Success and Failure of Infrastructure Construction Projects
The Brazilian Reality

SBS Swiss Business School, Zürich – Switzerland

Thesis Defence Presentation

Author: Luiz Eduardo Junqueira

Promoter: Thierry Kieffer

September – 2016

The Brazilian Reality
Thesis Research

Information about the study

Hypothesis Statement

- H_0 statement: Infrastructure construction projects in Brazil have a failure rate below or equal to 50%.
- H_a statement: Infrastructure construction projects in Brazil have a failure rate above to 50%.

Secondary Questions

- What are the main root causes for failure of Infrastructure construction projects in Brazil ?
- What is the failure rate when segmented per type of infrastructure project, respondent's professional position and type of respondent's company ?
- What are the main root causes of failure when segmented per type of company ?

swiss business school SBS

The Brazilian Reality
Infrastructure Construction Projects

Definition: "*temporary endeavour to build the basic physical structures needed for the operation of a society or enterprise*" (Oxford English Dictionary, 2011 and PMI, 2013)

Types of Infrastructure Construction Projects:

01 Logistics and transportation

02 Power

03 Telecommunications

04 Water and Sewage Systems

05 Urban Buildings and Other Systems

The Brazilian Reality
Infrastructure Construction Projects

Meant to Improve the living standards of the society;

Success or failure in a project like that highly influences the nation's status quo.

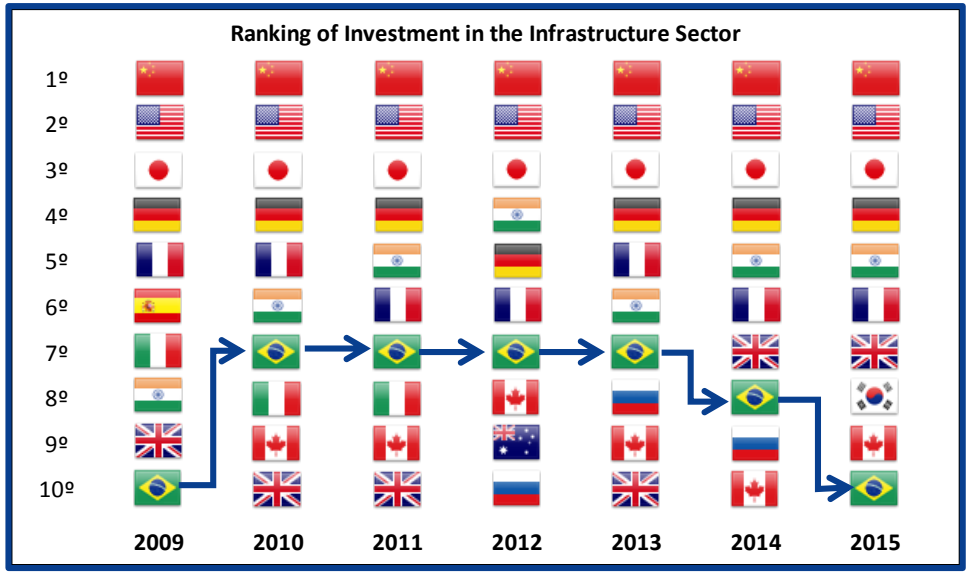
Affects the country's wealth;

The Brazilian Reality
Brazilian Infrastructure Sector

- Market size: USD 321.9 billion dollars in investments in 2015;
- Ranked as one of the Top 10 destinations worldwide for this type of investment since 2009 and the biggest market in Latin America (40%);
- Despite strong investment flow, infrastructure is still a major concern in Brazil;
- 74º position in the infrastructure ranking among 140 countries according to the Global Competitiveness Report (World Economic Forum).

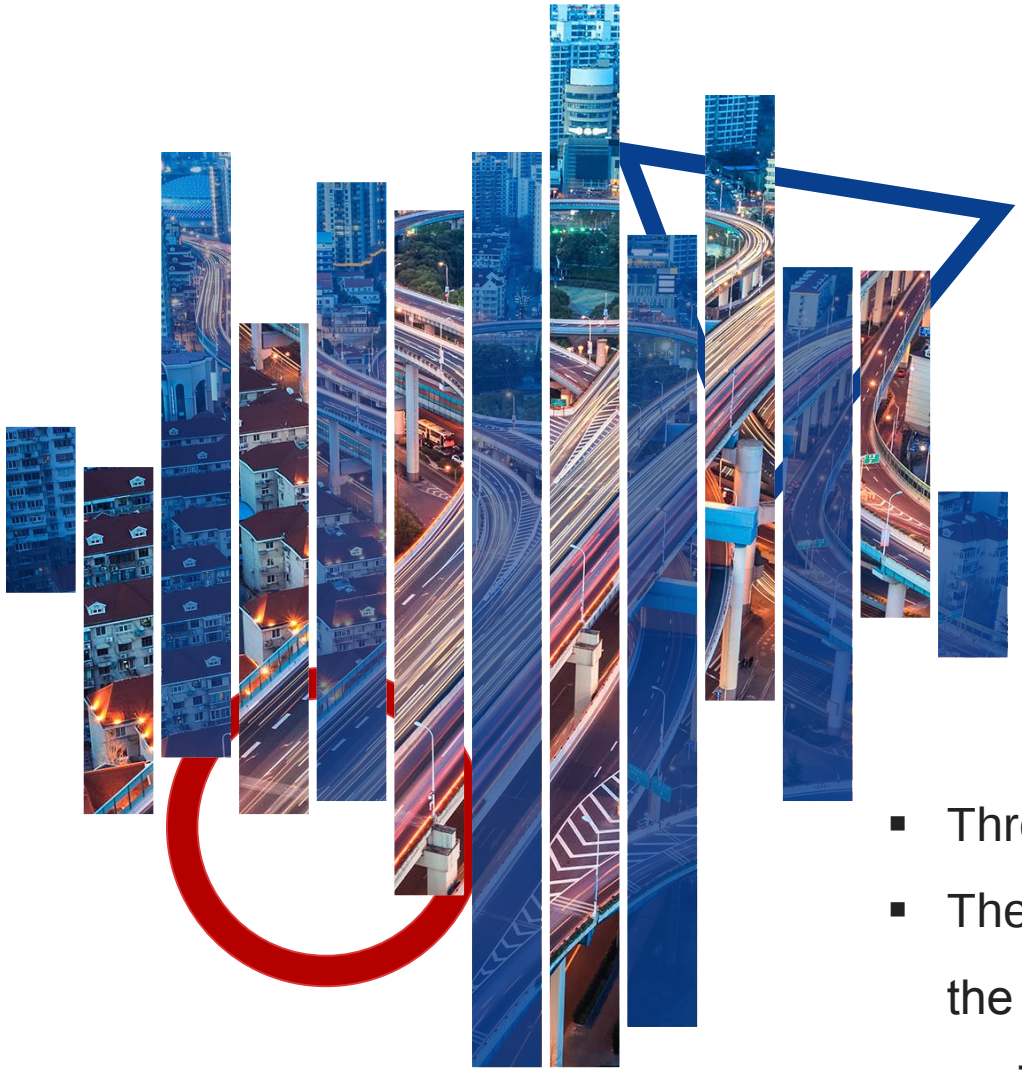
Infrastructure Investments (2015)

- China (1):	USD 4,765 billion
- USA (2):	USD 2,911 billion
- Japan (3):	USD 882.6 billion
- Brazil (10):	USD 321.9 billion
- World:	USD 17,982 billion



swiss business school SBS

The Brazilian Reality
Success and Failure Definition



Merrow (2011) have detected a failure rate of 65% in 318 global megaprojects in the fields of power, transportation, oil and gas, mining and industry.

Threshold for Failure (Merrow, 2011)	
Type of Outcome	**Threshold for Failure**
(T1) Cost overruns	>25%
(T2) Cost competitiviness	>25%
(T3) Slip in execution schedule	>25%
(T4) Schedule competitiveness	>50%
(T5) Actual production versus planned	Significant reduced production into year 2

Effect of thresholds for failure: NPV negative and substantially reduce the IRR.

- Thresholds Researched: T1, T3 and T5.
- The competitiveness outcomes (cost/schedule) are not contained to the project's internal reality and demand substantial knowledge of the project external environment what turns considerably difficult to receive reliable information from the respondents.

swiss business school SBS

The Brazilian Reality
Success and Failure Causes

Success and Failure Causes

Camilleri (2011) made an extensive literature research that catalogued the number of citations of factors that influences project failure/success.

Camilleri found 11 major factors that influences the success and failure of the projects.

Based on these factors, a total of 18 prospective root causes for failure have been researched.

For each cause the respondent had to classify according to a five-level Likert scale about that cause being one of the main root causes of failure.

Prospective Root Causes of Failure		
C1	Lack of project sponsor support	F4
C2	Lack of proper scope definition	F3
C3	Lack of proper planning and control	F1
C4	Lack of project strategic fit	F2
C5	Lack of commitment of the project team	F4
C6	Inadequate / lack of communication	F5
C7	Improper management / leadership	F6
C8	Inadequate / lack of project risk management	F7
C9	Inadequate project organizational structure	F8
C10	Inexperienced project team	F11
C11	Lack of knowledge management	F9
C12	Acts of good	N
C13	No acceptance by the local communities	N
C14	Uncontrolled environmental issues	N
C15	Failure in the cost estimation	F11
C16	Lack of payment	N
C17	Failure in the supplier/subcontractor management	F6
C18	Lack of supply management	F10

Independent Variables Dependent Variables

swiss business school SBS

The Brazilian Reality
Sample Construction – Survey

Population to be Researched

Professionals with previous experience in infrastructure construction projects in Brazil.

E-mails with the link of the online questionnaire were sent to a random selection among the population (author's database / participants of a professional online forum)

Results

- Online questionnaire remained open for 20 days;
- 135 questionnaires were filled;
- 121 questionnaires were completed by professionals with previous experience in infrastructure construction projects in Brazil;
- 724 projects have been informed regarding to the thresholds for failure.

The Brazilian Reality
Failure Rate – Questionnaire Results and Statistical Analysis

For a confidence level of 95%, the results of the "Failure Rate" were the following;

Failure Rate Case	Sample Size	Failure Rate	Type of Test	Reject Null Hypothesis?	Test Results
Not Segmented					
Project Sample (Q8)	724	62.15%	Z-test	Yes	$Z_{score} = 6.565 > Z_{critical} = 1.645$
Open Question (Q11)	113	60.99%	T-test	Yes	$T_{score} = 5.079 > T_{critical} = 1.659$
Q8 Results Segmented According to Question 2 – Respondent's Position					
CEO, VP, Director	230	64.78%	Z-test	Yes	$Z_{score} = 4.484 > Z_{critical} = 1.645$
Project Director	129	60.47%	Z-test	Yes	$Z_{score} = 2.377 > Z_{critical} = 1.645$
Project Manager	261	61.30%	Z-test	Yes	$Z_{score} = 3.652 > Z_{critical} = 1.645$
Professional	104	60.58%	Z-test	Yes	$Z_{score} = 2.157 > Z_{critical} = 1.645$
Q8 Results Segmented According to Question 6 – Type of Respondent's Company					
Contractor	339	70.80%	Z-test	Yes	$Z_{score} = 7.658 > Z_{critical} = 1.645$
Investor / Project Owner	206	54.37%	Z-test	**No**	$Z_{score} = 1.254 < Z_{critical} = 1.645$
Designer / Consultant	179	54.75%	Z-test	**No**	$Z_{score} = 1.271 < Z_{critical} = 1.645$
Q8 Results Segmented According to Type of Infrastructure Construction Project					
Transport/Logistics	161	70.81%	Z-test	Yes	$Z_{score} = 5.280 > Z_{critical} = 1.645$
Power	356	60.11%	Z-test	Yes	$Z_{score} = 3.816 > Z_{critical} = 1.645$
Telecommunications	10	60.00%	Binomial	**No**	$1 - B(5;10;0.5) = 0.038 < 0.05$
Water and Sewage	102	56.86%	Z-test	**No**	$Z_{score} = 1.294 < Z_{critical} = 1.645$
Others	382	66.23%	Z-test	Yes	$Z_{score} = 2.155 > Z_{critical} = 1.645$

The Brazilian Reality
Failure Rate – Hypothesis Test Results

Based on the statistical tests made for the non-segmented projects data (question 8) and open question data (question 11), we can reject the proposed null hypothesis and accept the alternative hypothesis that is the following: "Infrastructure construction projects in Brazil have a failure rate above to 50%"

Secondary Questions Results – Failure Rate

It is possible to reject the null hypothesis for all segments researched, except:

Type of Company

- ✓ Project Owner / Investors;
- ✓ Designer / Consultants.

Type of Infrastructure Construction Project

- ✓ Water and Sewage Systems;
- ✓ Telecommunications.

The Brazilian Reality
Main Root Causes of Failure – Statistical Analysis

Applying the Welch ANOVA Test, for a confidence level of 95%, the results of the "Main Root Causes for Failure" in the non-segmented Q10 responses were the following:

Ranking of the Prospective Root Causes of Failure				
#	Prospective Root Causes of Failure	Mean Value Results		
		Ranking	Mean (μ)	Std dev (σ)
C15	Failure in the cost estimation	1	4.254	0.797
C3	Lack of proper planning and control	2	4.212	0.749
C2	Lack of proper scope definition	3	4.008	0.947
C8	Inadequate / lack of project risk management	4	3.924	0.829
C4	Lack of project strategic fit	5	3.780	0.839
C6	Inadequate / lack of communication	6	3.771	0.881
C7	Improper management / leadership	7	3.771	0.900
C14	Uncontrolled environmental issues	8	3.729	1.051
C10	Inexperienced project team	9	3.695	1.025
C9	Inadequate project organizational structure	10	3.653	0.900
C17	Failure in the supplier/subcontractor managemen	11	3.644	0.929
C11	Lack of knowledge management	12	3.593	1.006
C16	Lack of payment	13	3.568	1.158
C18	Lack of supply management	14	3.483	0.894
C1	Lack of project sponsor support	15	3.407	1.064
C5	Lack of commitment of the project team	16	3.178	1.114
C13	No acceptance by the local communities	17	2.958	0.982
C12	Acts of good	18	2.890	0.959

Welch ANOVA Test Results

→ p = 0.081 > 0.05 (Position 1)

→ p = 0.136 > 0.05 (Position 2)

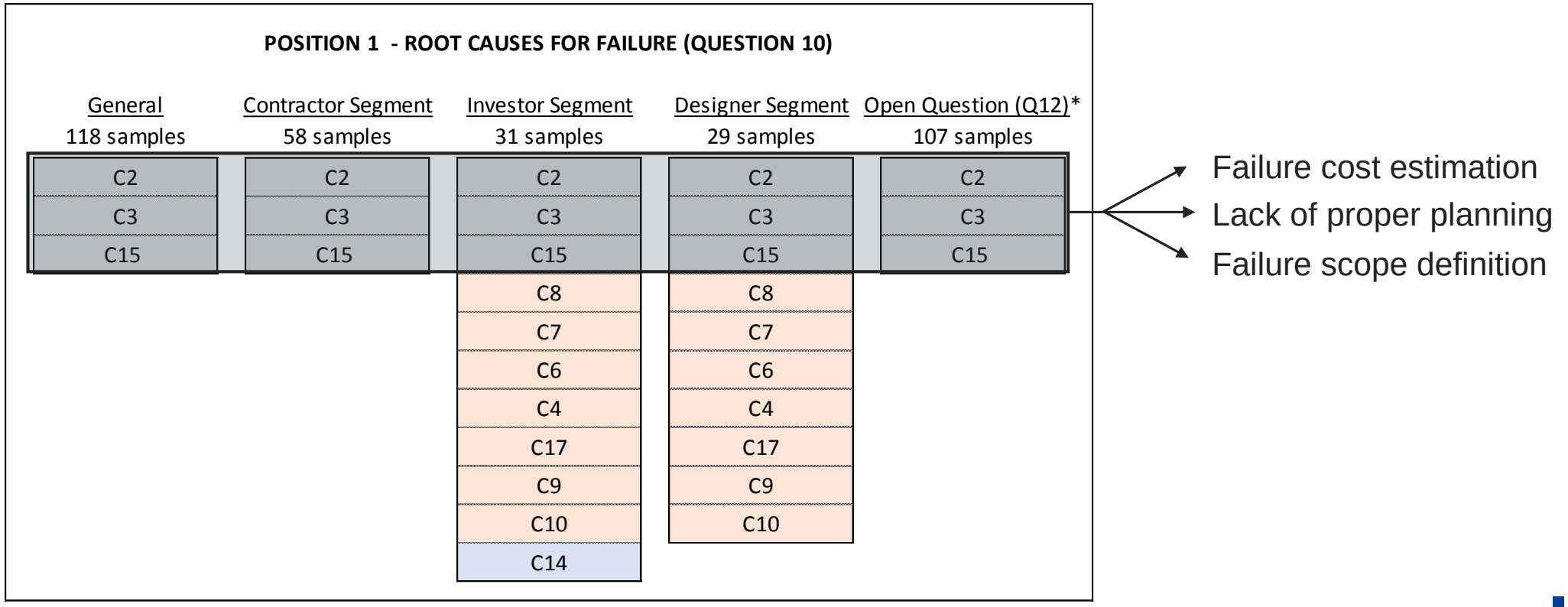
→ p = 0.066 > 0.05 (Position 3)

→ p = 0.592 > 0.05 (Position 4)

The Brazilian Reality
Main Root Causes of Failure – Segmented Statistical Analysis

The results of the Question 10 were segmented according to the type of company (Q6). An open question (Q12) also collected respondents free opinion regarding to the main root causes of failure.

The results for the Position 1, using Welch ANOVA Test, were the following:

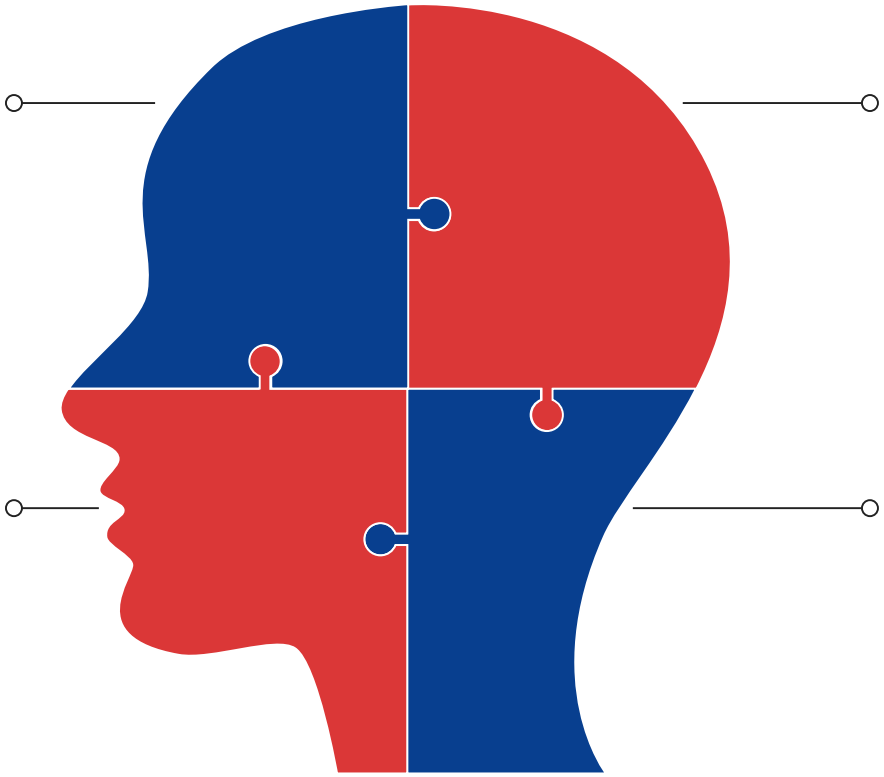


* Top 3 causes mentioned in the question 12 (open question)

The Brazilian Reality
Overall Conclusion

The research discovered a market of poor performance infrastructure projects in Brazil with the size of at least USD 161 billions (2015);

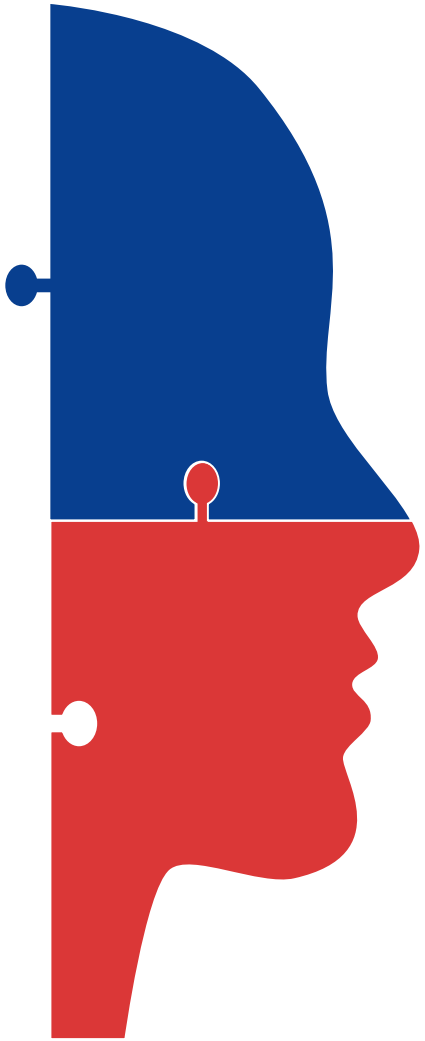
Contractors tend to witness more project failure than designers and investors because they are tied to EPC contractual arrangements that does not allow them transfer delays or higher costs to the investor;



Projects less vulnerable to poor scope definition due to site investigations (Telecom, Water and Sewage) tend to fail less than other type of projects (Transport/ Power and General Buildings);

The vast majority of the respondents (83.1%) agree that the "development phase" is the main responsible for infrastructure construction project failure, for this reason poor performance is highly connected to poor decisions in the early project stages.

The Brazilian Reality
How to assure better performance?



➢In order to improve this poor project performance in the Brazilian infrastructure sector, the companies shall focus in:

- ✓ Provide a better scope definition in the early stages of the project;
- ✓ Better estimate of the project costs/schedule in the early stages of the project.

➢Front End Loading (“FEL”) methodology, a stage-gated development approach, could help companies to reach the right level of scope definition in order to move forward with the project and request the full funds authorization;

➢Non-controllable variables (e.g.: acts of good) were positioned last in the root causes of failure and are often the main justification for a construction project failure.

➢Companies shall incentivise the development team in accordance with the long term aspects of infrastructure projects.

➢Organizational aspects are more valuable to investors and designers for project success than contractors.

The Brazilian Reality
Learning Aspects and Ethics

➢Learning Aspects:

- ✓ Huge market discovered, market segmentation and different opinions;
- ✓ Primary research development, hypothesis testing and statistical analysis; and FUN!

➢Ethical Issues:

- ✓ Remuneration of the development team is linked to project approvals (short term goals) and this type of project generate or destroy value only in a long term;
- ✓ "*Cook the forecasts to get ventures ahead*" - Flyvbjerg (2003);
- ✓ "Corruption" and "Political Issues in Brazil" were appointed in the question 12 (open question) as one of the main root causes of failure – Ranked 7º and 9º of a total 25 causes.

Questions?