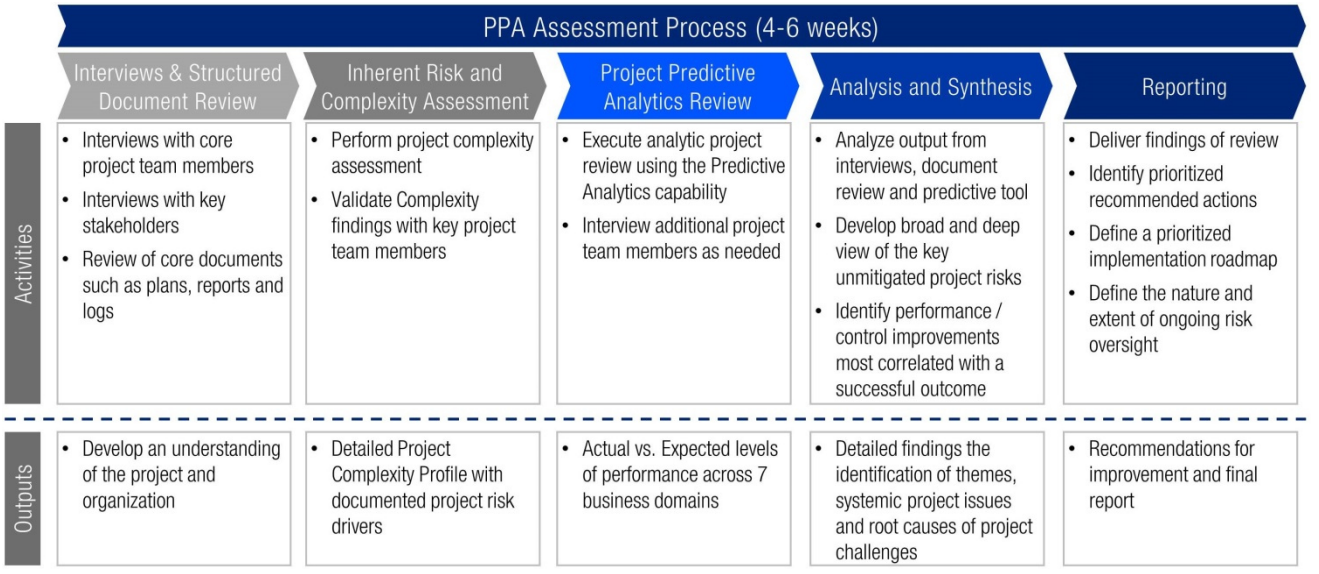


Figure 4: Deloitte's Predictive Project Analytic approach

technology, such as infrastructure impacts, integration and development complexity, and the availability and experience of available technical staff. Lastly factors such as team experience, team size, project structure and timeframe are assessed under the project management category. In this early stage, often also called Gate Zero Review, a detailed assessment of the project's risk and complexity is conducted with help of these 29 variables in order to determine the level of controls and governance required to deliver a successful project. Furthermore, all complexity findings are validated with project team members that own the particular area to make sure to create a strong main pillar for the following stages.

Step 3 Predictive analytics project review:

Next, all of the background information is entered into our predictive project analytic tool, which produces a correlation between project complexity, controls and success using a database of thousands of projects. An effective assessment of softer factors such as leadership and decision-making is then incorporated into the model. The application of predictive analytics to key project attributes, which produces a correlation between project complexity, controls, and success, is the core activity in this step. For the level of complexity determined in stage one, a benchmark of the project against projects with similar complexity profiles is part of the process. This indicates whether the overall level of project processes implemented were above or below expectations. The stage relies heavily on the repository of past project data and an effective assessment of softer factors, such as leadership and decision making, by analytics and business experts.

There are seven business domains, and a total of 172 individual project management characteristics within the database that will be involved in the analysis. The domains in this step include control categories such as details about governance, ownership, and business units. Furthermore, specialized management areas like delivery-, resource-, risk-, and contract management are covered in these domains. Answering these additional execution-related questions requires a good working knowledge of project management theory and familiarity with how the project is being managed. The individual questions are structured similarly to a maturity model, asking users to select the answer which

Figure 5: PPAs seven Control Areas

best fits the activity on the project side. Once the project has been assessed against all of the characteristics, the system provides a normalized graphical output showing how the project compares to expected control levels, across seventeen categories of characteristics. Using the expected level of project performance generated based on project complexity, a comparison between actual and expected project performance is generated for each individual characteristic. The whole process from assessing project complexity over the project performance and control assessment up to the delivery of results is visualized in figure 3.

Step 4 Analysis and synthesis:

The fourth step focuses on expert analysis as well as a synthesis of the complexity assessment and the project review in order to infer trends and themes from the data. By aggregating the qualitative and quantitative results from the structured and experiential review as well as the predictive analytic tool, a broad, deep view of key unmitigated project risks and an identification of specific control improvements is gained. Furthermore, governance and performance execution areas that need to be adjusted, implemented, monitored or enforced to enhance the likelihood of project success are highlighted in this step. These new insights can be utilized to support the achievement of a successful outcome and supplement flexible and scalable solutions for existing project management methodologies and control functions.

Step 5 Reporting:

In the last step of the PPA methodology findings need to be delivered in a format that makes sense for the project organization and management. A selection of commonly used predictive project analytic reports for these stakeholder groups is shown in figure 6. One of the main goals of these reports is to provide practical recommendations and prioritized actions to help address or avert identified project risks. For this purpose specialized reports are created in order to answer specific questions posed by the project management. Executive Dashboards allow company executives and managers a quick and easy way to view the complexity or execution related metrics and drill down to a deeper level of detail if needed. A side-by-side comparison of projects permits identifying systemic issues within project execution and management, as well as areas that are consistently over controlled by

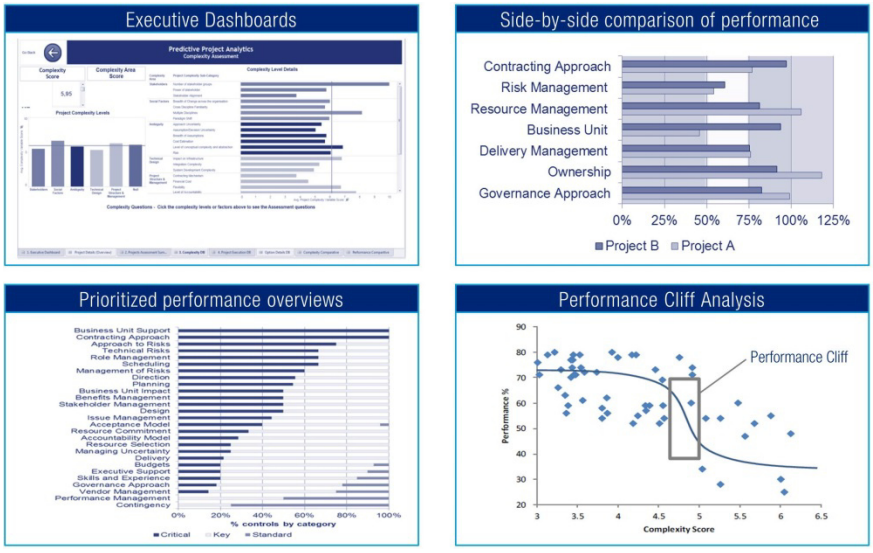


Figure 6: A range of different report types in Predictive Project Analytics

comparing similar projects directly. Prioritized performance reviews provide additional insight in project prioritization and fiscal planning. They support stakeholders to better manage risk levels related to complexity across project portfolios. Another frequently used report type in PPA is the performance cliff analysis. It allows understanding at what level of complexity projects begin to decrease in effective execution within an organization. It further helps to leverage existing data in order to uncover organizational project management capability strengths and weaknesses.

Following the five-step-approach allows identifying potential pitfalls and ways to manage project risks and costs by utilizing the experience and insights from past projects.

4. Areas that benefit from PPA

Several areas within or around project management, as shown in figure 7, can benefit from predictive analytic approaches and the ability to predict future events. First of all it is possible to apply PPA to inflight projects in order to assess areas of concern or with a high chance of turnaround within high-risk projects, with the help of quantitative risk data. During projects, predictive analytics acts as an additional source of data and provides actionable measures which can be used to improve the probability of success. Also applicable is the use of predictive analytics in project portfolio management. The previous mentioned performance cliff analysis can be utilized to find out the optimal level of manageable complexity based on organizational capabilities, which allows allocating the right projects to the right project teams. Additionally predictive project analytics allows improved capital efficiency by maintaining a favorable probability of project success, the ability to prioritize the right projects and supporting the ones that need additional attention. In the area of Merger and Acquisition (M&A) integration, planning and execution can be optimized by providing executives and management levels with quantitative risk data which allows handling inherently complex M&A activities. Resource management within projects can benefit from analytics through leveraging predictive insights to effectively allocate available resources to the right projects, and to engage the optimal level of internal or external expertise needed for successful projects. Knowledge management is critical during and after each project. Predictive analytics can support this area as well by making information more manageable and easily accessible. Further it drives comprehensive project planning by highlighting potential pitfalls and ensures that knowledge capital is effectively managed and retained within the organization. Lastly, internal project review processes can be enhanced, as predictive project analytics allows stronger and more effective risk management. The insights from the control and performance analysis further allow the enhancement of existing frameworks and project control functions through the application of additional insights. Consequentially, the use of predictive project analysis is not limited to the areas listed above, as the approach is still quite new to project management.

Figure 7: Downstream processes and areas that can benefit from PPA

To determine if an organization would benefit from using predictive project analytics an assessment of the several areas of expectations is necessary. Listed following are four exemplary questions that could be asked to determine if the use of predictive analytics would be beneficial for an organization:

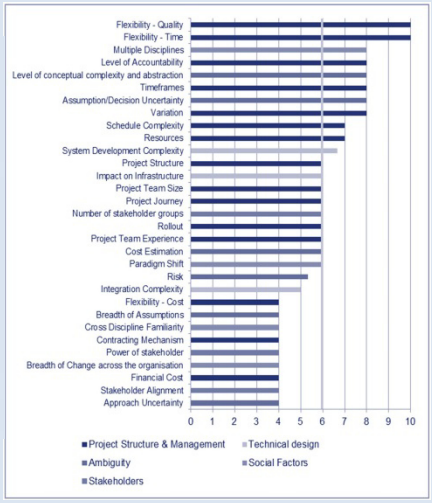
Client Example: Global SAP GNFR implementation

Background

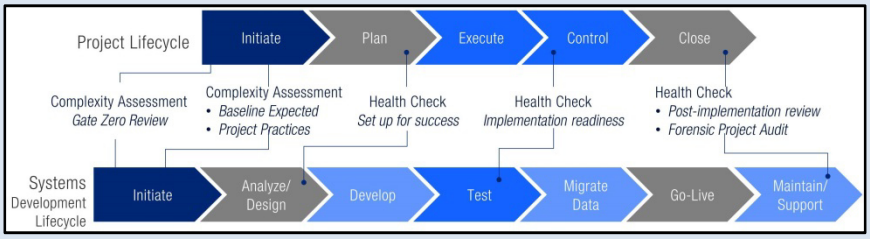
Three months ahead of go-live for a global implementation of a SAP GNFR system (indirect procurement solution), the client requested an independent review of its project to ensure it was positioned for success during deployment.

Key outcomes

- Assisted the vendor to identify and resolve the key issues impacting the schedule
- Reviewed and redesigned the project delivery approach to accelerate project completion by 12 months
- Advised and coached senior project management around the new delivery approach
- Reset the engineering change management and commercial approach of the vendor



Value across the lifecycle:



- How often do key projects meet the cost, timing, and performance requirements of stakeholders?
- What is the impact of projects across people, processes, and technology that have failed to meet stakeholder expectations or even failed entirely?
- What advantages would the company gain if key projects were successfully completed? For example would success allow attracting better talent, gaining additional market share, or transforming operations?
- Can the organization afford the use of predictive project analytics and do they have the necessary capabilities to utilize the full power of the approach?

Questions like these help in determining the objectives of an organization and whether dedicated PPA approaches should be adopted instead of a "one-size-fits-all" approach. Reflecting on the answers to these questions can give an organization the indication of whether predictive project analytics would be a valuable addition to existing project management techniques and procedures.

4. Conclusion

Project risks and suggestive mitigation strategies were predicted for years, based on experience, knowledge and various risk methodologies. Predictive project analytics, the application of the predictive analytics data science discipline in project management, allows the assessment of risks by utilizing data and intelligence with an approach that goes beyond individual expertise. By gaining an objective overview of project risks, exposing areas of improvements, and identifying specific measures, predictive project analytics allows the realization of many benefits. Utilizing the analytic approach in the right way allows the protection of project investments by assessing the different project phases and monitoring emerging project risks. Project costs can be lowered by an independent assessment of project budget adequacy and ongoing budget needs. Furthermore the likelihood of project success can be increased by predicting what can go wrong before it actually does. In sum, organizations can benefit from predictive project analytics in many different ways.

However, predictive project analytics is not the Holy Grail for project management and is not able to simply solve all approaching challenges. As with all approaches, procedures, or technologies it is necessary to meet several requirements on the organization, project and individual level in order to fully utilize the power of predictive analytics. Answering the questions for the complexity as well as the control and performance assessment requires a deep understanding of participating individuals about the project. Additional sources of data, such as manuals, guidelines, and logs, need to be available and up to date. Also strong senior management support is needed to drive the results of predictive project analysis, communicate them to all stakeholders, and implement the recommended areas for optimization thoughtfully.

If these requirements are met, predictive project analytics promises to be a valuable asset to project management and a potential source of new insights about new projects.

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