Will Data Science Change Project Management Forever? A Future Vision[1]

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Abstract

Data science is impacting a number of professions, yet its influence on project delivery is limited. Reports have been published on the future of project management but the timescales in which this future becomes a reality are beginning to compress. How will data science impact project delivery and how do we prepare for a future that will transform the project management landscape forever.

Keywords: Project data analytics, data science, project hack, vision for project management, future for project management.

Introduction

In 2017 the Association for Project Management, Arup and University College London published a report on the future of project management. It provides a vision for how project management may develop in the future, highlighting the increasing role of data science and analytics. But is the vision bold enough and will the pace of change be faster than envisaged?

In December 2017 the author launched the first London Project Data Analytics Meetup. Since then it has grown to a community of over 1200 people and in August 2018 alone it grew by 20%. It now has the support of PMI UK with a growing level of interest across other institutions.

> The meetup was created to *'share best practise on leveraging data within a project, programme and portfolio environment. We all know that data has the potential to transform how projects, programmes and portfolios are delivered, but practical implementation constraints often prevent the full value from being realised. This meetup will explore some of the challenges at the intersection of data analysis and project, programme and portfolio management and discuss how practitioners are working to resolve them, underpinned by real world examples. We'll also explore how machine learning and AI can help to resolve some of the challenges at the intersection of project / programme management and big data'.*

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There is a huge thirst for knowledge, insights and understanding on how data science may influence the future of project management. The meetup has also established `project:Hack` which aims to bring together data scientists, analysts, project professionals and subject matter experts to explore new boundaries and ignite the professional imagination on what can be achieved by working together. This paper is a product of the insights acquired from working with this community.

Background

In Dec 2017 the National infrastructure Commission (NIC) published the report 'Data for the Public Good', highlighting the huge opportunities for co-ordinating and sharing infrastructure data. In July 2018 the UK Government responded, agreeing with the NIC that *"greater data sharing has the potential to further modernise our construction industry, improve the productivity of our infrastructure and support the UK's digital economy"*.

The primary focus of this work is associated with Building Information Modelling (BIM) and the creation of digital twins rather than improving the performance of how projects are delivered. This misses a huge opportunity for society and is something that I am campaigning to influence.

Crossrail

Crossrail is one of the UK's largest ever infrastructure projects. It aims to increase rail capacity within London by 10%, delivering new services through 42km of new tunnels, at a cost of £15 billion. As a major piece of publicly funded infrastructure it has a mandate to share the good practice and lessons learned from the project with society at large. This principle is established as policy, yet the concept of a learning legacy only applies to a small handful of projects. Why does such a policy not apply to the 133 projects within the government major projects portfolio (GMPP) with a value of £423 billion? But this is only the tip of the iceberg, there are thousands of projects that fall outside of the GMPP, which all contain insights and experience which could influence the delivery of future projects.

> *"Passing on the lessons and good practice that we have learned at Crossrail is an absolutely essential part of raising the bar in the delivery of major projects. With an unprecedented number of infrastructure schemes around the corner, now is the time to start sharing what we have learned so the UK can build on its reputation for delivering on time and on budget"* ***Andrew Wolstenholme, Chief Executive, Crossrail 2011-2018***

> *"The IPA is wholly committed to ensuring the UK's delivery of major infrastructure projects is achieved efficiently and effectively……the more we can learn from the experience of others the closer we will come to flawless project execution."* ***Tony Meggs, Chief Executive, Infrastructure and Projects Authority (IPA)***

Although Crossrail shares insights on its processes, methods and lessons learned, the data acquired as a product of the project remains locked away. Some of this data will be handed over to Rail for London to support operation of the railway, but much of the project delivery data will be archived and may never see the light of day again.

As a once through project Crossrail doesn't have any responsibility to leverage this experience; it is not part of its mandate. Unfortunately, it is not part of anyone's mandate. There lies our biggest challenge. Organisations do not yet understand or value the insights, knowledge and experience that reside within the data acquired as a by-product of delivery. The investment case to forensically analyse this data has not yet been made. In 2017 the IPA launched 'Project X' to try and tackle this challenge. Its mission was a sound one, but it has struggled to gain traction.

There is a need to refresh the vision and work collegiately, across all sectors, to deliver it.

A Vision

Data science will impact project delivery at every level. From the automation of routine tasks through to the application of the knowledge and experience of past project delivery to future projects.

Conceptually, if we aggregate the knowledge of every project ever delivered we should be able to apply this knowledge to improving how projects are delivered in the future. Machine learning works by digesting huge volumes of data and identifying patterns within that data. These patterns will enable us to get a better understanding of what conditions a project, team or organisation are predisposed to. We can then implement measures to sense when these conditions are likely to arise. Machine learning can then provide evidence driven probabilistic recommendations on preferred courses of action, tailored to the specific circumstances of the project and leveraging the body of data from all projects that have gone before.

This possible future is not a pipedream. The technology already exists and is being used across a range of industries. Our challenge is to understand what we would like to achieve and deliver a roadmap for achieving it. There will be a number of challenges along this journey associated with data availability and confidentiality, but these are surmountable if we work collegiately with the ultimate aim of transforming how projects are delivered.

Some examples

Crossrail. The Crossrail project contained over £3 billion of change requests and risk drawdown. Which of these change requests were foreseeable? How could we mitigate them in the future? Which are specific to Crossrail and which could be applied to similar major infrastructure projects? If we consider the schedule as an aggregation of planning modules, which modules can we reuse in future projects; how can we use the aggregated performance of specific activities to shape the scheduling of future projects? How can we use these insights to take informed views on resourcing profiles? How can this evidence be used to challenge bias?

Tram projects. The Edinburgh Tram project had an original budget of £375m and the final overall project cost was £776.5m, for a route which was substantially reduced from the originally approved concept. It has been subject to public enquiry at a cost exceeding £8m. The Rotherham to Sheffield tram was investigated by the National Audit Office and Public Accounts Committee who explored the reasons behind the increase in costs from £15m to £75.1m. Reports will be written and lessons will be documented, but are they really learned? There is a raft of evidence that indicates that it won't be. In the last 6 months of 2018 alone the UK Government Public Accounts Committee commented that "Yet again this is poor contracting by Government with one of its major suppliers and it must learn lessons", "Department still does not seem to be learning lessons from high-profile.. failures" and "the Department has failed to learn the lessons from previous failures .. and has again allowed the operator to promise more than it could deliver". Data may help to explore a different approach; evidence based insights and recommendations tailored to the circumstances of the project at the point of need, rather than trivial statements that many would regard as obvious.

If we understand what has tripped up a previous project we begin to understand a project's predisposition to variance. We can characterise the probability and impact of this variance using evidence, rather than intuition based estimates. Data also provides the information to support reference class forecasts; not just on project out-turn, but on specific work, product or cost breakdown elements. Although there is value in individual data elements, the transformational value begins to emerge from the connections in the data.

Organisations such as nPlan and ALICE are reshaping the face of project scheduling. By ingesting hundreds of millions of schedule tasks they are able to understand context and detect patterns in task performance and schedule adherence. From this they are able to generate evidence based predictions rather than basing multi-million decisions on intuition.

If we begin to connect schedule data with other data then further insights begin to accrue. By connecting schedule data with weather data we gain evidence into the impact of weather on construction. Schedules, resources, procurement, equipment hire can be automatically replanned in real time based on the weather forecast. This capability is already beginning to emerge.

Projects maintain risk registers and track these risks throughout the project. But they are used to look forward, rather than conducting forensic analysis on how the risks evolved, whether they could have been avoided or whether a change in approach could have reduced variance. By aggregating this data we are increasingly able to 'avoid the avoidable'. We can approach the Board and make investment decisions on the basis of evidence, making hard decisions with a probabilistic understanding of the implications of different courses of action.

Programmes realise benefits but how many forensically review the variance between the original sanction and final outcome? How many benefits are underdelivered because actions were taken late or insufficient resources were applied? Is the benefits map for a particular project credible and how does it compare with others; is it possible to use machine learning to assist the creation of the benefits map? Data analytics will allow us to aggregate this

information, connect it with schedule, resources and other parameters and extract insights that will challenge every step of the journey. Such an approach will enable us to address many of the benefits management challenges identified by the UK's Infrastructure and Projects Authority.

Within Agile projects we may not have access to schedules and risk registers, but there is a swathe of data on story points, burndown charts, minimum viable products and the impact of these on delivery of outcomes. Although Agile projects conduct retrospectives do they really understand whether the route was optimised. An analogy is a ship in the ocean, continually adjusting its course to respond to conditions; if we aggregate these trajectories are we able to derive a more efficient route, with better outcomes?

Aggregating data

The key to enabling all of this capability is data. If every organisation that aspires to develop new methods, algorithms or approaches has to identify, correlate and integrate data, the barriers to entry become overwhelming. Whilst such an approach may favour the larger consultancies, it will stifle innovation at every level.

In order to overcome this there is a need to aggregate project data within a trusted environment. The concept of data trusts is beginning to emerge and this has significant merit in tackling how we combine and aggregate data, whilst protecting commercial sensitivities. If we are able to find a solution to this challenge we will open the door to a wealth of innovation that will initiate a revolution in how projects are delivered. It's a subject that I am working hard on and I hope to publish more on in the coming months.

Conclusion

Project managers tend to look forward, keeping their eye closely fixed on the road ahead. The rear view mirror is a point of historical reference, but it provides limited benefit to most project managers other than accrued personal experience. By aggregating the data that emerges as a by-product of project delivery there is an opportunity to transform how projects are delivered.

The volume of data needed by the algorithms demands a solution that extends beyond organisational and sector boundaries. Such a solution may be a data trust, working for the benefits of the community that it serves.

As a consequence of advanced project data analytics, project managers will have access to evidence based insights into the predisposition of specific projects to variance, the triggers for that variance and how they may be avoided or mitigated. By applying relevant experience stakeholders will be able to develop an outside view on their project and its trajectory, challenging inaccuracy, bias and strategic misrepresentation.

It's a fascinating future and one we need to actively engage with otherwise the project management profession will become increasingly obsolete, replaced by those proficient in data science and analytics. We will publish a follow-on paper on this subject in the coming weeks.

About the Author

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Martin Paver, Data Scientist, Registered Project Professional, Chartered Engineer, BEng, MBA, MAPM, MIMechE, is CEO of Projecting Success Ltd. and Founder of the London Project Data Analytics meetup.

Martin is a Registered Project Professional with the APM and a Chartered Engineer with the IMechE. He is the CEO/Founder of a P3M and data science consultancy called Projecting Success who help project organisations to connect and understand their data for a more certain, evidence-driven project delivery by analysing historical and real-time data to discover insights and make recommendations with improved confidence in outcomes. He has 30 years of delivery experience spanning senior strategic roles across government and the private sector, led projects of up to $1bn, both client and supply side and he also led a PMO for a $multi-billion portfolio of ICT projects.

In late 2017 Martin established the London Project Data Analytics Meetup, the UK's largest community that combines the cutting edges of data science and project management ranging from hosting talks, delivering hackathons through to influencing future thinking on project data science. He has also been instrumental in establishing a project data analytics work stream within the APM, helping to shine a light on the art of the possible and facilitate the development of a new cadre of professionals.

He is on a mission to leverage the benefits of advanced data science for the benefit of the project management profession, ensuring that we shape the direction of the industry and prepare us for a new future.

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