CLIENTS DRIVING INNOVATION

Case Study

SOURCES AND EFFECTS OF UNCERTAINTY IN THE MANAGEMENT OF CONSTRUCTION PROJECTS: FEDERATION SQUARE

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ABSTRACT

Construction projects have an unmatched level of expertise gained through thousands of years and boast an array of planning and controlling techniques. Still, many construction projects are frequently delayed. This research explores the sources and effects of uncertainty in construction projects as the ultimate reason for project delay. The thesis tested by this research was that projects can only be managed to a certain point due to uncertainty. Because of this limit to managing projects, they are frequently delayed in spite of the implementation of best practice in construction time performance and the effort put into projects by its managers and team members.

Keywords: Project Management, Construction, Uncertainty, Federation Square

1. INTRODUCTION

The construction industry represents a sound percentage of the gross domestic product in Australia, 5.5% of all industries (AusStats, 2002), is the oldest project based industry[1] and uses state-of-the-art management and controlling techniques. Still, on-time completion of projects has always been an irritating concern (Hormozi and Dube, 1999).

If construction projects have been done for quite long time and are so relevant for our culture and economy, why have we not yet mastered a flawless technique for completing construction projects on time? The answer may be *"because we cannot*".

As in *figure 1*, projects can be plotted in reference to their success on a line with two opposite points: *complete project failure* and *complete project success*. Whilst the former refers to projects not being able to finish on time, to cost and quality, the latter contains those finishing on time, on budget and quality. While some projects fail, the use of sound project management tools and techniques allow project managers to lead projects closer to the *complete success* end. However, there is a limit to how close they can get to this end.

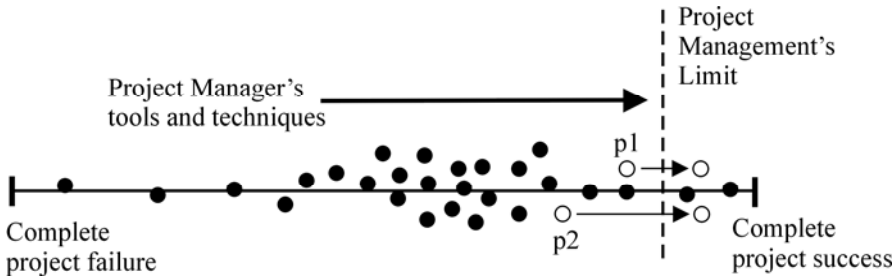


Figure 1: Project Management Limit

All projects between *complete project failure* and *project management's limit* vary only in how well they were managed and planned. However, the reason why some projects cross the *project management's limit* is because it is a possible outcome. That is, whilst a project manager's duty is to take projects as close to the *limit*, the fact that project *p1* crosses it, it is just because of chance. Project managers cannot take credit for that.

If chance is what helps projects to cross the limit; uncertainty is what prevent them from crossing it. This uncertainty is in fact a consequences of the physical characteristics ruling the environment in which projects are undertaken.

[1] Excavations at Terra Amata, France, showed dwellings dating from the Palaeolithic period which were built to specifications, involved planning and use of resources. (Fletcher, 1996)

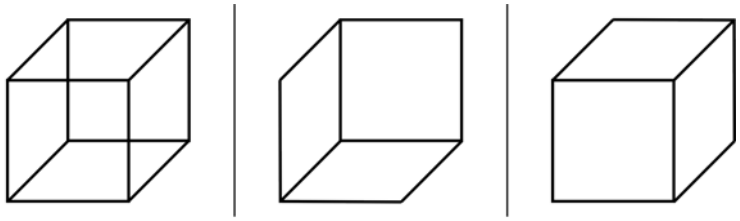
A very common mistake in the management of construction projects is to overlook the uncertain characteristic of the project environment and believe that projects are deterministic.

Determinism is the philosophical belief that every event is the inevitable result of preceding events. Therefore, every event can be completely predicted in advance, or in retrospect. (Coles, 2002) (Hawking, 1989)

For many centuries we believed that we lived in a deterministic world. Newton believed that the universe's behaviour was as regular as a clock work. That is, if the state of the Solar System, at any given time was known, one could predict its state in the future, as well as in the past, with complete accuracy. Nevertheless, in the early twenty century a twist in the scientific knowledge rendered Newton's deterministic model wrong. (Coles, 2002) (Hawkins, 1989)

The lost of a deterministic world not only meant shifting to new formulas or physics theories, it took away the power, or at least the illusion, to accurately predict and therefore manipulate the future. Not to mention the possibility of project managers playing god in their own projects.

Nevertheless, deterministic approaches are the standard on the management of construction projects. (Burke, 1999) It is not easy to leave the comfort of a deterministic world, the project manager dreamed world. However, this might be not only a whim, there are compelling reasons to believe that we have problems understanding, and therefore managing uncertainty. As Gigerenzer (2002) points out, even at unconscious level our perceptual systems automatically transform uncertainty into certainty. The Necker cube, *figure 2*, has ambiguous depth as its two dimensional lines do not indicate which face is in front and which is in back. However, we do not see it as an ambiguous figure, yet we see it one way or the other.



By staring at the cube **a)**, the perceptual impression shifts between **b)** and **c)**.

Figure 2: The Necker cube (Gigerenzer, 2002, p. 9)

If we cannot handle uncertainty, how can we manage projects that are undertaken under an environment that is ruled by it? Physics has proved to us that from the smallest, most elemental particle, the uncertainty principle, to large scale events, chaos theory, our environment is uncertain and produces unpredictable outcomes.

In an attempt to manage uncertainty we rely on probability. Therefore, we can say that a project activity has x% to eventuate. However, accordingly to

Kosko, (1994) probability maths comes from naked assumptions and not from a more general theory. Its axioms can be denied as easily as can be accepted, because mathematicians and scientists have arrive at them by will, by assumption. If you see apples falling from a tree, there is a *probability* that each will fall at a given time in the future. However, if this tree is recorded while its apples are falling and the movie is played backwards, the apple-falling probability never showed up. Where did the randomness go? Whilst probability and randomness is everywhere, we can only find the after-the-fact outcomes of random experiments. We see footprints, we can never catch probability in the act. (Kosko, 1994). In project management terms, once an activity has finished there is no longer uncertainty in its duration. It took as much time as needed and now there is no randomness when explained why it took the time it took.

Probability seems to be a psychological side effect of forward looking creatures. Probability is a physic instinct that help us organise our perceptions and memories and most of all, our expectations. (Kosko, 1994) Only forward looking creatures can conceive a discipline as project management, yet how much is project management possible and how much a created necessity to satisfy our instinct?

2. CASE STUDY: FEDERATION SQUARE

Detail of façade's geometry. Picture taken by Agustin Chevez.

Picture 1: Federation Square

2.1 SELECTION OF CASE STUDY

Whilst any construction project, from a small shed to a gargantuan size project is affected by uncertainty and hence suitable for this research, trying to draw conclusions for a whole group based on a sample demands carefully chosen representative samples, otherwise the information might be misleading. (Becker, 1998) Federation Square was chosen as case study because it is a high profile project, which used best practice for its management which reduced problems produced by poor planning. However, it was submitted to many variables and external pressures that maximised the effects of uncertainty on the project. Federations Square was also selected because research on project delays is difficult due to the fact that delayed projects are companies' well kept secrets. For this reason, information is difficult to access. However, being Federation Square a project under the public eye, its delays were not a secrete. Furthermore, they are well documented on public access information sources.

2.2 PROJECT OVERVIEW

Federation Square is a space that hosts a range of recreational, cultural, commercial, multimedia and entertainment facilities. Federation Square is situated in Melbourne's Central Business District. It is anticipated that 6 million people will visit Federation Square every year. (abc, 2003)

Federation Square is a Victorian Government initiative with support from Melbourne City Council and the Commonwealth Government. It is expected that the total project cost, once finished, can exceed 470 million AUD. (fedsq, 2003)(Misiak, 2003) (Report on Public Sector Agencies, 2003)

In 1988, the Government began the construction of Federation Square, Australia's biggest public project, before the designs were finished. In order to meet the project ambitious timeline, the project needed to be fast-tracked. (fedsq, 2003)

Federation Square was an enormous and challenging project, "*not just because of the scale and cost of the project, but also because of its complexity, its diversity of features, its topical and at times politicised nature as well as the logistics of managing such a large scale project in such a central, visible and contentious location.*" (fedsq, 2003)

2.2.1 Timeline

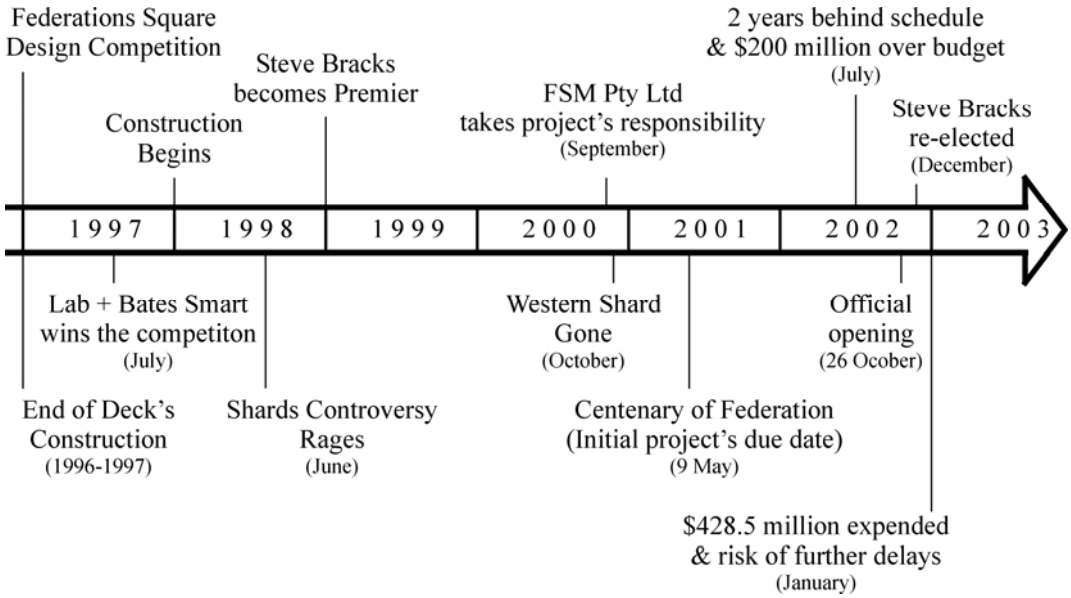


Figure 3: Timeline (abc, 2003)(Fedsq, 2003)(Misiak, 2003)(Report on Public Sector Agencies, 2003)

2.2.2 Political environment

Since its beginnings, Federation Square, was a politically driven project. Things got to the point that the State's Office of Major Project resigned out of

frustration over how the government was handling controversy. (abc, 2003) (Misiak, 2003)

2.2.3 Financial analysis

The development was expected to cost between $100 and $150 million AUD. However, the total cost of the project has reached $450 millions and is expected to cost $470 million AUD. Whilst Federation Square is a financial failure, profitability was not the main goal of the project, not even with its initial relatively low cost. (Misiak, 2003)

2.3 QUESTIONNAIRE

A set of carefully designed questions was compose in order to best asses the source and effects of uncertainty in Federation Square. In order to get an holistic perception of how uncertainty was perceived, understood and managed in Federation Square the selection of interviewees included project members from diverse areas. Following are the main 5 areas identified as relevant to the research.(archrecord, 2003)(fedsq, 2003)

1. Civil / Structural (Hyder Consulting, Connell Wagner);
2. Services (AHW Consulting);
3. Architecture (Lab Architecture, Bates Smart);
4. Quantity survey (WTP Melbourne);
5. General Constructor (Multiplex)

Next, are the questions send to 30 project members at different levels from the above companies.

QUESTION I

From the project management point of view, and using the following scale and list, please rank how these listed factors affected the development of Federation Square.

Scale:

1 = The factor had no impact in the project.

2 = The factor had little impact in the project .

3 = The factor had moderate impact in the project.

4 = The factor had an important impact in the project.

5 = The factor had a decisive impact in the project.

List of factors:

[ ] Complexity of the project (Design, construction)

[ ] Number of stakeholders

[ ] Political pressures

[ ] Planning

[ ] Project duration

[ ] Unforeseen situations

[ ] Completion date

[ ] Other (Please specify):_____

[ ] Other (Please specify):_____

[ ] Other (Please specify):_____

QUESTION II

How much do you believe that uncertainty affected the development of Federation Square?

[ ] It did not affect the development of the project

[ ] It moderately affected the development of the project

[ ] It was a major factor that affected the development of the project

QUESTION III

Do you believe that uncertainty in the management of construction projects is:

[ ] A characteristic of the environment under which projects are undertaken and therefore embedded to all projects.

[ ] A consequence of poor planning

[ ] Other (Please specify):

QUESTION IV

Do you believe that projects can be planned to their full extent?

[ ] Yes,

[ ] No,

2.3.1 Interviewee response and answers

From 30 questionnaires sent:

- 6 (20%) were answered;

- 15 (50%) were return unanswered because the employee does not longer work in the company. One of the reason for such a high percentage might be that teams could have been dissolved once the project reached certain level.

- 10 (30%) did not reply. The reasons are unknown.

Amongst those who responded were from the areas of:

- Civil;

- design; and

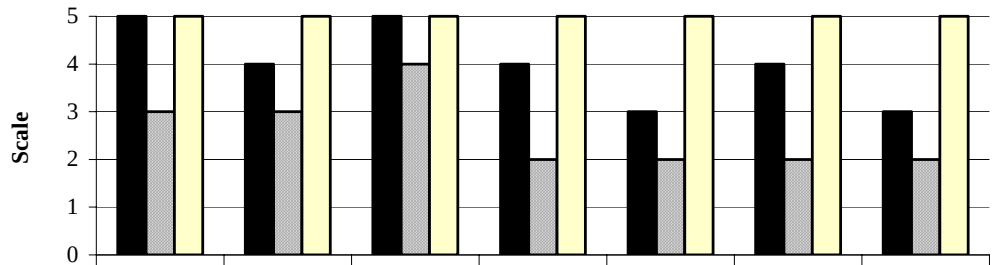
- quantity surveyor.

Following is a charted version of the answers to each question.

QUESTION I

Question = "*From the project management point of view, and using the following scale and list, please rank how these factors affected the development of Federation's Square.*"

Table 1: Results Chart 1 - *Question I*

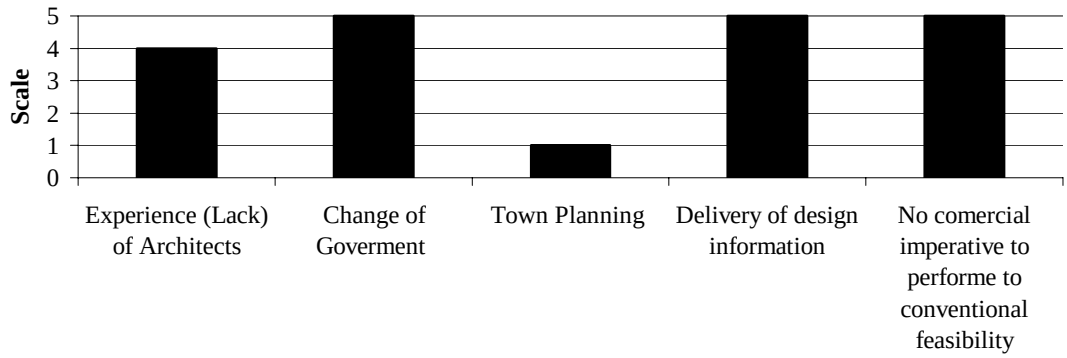


	Complexity of the	Number of stakeholders	Political pressures	Planning	Project duration	Unforseen situations	Completion date
Average	5	4	5	4	3	4	3
Lowest	3	3	4	2	2	2	2
Maximum	5	5	5	5	5	5	5

Scale
1 = The factor had no impact in the project.
2 = The factor had little impact in the project .
3 = The factor had moderate impact in the project.
4 = The factor had an important impact in the project.
5 = The factor had a decisive impact in the project.

The following answers were registered in the field "*Other (Please specify)*:" and ranked using same scale as above:

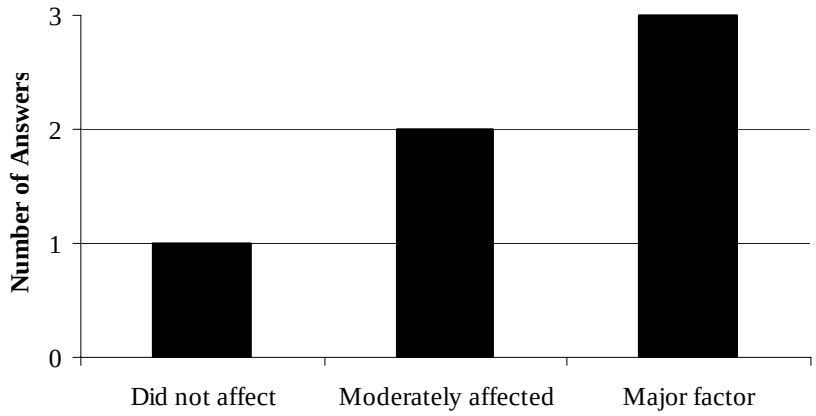
Table 2: Results Chart 2 - *Question I* – Comments to "*Other*"



QUESTION II

Question = "*How much do you believe that uncertainty affected the development of Federation Square?*"

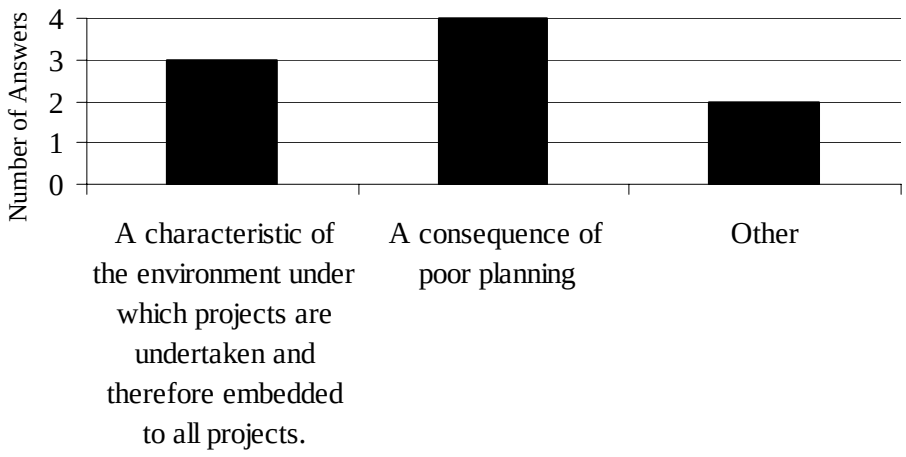
Table 3: Results Chart 3 - *Question II*.



QUESTION III

Question = "*Do you believe that uncertainty in the management of construction projects is:*"

Table 4: Results Chart 4 - *Question III*.



Some answers registered more than 1 option. Hence the number of answers add up to nine.

Comments on "Other":

a) "*A characteristic of the nature of the development of large scale projects; however that does not mean it cannot be properly managed, as many projects are delivered without such problems.*"

b) "*Client changes.*"

QUESTION IV

Question = *"Do you believe that projects can be planned to their full extent?"*

Table 5: Results Chart 5 - *Question IV*.

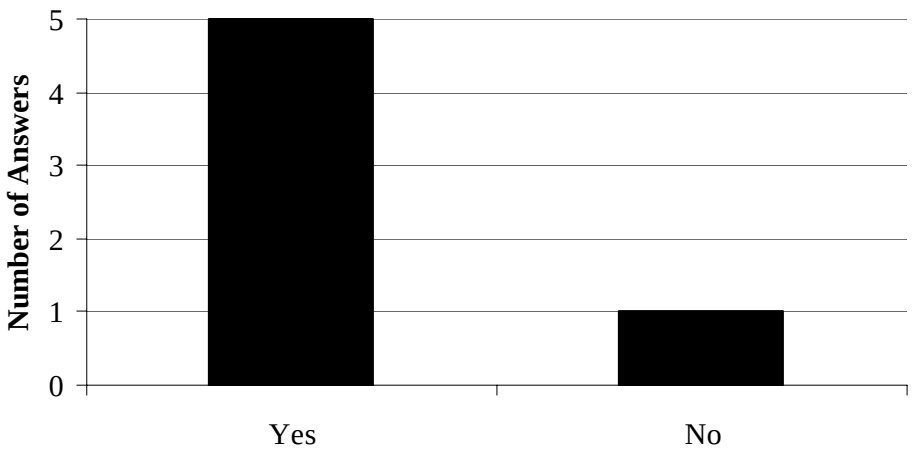


Table 6: Results Chart 6 - *Question IV* – Comments on "*YES*" / "*NO*".

Comments on "*Yes*"	**Comments on "*No*"**
"With proper briefing, team work, adequate time & cost."	*"Too many external variables. However planning (ongoing!) is important to the success of a project"*
"But the management of the planning in practice is more complex than the theoretical planning."	
"A commitment by the client and all team members to apply appropriate resources and management throughout the project is an essential ingredient for large scale projects."	

2.3.2 Analysis of results

As previously commented, the political pressures and complexity of the project were two major factors that affected the development of the project. However, in every answered questionnaire, every single option (*Complexity of the project, Number of stake holders, Political pressures*, etc.) was ranked as a factor that had a decisive impact on the project. This denotes that project's threats are perceived differently accordingly not only to the person, but to the role he/she plays in it as different responses were provided accordingly to this latter attribute. Hence, each project member will have a different conception on the uncertain elements of a project.

Uncertainty played an important factor in the development of the project as 50% considered that it was a "*Major factor*" and 33% that it "*Moderately affected*" the project. Only 17% (one answer) considered that it did not affect the project. Again, it could be said that, as explained above, the impact that uncertainty has on the project depends on the person and his/her role on it.

The fact that the answer that registered the most responses on *Question III* was "*A consequence of poor planning*" denotes that there is a feeling that projects are deterministic. The rational behind this idea is that if everything is correctly planned there will be no uncertainty. However, there is a paradox between the results of Question II and Question III. Whilst Question II claims that uncertainty played an important factor in the project, Question III assures that if a project is properly planed you avoid uncertainty, yet how can you plan for uncertainty if you believe that projects are deterministic?

On the same question, Question III, the answers to the field "*Other*:": "[Uncertainty is] *A characteristic of the nature of the development of large scale projects…*"denotes that there is a direct relationship between the size of the project and the level of uncertainty.

With more than 80% of the interviewees believing that projects can be planned to their full extent, Question IV confirms the idea that projects are deterministic. However, the comment section explains the complexities of project planning. One particular comment "*But the management of the planning in practice is more complex than the theoretical planning*" indicates that today's tools are not suitable to manage the complexities of the real environment under which projects are undertaken.

In one way or another, the answers to all questions indicate that projects are affected by uncertainty, yet it is still believed that projects are deterministic. It is also clear that the sources and level of impact that uncertainty has in the project is perceived differently form person to person.

3. CONCLUSIONS

Thinking that we live in a deterministic world whose future we can control is a very comfortable and luxurious point of view. Today's construction industry is paying a high price, millions of dollars in delayed projects, for maintaining this level of comfort and Federation Square was not the exception.

It is obvious that mankind, in one way or another, has found its way to overcome uncertainty and materialise his projects 300,000 years ago, way back before the words "project" and "management" were put together. Further, ironically it can be said that thanks to uncertainty more project have been constructed. If not, what were the odds of Federation Square ever being built if stakeholders would know beforehand it would take 2 more years and over $450 million dollars to build it? Uncertainty buffers reality and allow us to undertake projects we would otherwise reject.

Once a project has finished there is no uncertainty in it, but it is also no longer in the project manager hands. Nevertheless, while it is still in the project manager's domain, uncertainty is constantly shaping the project's future.

Whilst challenging, uncertainty gives the essence of life to the project management practice and the construction industry can dramatically improve its performance by understanding better the environment under which its projects are undertaken.

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