Modeling Performance Impact Factors Using Expert Opinion

Mauricio Aguiar

TI Métricas
Rio de Janeiro, RJ
Brasil

Abstract

– *Expert opinion or judgment may be very helpful in the discovery, definition, and quantification of performance impact factors (PIFs). Expert opinion is specially helpful in the absence of historical data.This presentation will show a simple method for modeling PIFs using expert opinion.*

Agenda

- About TI Métricas
- A Simple Example Tells The Story
- Recommendations
- Summary

About TI Métricas

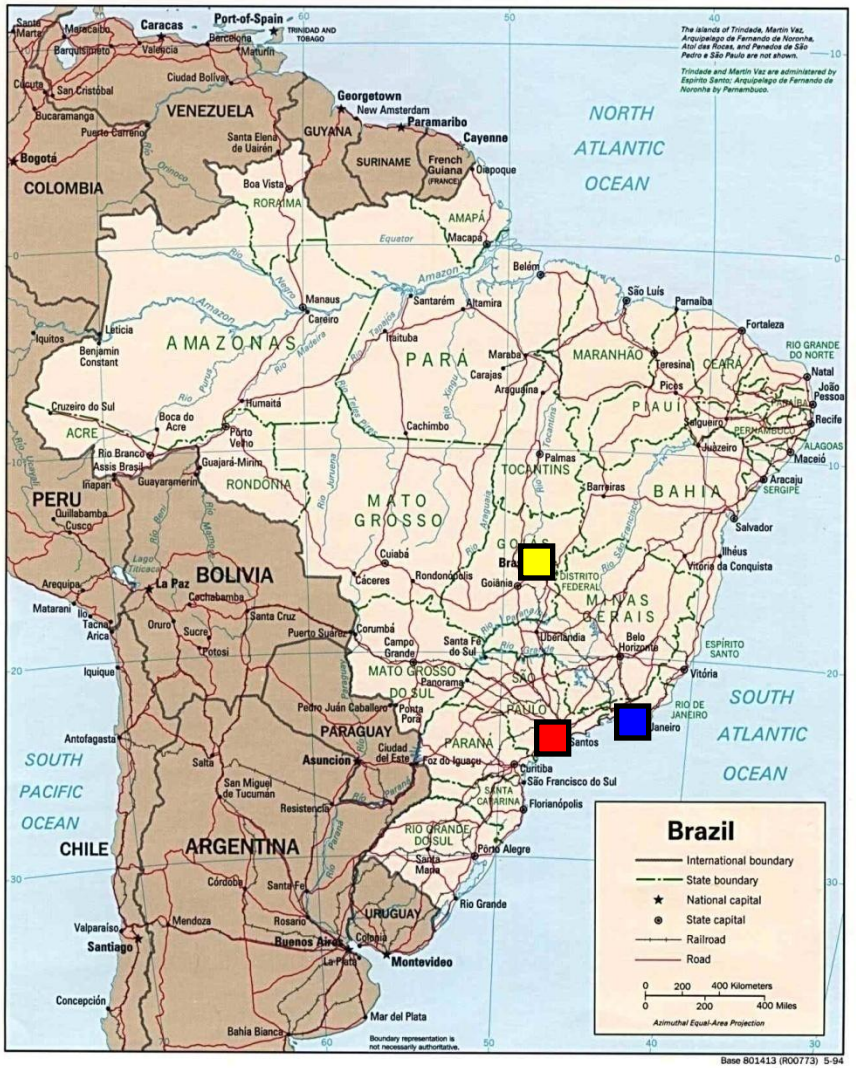
Company Information

- Software Measurement Company
  - Based in Brasil (Rio, São Paulo, and Brasília)
  - Services:
    - **Function Point Counting** (main service)
    - Project Estimation (COCOMO II)
    - Productivity Studies
    - PSM(*) Consulting and Training
    - FP Consulting and Training (IFPUG & COSMIC)
  - Some Numbers:
    - 75+ employees (54 IFPUG Certified)
    - 60,000 FPs counted per month
  - Client Areas:
    - Government - Finance & Banking - Telecom
    - Insurance - Airline - Energy

(*) Practical Software & Systems Measurement

Where We Are

- Rio
- São Paulo
- Brasilia



A Simple Example Tells The Story

A Simple Example Tells The Story
From Downtown Rio to Barra Shopping Mall

29 Kms – How long will it take to get from A to B?

A Simple Example Tells The Story
Some Assumptions

- No historical data
- No access to Google maps
- Our only option is to ask commuters who frequently use that route

A Simple Example Tells The Story
First Question – Average Time

- "What is the average time to go from Downtown Rio to the Barra Shopping Mall?"
  - No other information available – we only provided the origin, destination, and means of transportation (car)
  - After interviewing 5 to 10 people we compute the average (or median) time and find it to be 40 minutes.
  - If we had no additional information our best guess would be 40 minutes.

A Simple Example Tells The Story
More Information = Better Estimate

- “What would I need if I wanted a better estimate?”
  - Information about whatever affects travel time
    - Time of departure (peak hour?)
    - Weather conditions (rain?)
    - Other factors
  - We may call those factors “performance impact factors“ because they affect our travel performance.

A Simple Example Tells The Story
How do factors affect travel time?

- For the sake of simplicity, assume we only have discovered the following PIF's:
  - Time of departure (no traffic, average traffic (typical), peak hour traffic)
  - Weather conditions (fair weather (typical), light rain, heavy rain)
- How do these factors affect travel time?

A Simple Example Tells The Story
Our Factors

- For this simple example our factors will be:
  - **F** – Traffic factor. This will increase/decrease the average travel time by a certain percentage.
  - **W** – Weather factor. This will also change the average travel time by a certain percentage.
- If the travel time for trip **i** is $\mathbf{T_i}$ then

  $\mathbf{T_i} = \mathbf{A}.\ \mathbf{F_i}\ .\ \mathbf{W_i}$

  where **A** is the average travel time for all trips.

A Simple Example Tells The Story
Calibration

- To use the model we need to find values for:
  - **A** – The Average travel time in a typical day/period
  - **F** – Traffic factor. A value greater than 1 for the peak hour traffic period, a value equal to 1 for the "typical" period, and a value less than 1 for the "no traffic" period.
  - **W** – Weather factor. A value greater than 1 for "heavy rain", a value also greater than 1 for "light rain" (but smaller than the one for "heavy rain"), and a value equal to 1 for "no rain".

A Simple Example Tells The Story
Calibration

Traffic Factor (F)

Level	Description	Multiplier
High	Peak hour traffic	1.___
Typical	Average traffic	1
Low	No traffic	0.___

Weather Factor (W)

Level	Description	Multiplier
Very High	Heavy rain	1.___
High	Light rain	1.___
Typical	No rain	1

A Simple Example Tells The Story
Calibration

- Ideally, historical data and some statistical manipulation would give us the four values we need.
- In the absence of historical data we would have to do with people's perceptions of those effects.
- That type of information may exist in people's minds but has to be elicited and quantified.

A Simple Example Tells The Story
Interviews (one example)

- How long does it take you to get from A to B on a typical day?
  - Hmm.. about 40 minutes.
- OK. Is that in the rush hour or what?
  - That's in the rush hour. Off the rush hour it would take, say, 30 minutes.
- What if you chose to travel at 3am?
  - Wow! Then it would take like 20 minutes!

A Simple Example Tells The Story

Interviewees 1, 2, and 3 - Traffic

1

Level	Description	Minutes
High	Peak hour traffic	60
Typical	Average traffic	35
Low	No traffic	25

2

Level	Description	Minutes
High	Peak hour traffic	50
Typical	Average traffic	30
Low	No traffic	20

3

Level	Description	Minutes
High	Peak hour traffic	60
Typical	Average traffic	40
Low	No traffic	25

Medians
60
35
25

Factors
1.71
1.00
0.71

A Simple Example Tells The Story

Interviewees 1, 2, and 3 - Weather

1

Level	Description	Minutes
Very High	Heavy rain	60
High	Light rain	50
Typical	No rain	35

2

Level	Description	Minutes
Very High	Heavy rain	50
High	Light rain	40
Typical	No rain	30

3

Level	Description	Minutes
Very High	Heavy rain	60
High	Light rain	50
Typical	No rain	40

Medians
60
50
35

Factors
1.71
1.43
1.00

A Simple Example Tells The Story
Factor Levels

Traffic Factor (F)

Level	Description	Multiplier
High	Peak hour traffic	1.71
Typical	Average traffic	1.00
Low	No traffic	0.71

Weather Factor (W)

Level	Description	Multiplier
Very High	Heavy rain	1.71
High	Light rain	1.43
Typical	No rain	1.00

A Simple Example Tells The Story
Estimated Travel Times (rounded)

Traffic/Weather	Very High (1.71)	High (1.43)	Typical (1.00)
High (1.71)	1.71 x 1.71 = **2.92**	1.71 x 1.43 = **2.45**	1.71 x 1.00 = **1.71**
Typical (1.00)	1.00 x 1.71 = **1.71**	1.00 x 1.43 = **1.43**	1.00 x 1.00 = **1.00**
Low (0.71)	0.71 x 1.71 = **1.21**	0.71 x 1.43 = **1.02**	0,71 x 1.00 = **0.71**

Traffic/Weather	Very High	High	Typical
High	**102**	**36**	**60**
Typical	**60**	**50**	**35**
Low	**42**	**36**	**25**

A Simple Example Tells The Story
Average Travel Time

Suppose we know the percentage of trips under each condition.

Traffic/Weather	Very High	High	Typical	% of Trips
High	**102**	**36**	**60**	40
Typical	**60**	**50**	**35**	40
Low	**42**	**36**	**25**	20
% of Trips	10	20	70	100

The weighted mean is **45.7** (*)

(*) The simple mean is **49.6**.

A Simple Example Tells The Story
Normalizing Factor Levels

- Suppose we have secondary data on the mean travel time(*):
  - The mean travel time from A to B is known to be 40 minutes
  - However our computed mean is 45.7
  - So all time values on slide 22 should be corrected by a factor of 40 / 45.7 = 0.88

(*) From, say, the Department of Motor Vehicles.

A Simple Example Tells The Story
Corrected Estimated Travel Times

All previous values were multiplied by 0.88 and rounded.

Traffic/Weather	Very High	High	Typical	% of Trips
High	**90**	**32**	**53**	40
Typical	**53**	**44**	**31**	40
Low	**37**	**32**	**22**	20
% of Trips	10	20	70	100

The model is ready to be used.

Recommendations

Recommendations
Data Collection

- Thoroughly understand and document all activities being analysed
  - Make sure to include all tasks and steps
  - Note optional activities if any
  - Fully understand the reason for each activity, task, step, and goal – use both qualitative and quantitative methods

Recommendations
Data Collection

- Don’t ask direct questions – lead the interviewee to the appropriate scenario
  - Don’t ask: “What percentage of your time do you spend on coding?”
  - Say Instead: “Tell me about your day...”
  - Why? Most people don’t usually think in terms of percentages or proportions. However they are usually aware of minutes, hours, days.

Recommendations
Data Collection

- Do not simply discard outliers – investigate them before deciding what to do
  - Some people may have information others don't have
  - Others may simply exaggerate
  - Before discarding an outlier find out why it was there in the first place

Recommendations
PIF's

- Select performance impact factors that:
  - Are objective (do not depend on opinions)
  - Are known before the fact (e.g, before project kick-off)
- Use the same criteria above for factor levels
  - Factor: Number of users (U)
  - Levels:
    - Low 1 <= U <= 2
    - Typical 3 <= U <= 6
    - High U > 6

Recommendations
Document Everything

- Summarise every interview
  - Make detailed notes and review them while you still remember the conversation
  - If possible use a recorder
- Maintain traceability
  - Make sure you have all raw data and intermediate results, including who said what and when

Summary

Summary

- Expert opinion or judgment may be very helpful in the discovery, definition, and quantification of performance impact factors (PIFs).
- Expert opinion is specially helpful in the absence of historical data.
- It is possible to elicit expert knowledge and transform it into quantitative data
- Data collection and analysis skills are essential for success

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Thank You!

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info@metricas.com.br

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