

Metrics for Measuring Innovation in Integrated Project Delivery

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Abstract

The research project evaluates different infrastructure project delivery methods used internationally. The goal is to define the main benefits, deficiencies, and requirements of the project delivery systems for both the short term and long term perspectives. Also, the research attempts to determine alternatives to modify and to promote change in the current infrastructure project delivery methods in order to make the processes more efficient with value added benefits to all participants.

Keywords: Innovation, Integrated Project delivery, Metrics

1. Introduction

Integrated project delivery has been billed as a means by which project owners can encourage and receive the benefits of innovation in design, construction, and project management. For purposes of this project, "innovation" is defined as the successful implementation of an idea, system, or product that is new to the organization that adopts it. This research seeks to develop a means by which innovation in integrated project delivery can both be defined and measured. The research will focus on identifying incentives for and barriers to integrated project delivery innovation. It will seek to distill a set of best practices based on rigorous analysis of case study projects that establish the proper incentives to encourage innovation in integrated project delivery.

2. Solution

Today's utilities need to ensure that capital projects are delivered to specification, on-time and within budget.

With reduced margins in today's economy, this has become imperative now more than ever. The difference between a successful project (delivered on-time and under budget) vs. an unsuccessful one (scope problems, schedule slippages or rising costs) can usually be attributed to one main factor: the delivery methodology.

Because of the diverse nature of the global construction industry and the fact that it involves many interrelated areas and disciplines it is important to understand the applicability and relevance of innovation.

Innovation is about the creation of new ideas and thinking that can be applied in one form or another to provide a solution to a problem through public and private organizations that transform knowledge and technologies. It may be the direct result of creativity or it could be developed from the outcome of a defined programme of research. A high rate of innovation in turn contributes to more intellectual capital, market creation, economic growth, job creation, wealth and higher standard of living. A dramatic change in the approach to innovation is now required if we wish to sustain our competitive advantage.

2.1 Sources of the innovation

- 1) Strategic: decisions concerning the methods of project delivery, and types of innovations to attempt there.
- 2) R&D: Experimental development that goes beyond

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and applied research:

- a) Basic research for expanding knowledge about fundamental processes related to the project delivery in the firm;
 - b) Strategic research (research with industrial relevance but no specific application) to broaden the range of applied projects that are open to the firm, and applied research to produce specific inventions or modifications of existing techniques;
 - c) Develop project delivery concepts to judge whether they are feasible and viable, a stage which involves: i) prototype design; ii) development and testing; and iii) further research to modify designs or other functions.
- 3) Non-R&D: activities that do not have straight forward relation to R&D, and are not defined as R&D, yet play a major role in innovation and performance:
- a) identification of the new integrated project delivery concepts and process techniques:
 - i) via relations with organisations
 - ii) via design and engineering capabilities;
 - iii) by monitoring competitors;
 - iv) via using consultants;
 - b) Development of pilot and then full scale facilities;
 - c) Purchase of technical information, paying fees and royalties for patented inventions (which usually require research and engineering work to adopt and modify), or buy know-how and skills through engineering and design consultancy of various types;
 - d) Investing in intermediate inputs which embody the innovative work of others;
 - e) Management systems and its methods reorganisation including new types of inventory management;

3. Metrics for measuring innovation

3.1 Revenue growth from new integrated project delivery

It is based on strategic targets set by the project owners and an understanding of how the company can achieve its growth targets (the Innovation Gap).

3.2 Idea submission and flow

The ideas flowing through an idea management

system provide a visible reference point to the volume and quality of submissions.

3.3 Innovation capacity

Companies measure innovation capacity using survey tools such as KEYS, the Innovation Climate Questionnaire or other tools and use the information on a 12- to 24-month basis to determine whether the company has become more innovative.

3.4 Ideas

1. No. of ideas generated in the process
2. No. of workable ideas
3. Ideas with minimum cost
4. Savings / Benefits because of the ideas

3.5 R&D spending, cooperative alliances and pressures of competition.

However, informativeness, i.e. the capacity to turn innovation inputs into innovation outputs (the latter, for instance, being gauged by the share of innovative delivery method in a company for receiving the benefits in design, construction, and project management), usually remains in the sphere of the mystic.

4. OUTCOME METRICS

We can't improve what we can't measure. So metrics must be developed based on the priorities of the strategic plan, which provides the key business drivers and criteria for metrics that managers most desire to watch. Processes are then designed to collect information relevant to these metrics and reduce it to numerical form for storage, display, and analysis. Decision makers examine the outcomes of various measured processes and strategies and track the results to guide the company and provide feedback.

So the value of metrics is in their ability to provide a factual basis for defining:

- Strategic feedback to show the present status of the organization from many perspectives for decision makers
- Diagnostic feedback into various processes to guide improvements on a continuous basis
- Trends in performance over time as the metrics are tracked
- Feedback around the measurement methods themselves, and which metrics should be tracked
- Quantitative inputs to forecasting methods and models for decision support systems

The goal of making measurements is to permit project managers to see their company more clearly from many perspectives and hence to make wiser long term decisions.

"Modern businesses depend upon measurement and analysis of performance. Measurements must derive from the company's strategy and provide critical data and information about key processes, outputs and results. Data and information needed for performance measurement and improvement are of many types, including: service performance, operations, market, competitive comparisons, supplier, employee-related, and cost and financial. Analysis entails using data to determine trends, projections, and cause and effect - that might not be evident without analysis. Data and analysis support a variety of company purposes, such as planning, reviewing company performance, improving operations, and comparing company performance with competitors' or with 'best practices' benchmarks." A comprehensive set of measures or indicators tied to customer and/or company performance requirements represents a clear basis for aligning all activities with the company's goals. Through the analysis of data from the tracking processes, the measures or indicators themselves may be evaluated and changed to better support such goals."

4.1 Incentives for and barriers to innovation in the integrated project delivery process

- 1) The general objective here should be to relate the technological assets and strategies of firms to the scope of their sources of information for innovation and to the obstacles which they perceive. Most firms have a wide range of potential sources of technical information. Their importance will vary with the firm's technological capabilities and strategy.
- 2) It is important to distinguish between internal and external (or endogenous and exogenous) sources of change. Internally, interest is likely to focus on the role - or roles - of the R&D department, and the involvement of all parts of the firm, particularly the design and construction side, in decisions to innovate and on innovation activities. Externally, the focus will be on public research institutions as sources of technical information, and on inter-firm or inter-industry technology flows. Consideration of external sources of innovation or technological change ought logically to extend to international sources of technology, and be structured in such a

way as to throw light on some of the unresolved problems with the technology balance of payments.

- 3) A problem to be resolved here is the classification of firms that is used to analyse technology flows for integrated project delivery.
- 4) The underlying issue here, which has considerable significance for policy, is that relatively little is known about what factors of environment, opportunity or regulation actually determine the locus of innovation in complex networks of organizations where innovation can obviously occur at a variety of places.
- 5) Obstacles to innovation are significant for policy as well, since a good proportion of government measures are in one way or another aimed at overcoming them. Many obstacles - skill shortages, problems of competence, finance, appropriation - are relatively straightforward to assess with survey methods.
- 6) Lack of availability of data is likely to be a problem in some aspects of measuring innovation performances. This problem may be addressed in some cases by partnership with groups such as Design Build Institute of America, (DBIA). In other cases raw data will have to be specially collected.
- 7) Identifying Risks: Early in the project, the team identified and documented potential risk events that might be barriers to the success of the project, and formulated plans to mitigate the risks should they occur. Some of the risk factors included: Organizational Inertia, Fear, Availability of funding, Availability of data, Lack of skills necessary to implement process, Improvements.
- 8) Change control addressing both delivery and project plan changes. Since change can occur in both areas and since these areas are interdependent, change control mechanisms must address all steps necessary to approve or reject any change requests. The process must formally recognize that new requirements may create new work.
- 9) Allow linking of scheduled work to requirements. All team members must be fully informed as to the requirements they are working to achieve. Conversely, should some work be delayed, managers must have a tool to find out what requirements are a priority or now at risk.
- 10) Problems may arise because of lack of multidisciplinary research, Low connectivity, Diverse research base which is broad but not deep and when R&D budget relatively small, they can be overcome by collecting proper data, good funding

and skilled personnel.

4.2 Examples of actual innovation to achieve desired innovation

Many countries around the world are attempting to answer the key challenges to the construction and maintenance of the infrastructure networks that are essential to the economic stability within their respective countries. Society is rapidly changing and public clients are trying to meet the critical needs of this fast-paced society. Aging infrastructures, cost escalation, limited resources, productivity, acute regional development, environmental issues, and sprawling growth are causing concern to the

management and administration of infrastructure networks. There are strong incentives for seeking alternative and innovative means to procure the main foundations of society and maintain economic stability. The study, called "Innovative Project Delivery Methods for Infrastructure - An International Perspective", attempts to demonstrate practices and

Methods that can be utilized by client organizations to more effectively secure products and services. The goal is to share some of the most innovative or at least the most progressive methods used in several countries. It is important to distinguish between the delivery methods used for "Capital Projects" and "Maintenance Contracts". The details contained in the report are from data and information gathered mostly from the road sector, but they have implications that can be utilized in other infrastructure sectors, as well. The countries included on that study are Australia, Canada (Alberta, British Columbia & Ontario), England, Finland, New Zealand, Sweden, and the USA.

4.3 Examples of actual innovation of failure to achieve desired innovation

Most software projects can be considered failures or at least partial failures because few projects meet all their cost, schedule, quality, or requirements objectives. Failures are rarely caused by mysterious causes, but this cause is usually discovered post-mortem, or only after it

is too late to change direction.

5. Conclusion

Project delivery methods can be considered as tools for a client organization when deciding to initiate a project. The type of project, client expectations, and many other criteria are inputs into the process the client decides to utilize when selecting a project delivery method. Also, as part of a client procurement strategy it would be wise to consider a healthy mix of project types for flexibility, maintaining competition, and project duration. More and more countries appear to be increasing the use of innovation in their new construction projects. Innovation is about the creation of new ideas and thinking that can be applied in one form or another to provide a solution to a problem through public and private organizations that transform knowledge and technologies. It may be the direct result of creativity or it could be developed from the outcome of a defined programme of research. A high rate of innovation in turn contributes to more intellectual capital, market creation, economic growth, job creation, wealth and higher standard of living. A dramatic change in the approach to innovation is now required if we wish to sustain our competitive advantage. Innovation is the key to progress and success. The industry must take a major step forward in understanding and realizing innovation on projects

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