



Applying COCOMO II and Function Points to Brazilian Organizations

Mauricio Aguiar, TI Métricas,
Rio de Janeiro, Brazil

Diana Baklizky, TI Métricas,
Sao Paulo, Brazil

Goal

In the past 10 years TI Métricas has successfully used Function Points and COCOMO II to support its clients.

The goal of this presentation is to share practical applications of Function Points and COCOMO II in software acquisition.



Agenda



- About TI Métricas
- Function Points and COCOMO II
 - The 2005 Study
 - Case Study 1 – Defining Productivity Bands
 - Case Study 2 – Recovering a Troubled Project
 - Case Study 3 – Estimating and Managing a Project







About TI Métricas

Company Information

- Software Measurement Company
 - Based in Brazil (Rio, Sao Paulo, Brasilia & Porto Alegre)
 - Services:
 - **Function Point Counting** (main service)
 - Project Estimation (several methods, featuring COCOMO II)
 - Productivity & Benchmark Studies
 - PSM(*) Consulting and Training
 - FP Consulting and Training (IFPUG FP, SNAP, COSMIC FP)
 - Some Numbers:
 - 70+ employees (50+ IFPUG Certified)
 - Averages 70,000 FPs counted per month
 - Client Areas:
 - Government
 - Insurance
 - Health
 - Finance & Banking
 - Airline
 - TV Network
 - Telecom
 - Energy

(*) Practical Software & Systems Measurement

Where We Are

	Rio
	São Paulo
	Brasília
	Porto Alegre





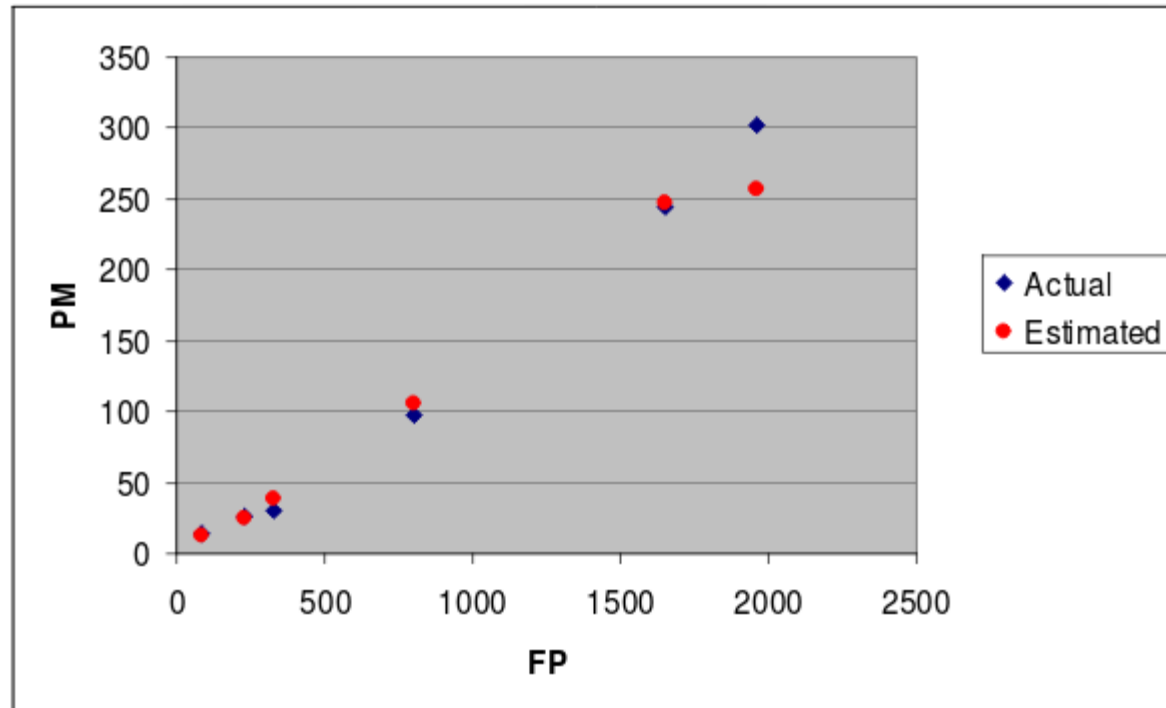
Function Points and COCOMO II

Function Points and COCOMO II

- The 2005 Study

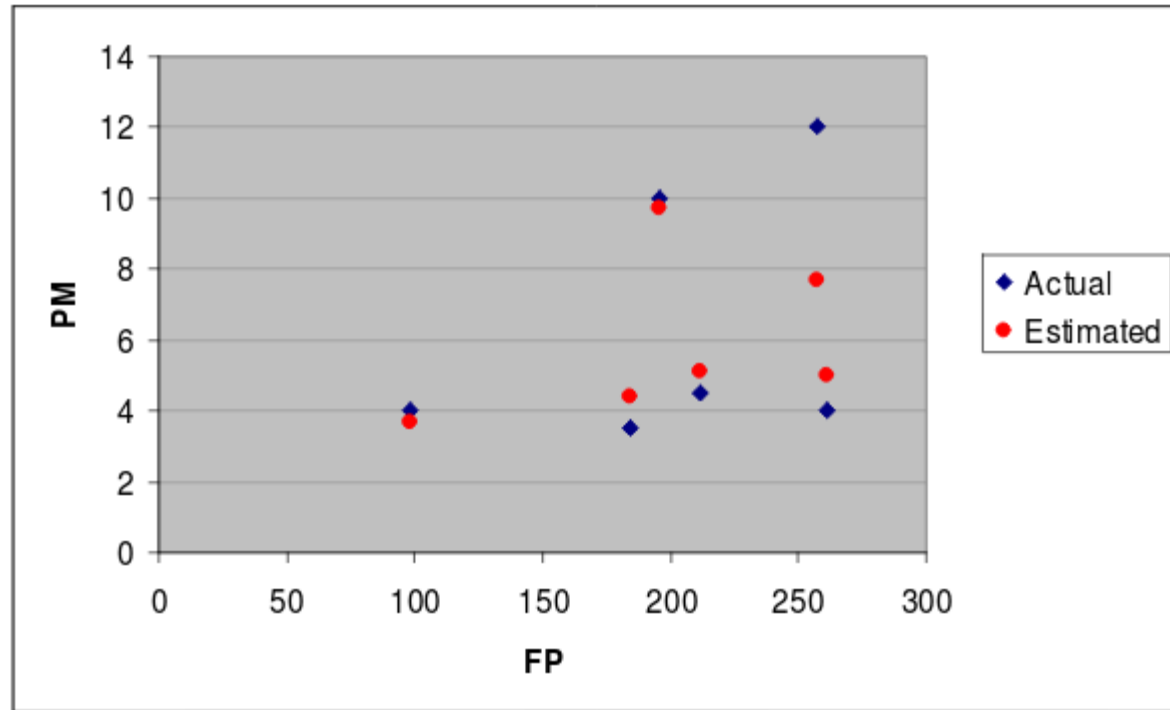
- *20th International Forum on COCOMO and Software Cost Modeling
October 25-28, 2005, Los Angeles, California*
- About the 2005 presentation:
 - Five organizations were involved;
 - A different COCOMO II model was calibrated for each organization;
 - Size was measured in IFPUG Function Points with a single gearing factor of 100 for all platforms.

Function Points and COCOMO II (2005-A)



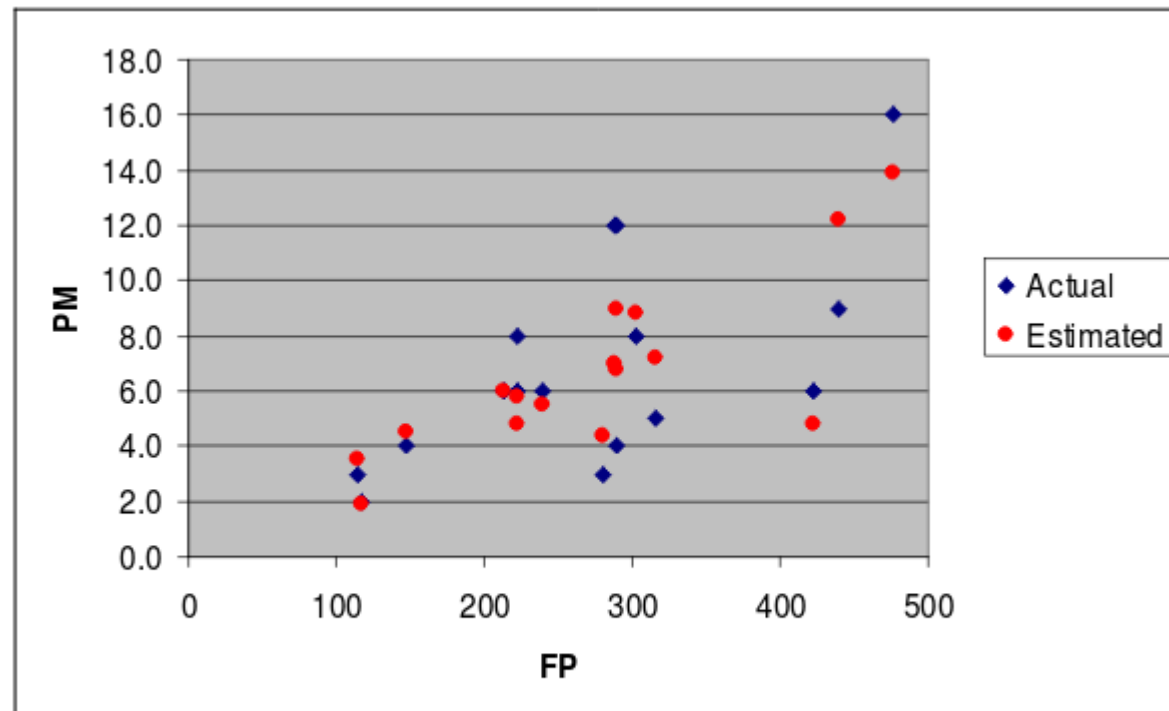
MRE = 11.38% – PRED(.30) = 100%

Function Points and COCOMO II (2005-B)



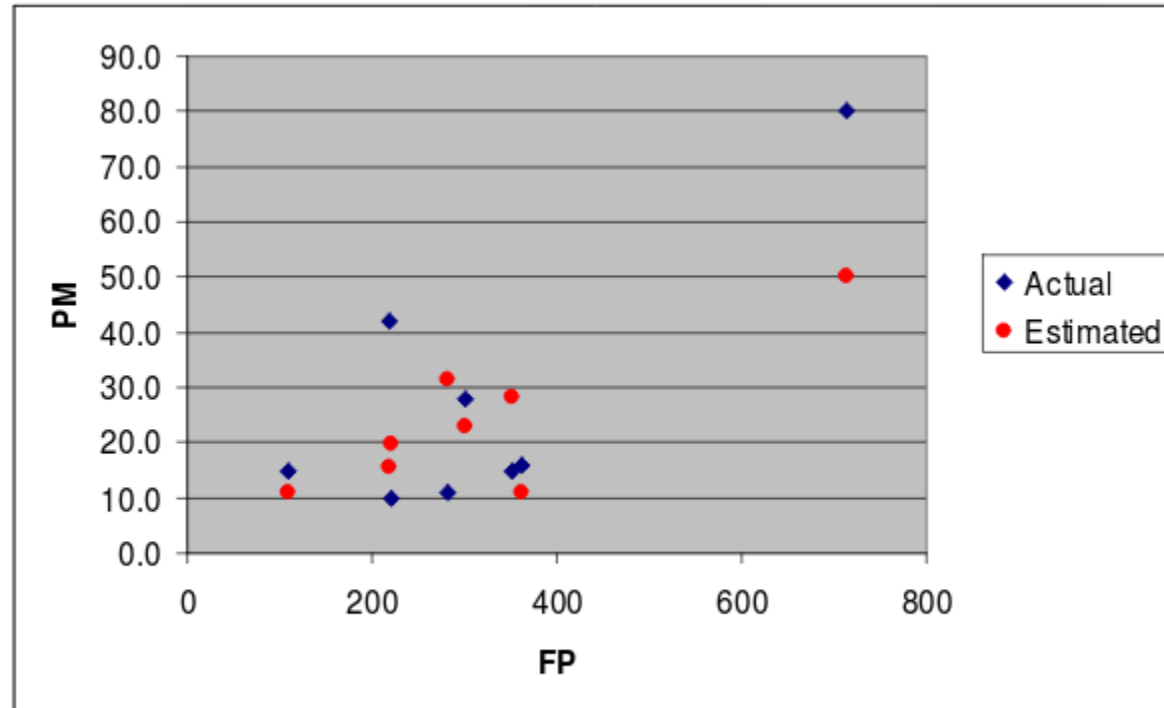
$$\overline{MR\bar{E}} = 18.50\% - \text{PRED}(.30) = 83\%$$

Function Points and COCOMO II (2005-C)



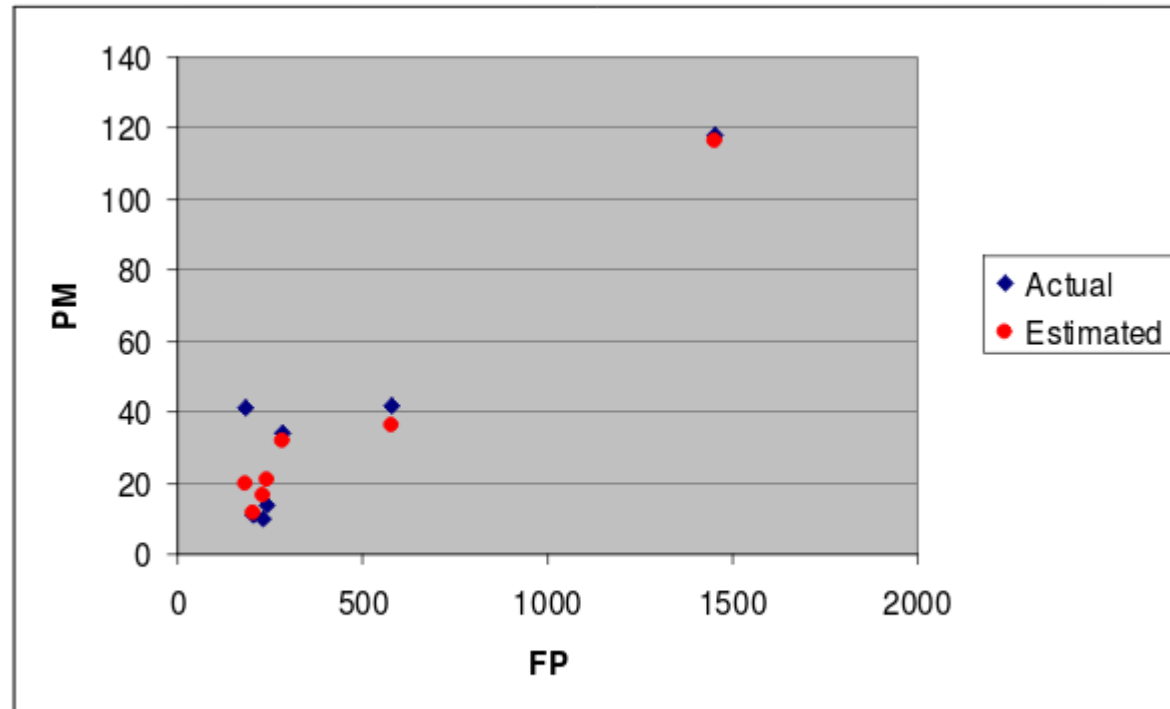
MRE = 29.52% – PRED(.30) = 56%

Function Points and COCOMO II (2005-D)



MRE = 68.24% – PRED(.30) = 25%

Function Points and COCOMO II (2005-E)



$$\text{MRE} = 27.42\% - \text{PRED}(.30) = 57\%$$

Function Points and COCOMO II 2005 Summary

2005 Study Summary

Organization	# of Projects	MRE	PRED(.30)
A	6	11.4%	100%
B	6	18.5%	83%
C	16	29.5%	56%
D	8	68.2%	25%
E	7	27.4%	57%



Case Study 1

Defining Productivity Bands

Business Sector: Banking

Case Study 1



- Context:
 - Contracts based on Price-per-FP;
 - Fixed productivity per project type (new development, enhancement);
 - Price computed as
 - $\text{Size (FP)} * \text{Productivity (Proj Type)}$
- Problem:

Productivities and prices did not reflect project characteristics and led to a situation perceived as unfair by suppliers.

Case Study 1



- Analysis:
 - 880 projects were analyzed for development type, platform, and size range;
 - Several interviews were conducted;
 - Delays, replanning, and other relevant events were identified
- Decision:
 - The team decided to implement a separate COCOMO II model for each of the two main platforms namely, mainframe and non-mainframe projects.

Case Study 1

Calibration Results

Case Study 1 Results

Platform	# of Projects	MRE	PRED(.30)
Mainframe	40	23.0%	73%
Non-mainframe	42	25.0%	64%

Case Study 1

Results



- The two COCOMO II models allowed the team to define productivity bands (minimum, expected and maximum values) for each potential project;
 - ‘Productivity’ = Effort/Size, measured in Hours/Function Points.
- Client and suppliers were satisfied and an updated version of the model is still in use today.



Case Study 2

Recovering a Troubled Project

Business Sector: Power Generation

Case Study 2

- Context:
 - Development of a software system with 17 modules and approximately 6,000 Function Points;
 - Budget based on a single productivity for all modules;
- Problem:
 - Performance varied widely among modules;
 - Potential causes for poor productivity were: poor quality of functional requirements, high business complexity and high technical complexity;
 - The initial budget needed to be revised considering learned lessons and each module's characteristics.



Case Study 2

- Each module was analyzed...
 - FP size was measured;
 - Actuals for effort and productivity were obtained;
 - Interviews revealed the supplier had made improvements to the process and had more planned. However, they did not expect to meet the productivity level needed to recover the project.



Case Study 2

COCOMO II enters the scene...

- The EAF was calculated for each module...
 - Modules had quite different EAFs;
 - New potential improvements were identified.

- A new EAF was predicted for each module considering the potential improvements identified.



Case Study 2

EAF – Actual and Predicted After Improvements

Effort Multipliers	Initial Level	Predicted Level
ACAP – Analyst Capability	Low to Nominal	Nominal to High
APEX – Applications Experience	Nominal	Nominal to High
LTEX – Language and Tool Experience	Nominal	High
PCAP – Programmer Capability	Nominal	Nominal to High
PCON – Personnel Continuity	Very Low to Low	Nominal to Very High
PLEX – Platform Experience	Nominal	High
SITE – Multisite Development	Nominal	Extra High

Case Study 2

Results



- COCOMO II made the following possible...
 - To improve the use of Function Points in software management and estimating;
 - To produce better estimates;
 - To identify potential improvements.
- The project was successfully completed on schedule and reached maintenance status;
- Currently, maintenance estimates use different productivity values for each module.



Case Study 3

Estimating and Managing a Project

Business Sector: Credit Card Processing

Case Study 3

- Context:
 - New development - estimated 6,000 FPs with 9 modules;
 - Requirements format – user stories in product backlog.
- Problem:
 - Estimate development effort and schedule;
 - The client had practically no history for this kind of project (considering size, development method and complexity level).

Case Study 3

- Each user story in the product backlog was sized in Function Points;
- A COCOMO II model was calibrated using 6 completed projects ranging from 500 to 3200 Fps;
 - 3 similar projects from the client organization and 3 from the TI Métricas database
- Effort and productivity were estimated for each module.

Case Study 3

Productivities
(Hours/Function Points)
were computed using
the calibrated
COCOMO II model.

Module	Stories	Size (FP)	Productivity
A	86	256	16
B	304	306	17
C	440	551	15
D	308	1470	23
E	75	578	14
F	98	781	25
G	586	810	15
H	421	713	21
I	193	330	15

Case Study 3

Project Management

- System Release 1 - indicators showed large differences between planned and actuals
- Improvement actions:
 - Reducing non-productive hours;
 - Detailing requirements;
 - Monitoring rework;
 - Changing development method to incremental;
 - Reviewing each module's functionality;
 - Managing change requests;
- System Releases 2,3, and 4 – indicators showed productivities closer to plan



Case Study 3

Results



- COCOMO II made the following possible:
 - To estimate effort and schedule using functional size and other drivers that affect productivity;
 - To improve processes and reduce development costs.
- The model will be continuously maintained to:
 - Follow organizational changes;
 - Produce updated results;
 - Be used in similar, future projects.



Thank you!



A PSM Transition Organization

info@metricas.com.br

