

Exploration of an Error Prevention Model For COSMIC Functional Size Measurement Method

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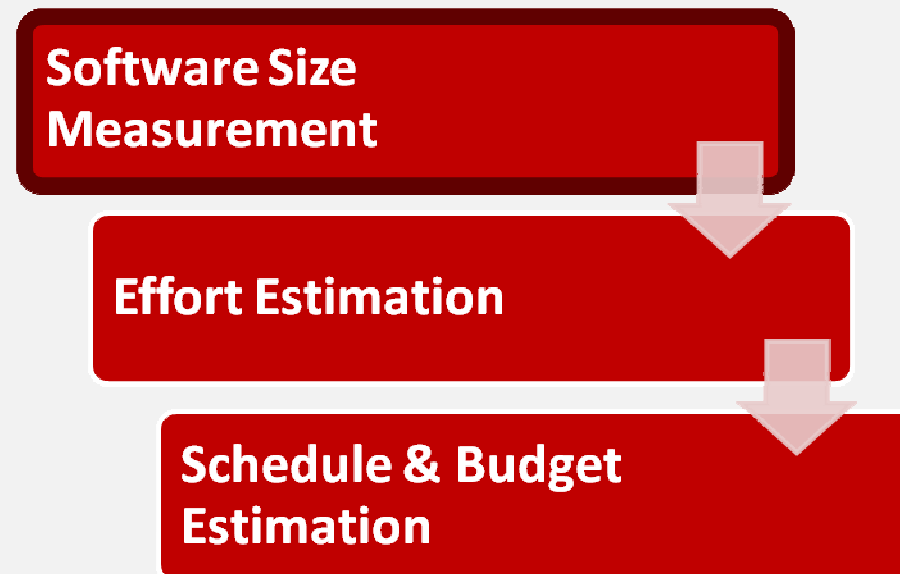
Roadmap

- Introduction
- Research Questions
- Related Research
- Solution Approach
- Case Studies
- Conclusion & Future Works



Introduction

In a software project, variations in the measured size may create significant discrepancies in the schedule and budget estimation.



Research Questions

“What are the common errors in COSMIC measurement?”

“Can we prevent common errors with a structured model?”

“What is the mechanism to prevent the errors with a structured model?”

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Related Research

- Reliability of FSM Methods
 - Reasons of the variations in COSMIC
 - Wrongly applied rules of measurement
 - Assumptions and interpretations of the measurer
 - COSMIC: Guideline for Assuring the Accuracy of Measurements
 - Errors made by the measurers
 - Quality of the measurement artifacts
 - Process used in the measurement activities

Related Research cont.

- Methods proposed
 - Increase measurers experience and awareness

- We aim
 - Minimum measurer initiative
 - During the measurement process

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Solution Approach

- Common Errors in COSMIC
 - Measurement process
 - Understanding the artifacts
- Errors related with FP types
 - Retrieve is defined as a part of another FP
- Errors related with cascading processes
 - Cascading Delete is ignored

Solution Approach cont.

Two step model, First:

- FP's according to the FP types
 - Predefined DM patterns of the FP types.

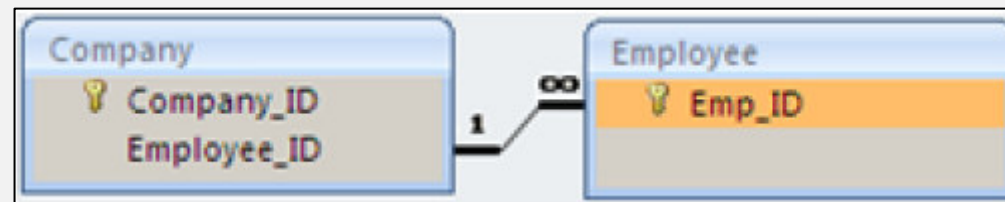
FP Type	Data Movements		
	Triggering Entry	Repetitive Part	Error / Confirmation
List	E	R-X	X*
Retrieve	E	R-X	X*
Add	E*	R-W	X*
Update	E*	R-W	X*
Delete	E	W	X*
Other	E	...	X*

*Measurer may omit this movement

Solution Approach cont.

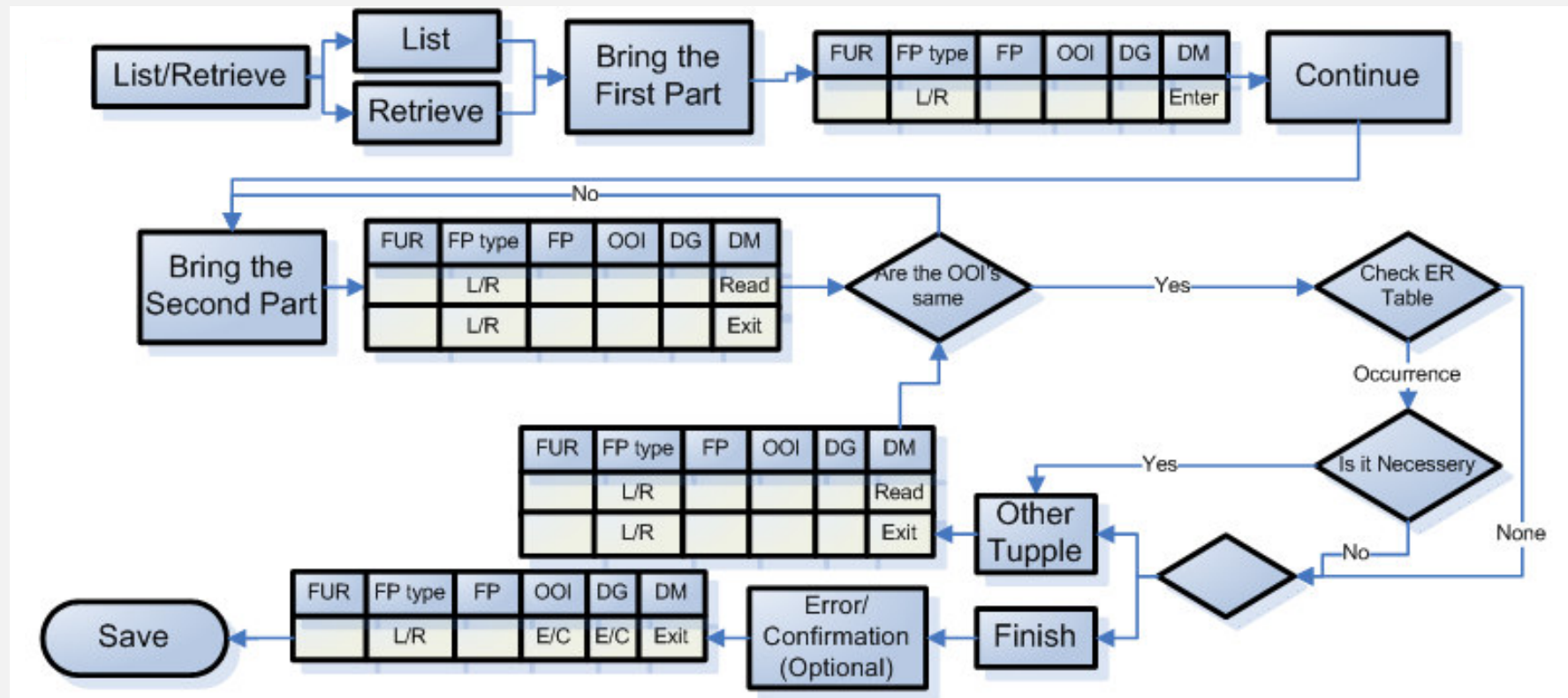
Two step model, Second:

- ER diagram of the software
 - to prevent cascading process related errors
 - If “1” cardinality, entity may need a cascading process.



- Cardinality Table in Preventive COSMIC

Solution Approach cont.



Solution Approach cont.

- Preventive COSMIC
 - Integrated the model Into CUBIT
 - Guides the user



Solution Approach cont.

- Preventive COSMIC
 - Controls the cardinality table

Create Cardinality

Entity1 Cardinality1 Entity2 Cardinality2 Relation Project

Add Cardinality Relation

Cardinality List

Cardinality 35 created

Delete	Id	Entity1	Cardinality1	Entity2	Cardinality2	Relation
<input type="button" value="Edit"/> <input type="button" value="Delete"/>	35	Employee	N	Company	1	Works In

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Case Studies

- 1. Case Study
 - Exploratory
 - Build and verify the model
- 2. Case Study
 - Validate the model
 - Use Preventive COSMIC



Case Studies cont.

Exploratory Case Study

- Errors and Prevention Model
- Software Project Management class
- MIS application / 463 CFP
- SRS Document
- Errors identified / analyzed / divided
 - related with data movements in FP
 - related with cascading processes
 - related with the interpretation of the measurer

Case Studies cont.

Errors Found in Case Study

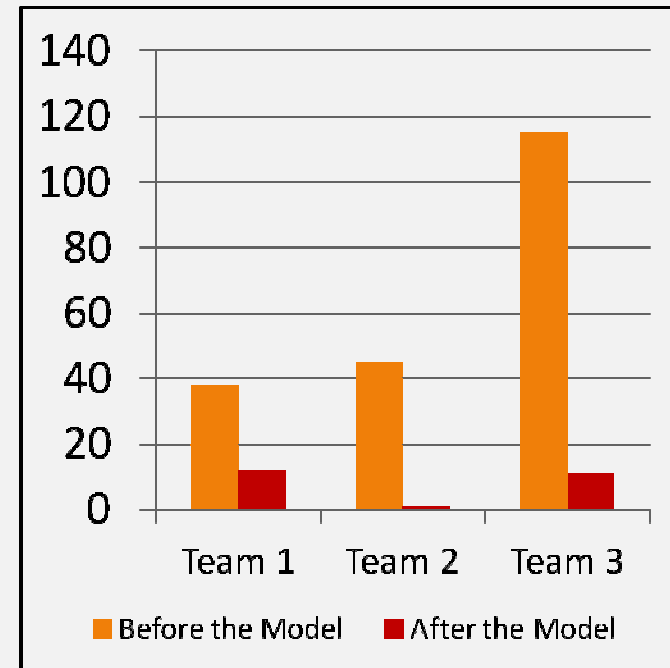
ERROR	Prevention Method
Different error messages are considered as separate exits	DM Pattern
Missing exits for error/confirmation	DM Pattern
List is defined as a part of update FP	FP Type Option
Retrieve is defined as a part of another FP	FP Type Option
Missing triggering entry	DM Pattern
Cascading delete is ignored	Cardinality Reminder
List & retrieve combined	FP Type Option
Retrieve and update combined	FP Type Option
Query & detail listing combined	FP Type Option
Assumed read before write	DM Pattern
Redundant exits for error/confirmation	DM Pattern*
Assumed a retrieve FP before delete/update FP	FP Type Option*
List before update/delete is ignored	FP Type Option*
Retrieve before update/delete is ignored	FP Type Option*

* These errors are related also with measurers' interpretations.

Case Studies cont.

Number of Errors

		Team 1	Team 2	Team 3
Expected Improvement	Total Error Counts (A)	38	45	115
	DM Errors (B)	6	29	97
	Cascading Errors (C)	20	15	7
	Interpretation Errors (D)	12	1	11
	Expected Improvement Rate (E)	68%	98%	90%

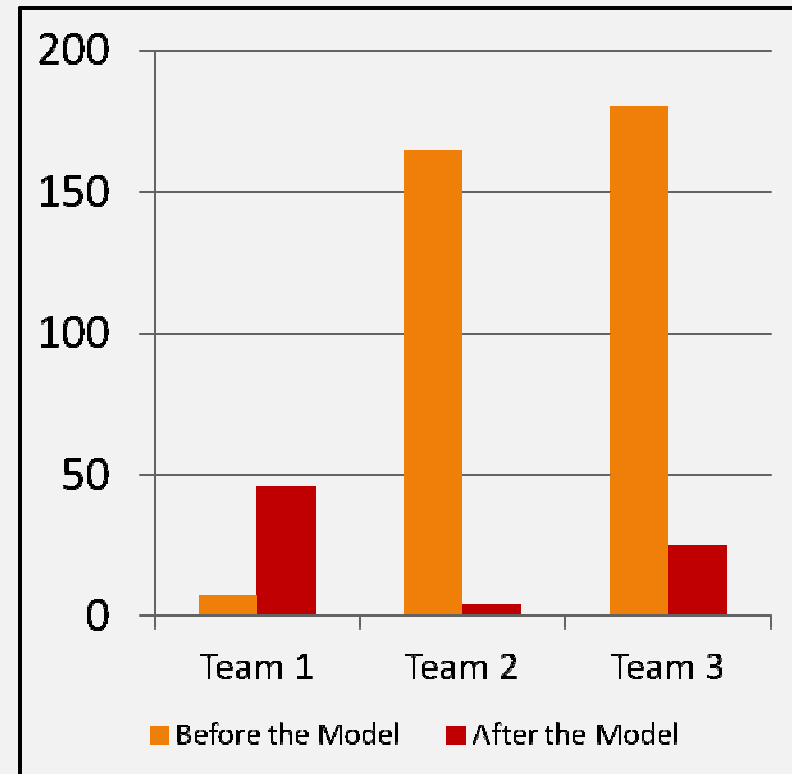


Expected Improvement Rate: $(B+C)/A$

Case Studies cont.

Difference in Measured Size

	Team 1	Team 2	Team 3	
Expected Size (A)	463 CFP	463 CFP	463 CFP	
Calculated Size (B)	456 CFP	628 CFP	643 CFP	
Calculated Size Difference (B-A)	-7 CFP	165 CFP	180 CFP	
Expected Improvement	Total DM Errors Size (C)	-3 CFP	96 CFP	181 CFP
	Total Cascading Errors Size (D)	-47 CFP	73 CFP	24 CFP
	Total Interpretation Errors Size (E)	43 CFP	-4 CFP	-25 CFP
	Expected Size After Expected Improvement (F)	509 CFP	459 CFP	438 CFP
Size Difference After Improvement (F-A)	46 CFP	-4 CFP	-25s CFP	
Change	(%557)	%98	%86	



Case Studies cont.

- After the Case study:
 - Errors are classified
 - Preventive model structured
 - Substantial potential
- There are validity threads:
 - MIS software only
 - SRS document
 - 463 CFP
 - Three students groups, same organization

Case Studies cont.

Validation Case Study

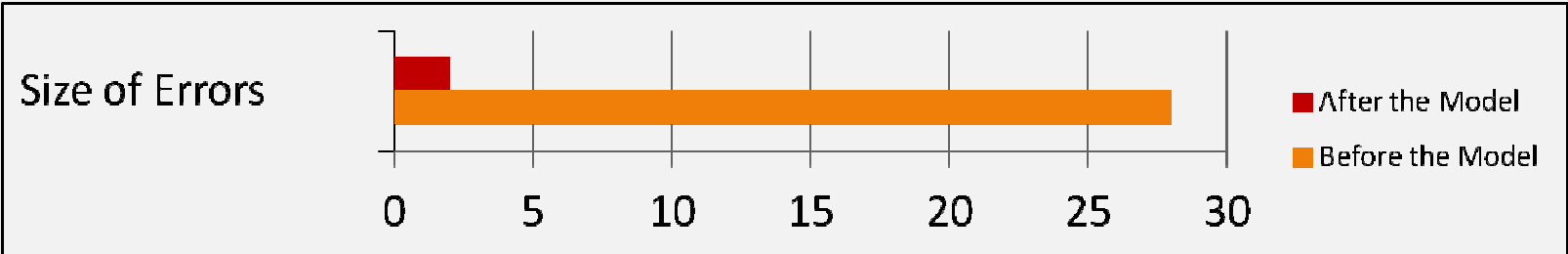
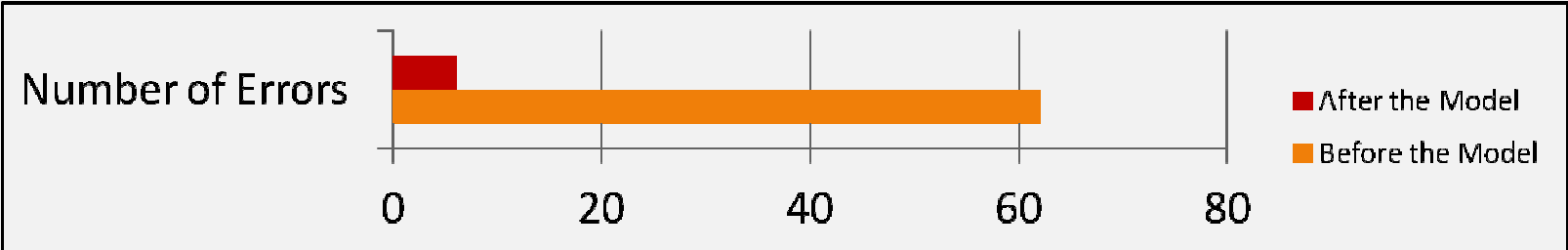
- Preventive COSMIC
- MIS application / 337 CFP
- SRS Document
- Same measurer with 1 year difference

Case Studies cont.

Errors in Case Study

	Total Size (CFP)	Error Definition	Total Effectuated Size	Count of Error
First Measurement	365	Missing "List" FP	-30	9
		Combined Retrieve FP	0	11
		Missing "Retrieve" FP	-3	1
		Missing "Add" FP	-19	2
		Missing DM	-3	2
		Combined FP	-36	3
		Unnecessary DM Before Confirmation	+20	10
		Unnecessary DM Before Delete	+24	12
		Other Unnecessary DM	+75	12
Second Measurement	335	Missing Retrieve Before Update	-6	2
		Unnecessary Error/Confirmation	+4	4
Expected Size	337			

Case Studies cont.



	Total Number of Errors	Size Difference with the Expected Size
First Measurement (A)	62	28
Second Measurement (B)	6	2
Improvement (C)	90%	93%

Improvement : $(A-B)/A$

Case Studies cont.

- After the case study:
 - Model reduced the errors by **90%**
 - Preventive COSMIC guides successfully
- There are validity threads:
 - MIS software only
 - SRS document
 - Only 337 CFP
 - One measurer, same organization

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Conclusion

- Preventive model improve the reliability of measurement by reducing the number of errors by 90% in the case studies
- Also improved measured size of the software in the case studies
 - In second case study model reduced size difference by 93%
- It does not provide an error free measurement
 - New rules may be determined for other errors

Conclusion

- ER diagram should be available
- In preventive COSMIC, measurer should enter the ER table before the measurement
 - take nearly 10% of measurement time.
 - in the first case study 24% of the errors in average were related with cascading processes
- Two main contributions
 - A model to prevent the errors during COSMIC functional size measurement activities
 - Preventive COSMIC software

Future Works

- Different software domains
- Inter-organization, industry wide study
- Different phases with different artifacts
- Models for other FSM methods
- Extract cardinality information from other formats
- Guide the user while editing the results

THANK YOU

Q/A