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Proposal for
A Software Development Effort Ready Reckoner

Based on analysis of ISBSG data
And
Some assumptions and analysis
Of Data

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Based on Initial work by Pam Morris & Tony Rollo

Preamble

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- This presentation is intended to be seen as a proposal
- The proposal could be adopted as a web based tool by ISBSG
- Many of the ideas will need validation
  - To see if my assumptions are borne out by data
  - To see if they would be useful; to the IT development industry
- Current versions of the reality checker depend upon an initial estimate of Function Point size
- I have tried to seek ways in which no knowledge of FP is required
- FP based estimates remain for those who are familiar with FP

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- Introduction
  - Rules Relative Size Scale
- Estimation Based on Project Attributes
- Estimation Based on Estimate of Business Transactions
- Estimation Based on estimate of FPA Transactions

Introduction

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What Does it Do?

The Ready Reckoner is Intended to:

provide a Quick rough estimate of the effort
required to develop a software artefact
or to enhance it.

The purpose of the ready reckoner is to provide a ‘health check’ of any estimates of cost being provided

Filter of Accuracy

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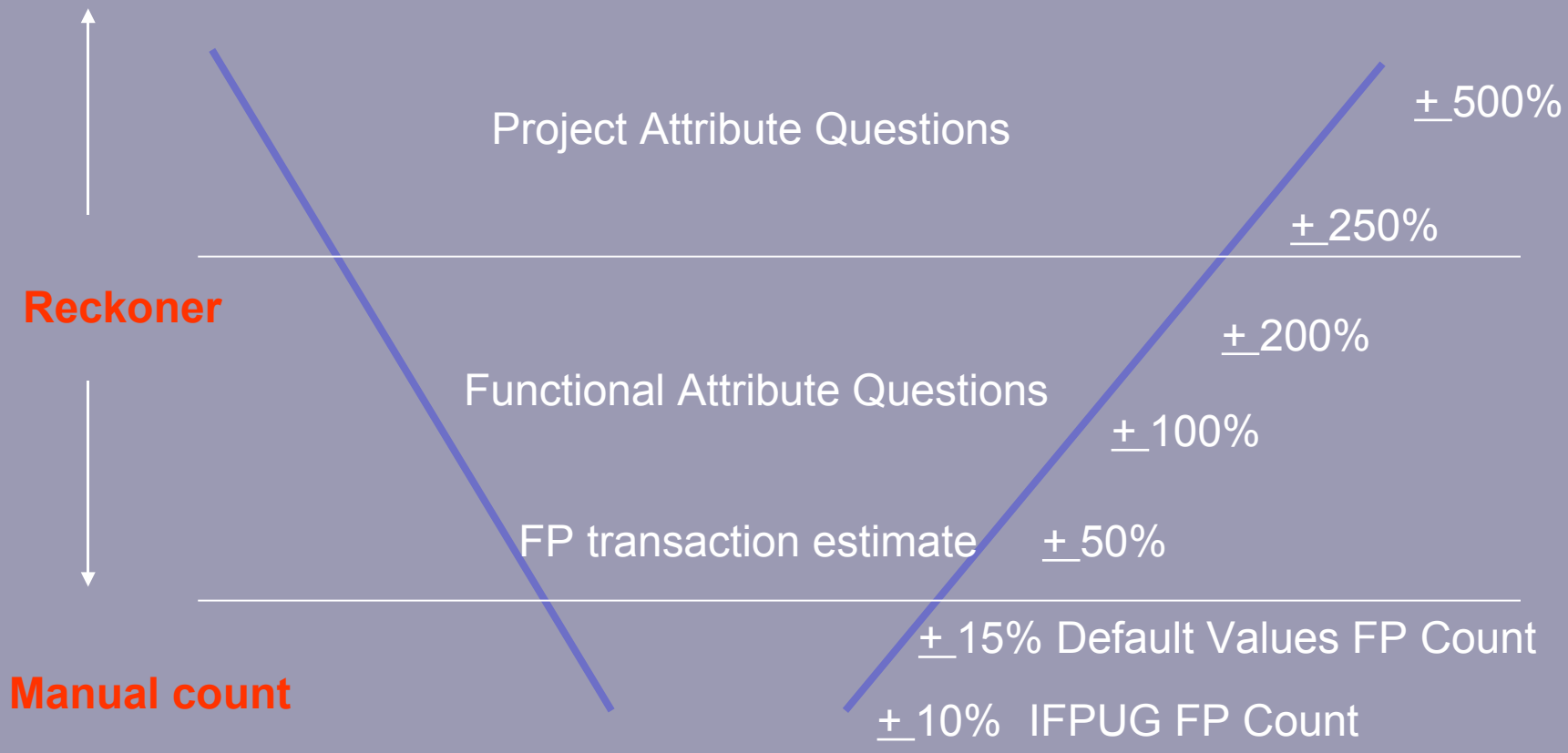

Software Size Ready Reckoner

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Will allow input in basic attributes of a software project and give an estimate of functional size.

Will estimate size by :

- Analogy using ISBSG's matches for projects from similar types of: Organisations, applications, language and so on.
- Estimation based upon a knowledge of the number of Business transactions
- Estimation using attributes of this project and using ISBSG's statistics and expert knowledge to estimate size from functional attributes of the project:
  - No of Screens
  - No of Reports
  - No of Interfaces
  - No of Entities
- Estimates based on an understanding of the number of some FP transaction types

The Effort – Cost Estimate

Size will be reported as *bands* of size, based on Rules relative sizes.

And/Or as a bounded effort estimate only if that is more appropriate

The user will need to provide either data to allow a productivity figure to be calculated – or provide the figure directly if known

In addition it will be necessary to provide the Average fully burdened daily rate of employing development staff

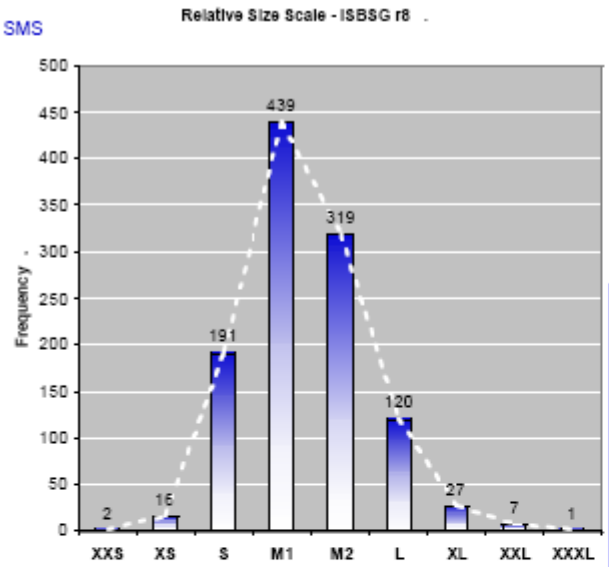
The Ready Reckoner can then give a bounded effort and cost estimate

NB this is NOT a substitute for a sound estimation process

Remember your supplier will have a profit on top of these estimates – at least 30% possibly more!

Rules Relative Size Scale

SMS



Size	Bin	Frequency	%
XXS	10	2	0.2%
XS	30	16	1.4%
S	100	191	17.0%
M1	300	439	39.1%
M2	1000	319	28.4%
L	3000	120	10.7%
XL	9000	27	2.4%
XXL	18000	7	0.6%
XXXL	More	1	0.1%
IFPUG function points		Total =	1122

Project Size Categories based on a logarithmic scale

Slide 3

Rule's Relative Size Scale

Extra-extra-small	XXS	<10	
Extra-small	XS	=> 10	<30
Small	S	=> 30	<100
Medium 1	M1	=> 100	<300
Medium 2	M2	=> 300	<1000
Large	L	=> 1,000	< 3,000
Extra-large	XL	=> 3,000	< 9,000
Extra-extra-large	XXL	=> 9,000	< 18,000
Extra-extra-extra-large	XXXL		=> 18,000

Reasonable limits

Rule's Relative Size Scale

Version 1.b

P.G.Rule see www.measuresw.com

Area of Greatest Interest

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Extra Extra Small	XXS	<10
Extra Small	XS	<30
Small	**S**	**<100**
Medium Small	**MS**	**<300**
Medium	**M**	**<600**
Medium Large	**ML**	**<1000**
Large	**L**	**<3000**
Extra Large	XL	<9000
Extra Extra Large	XXL	<18,000
Extra Extra Extra Large	XXXL	>18,000

60% of the projects in the ISBSG data set lie between 300 and 1000 FP

Feasible region for Projects

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Extra Extra Small	XXS	<10	< 2%
Extra Small	XS	<30	
Small	**S**	**<100**	17%
Medium Small	**MS**	**<300**	
Medium	**M**	**<600**	67%
Medium Large	**ML**	**<1000**	
Large	**L**	**<3000**	11%
Extra Large	**XL**	**<9000**	2.4%
Extra Extra Large	XXL	<18,000	< 1%
Extra Extra Extra Large	XXXL	>18,000	

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Project Attribute Questions

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User answers one or all questions The more you can answer the narrower the range of the estimate

ISBSG's Project Attribute Questions

- Organisation Type
- Business Area type
- Development type
- Application Type

  eg. Savings and Loan, CRM, Workflow Management system

Estimating From Project Attribute Questions

Let us Assume that we have a project and the answer to the project attributes questions are as follows:

Organisation Type	Communications
Business Area Type	Telecommunications
Application Type	Network Management
Development Type	New Development

Analysis of the ISBSG CD10 reveals that
7 similar projects exist and they have an effort range from 252 hrs to 2450 that is 10 :1 and we need more data

Estimating From Project Attribute Questions

Let us Assume that we have a project and the answer to the project attributes questions are as follows:

Organisation Type	Communications
Business Area Type	Telecommunications
Application Type	Network Management
Development Type	New Development
Language type	3GL
Primary Language	C++

Analysis of the ISBSG CD10 reveals that
3 similar projects exist and they have an effort range from 1430 hrs to 2500 that is 2 :1
But we now have a very small data set

How should this Appear

I propose that:

An appropriate approach would be for the ready reckoner to ask all the questions (and possibly a couple more – architecture?)

But that it should filter results until say 10 data points or more remain.

If the top to bottom ratio exceeds 3:1 (+-50%) i.e., 300 – 100.

Then it should continue to apply filters if requested and issue the effort with a warning regarding the danger of being too reliant upon the answer

This method is certainly no more accurate than +-50%

Business Transactions

If we know how many business transactions there are we can estimate the FP size and hence the effort.

The business transaction must be defined as the lowest level of business function that remains meaningful to the business

e.g., Cash a Cheque, place an order, view client list and so on.

Function Points and Transactions

How many function points are there to a transaction?

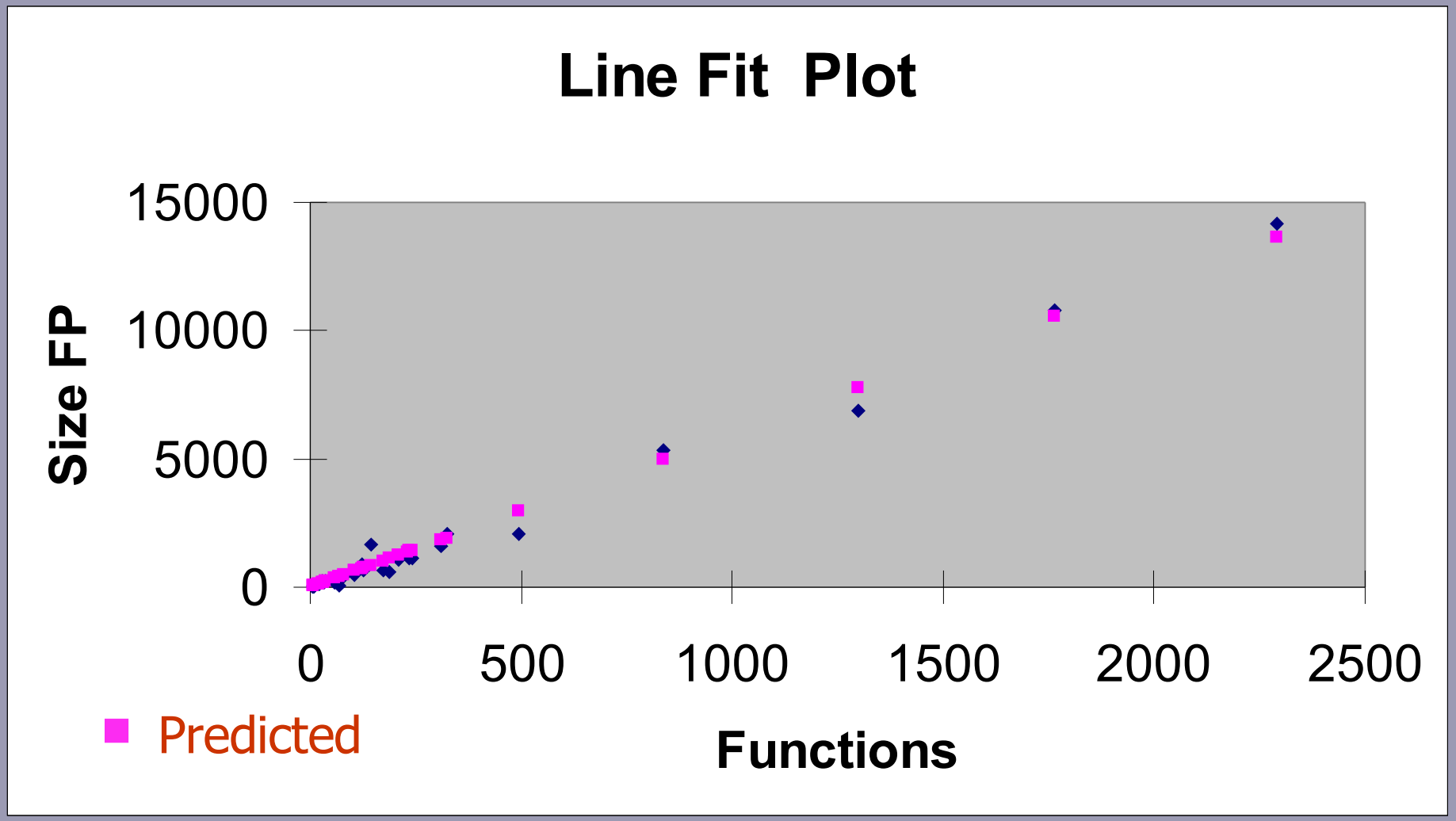
Taking a set of 31 data points from counts done over a number of years

We get a regression formula:

$y = x*6$

A good regression the 95% levels are 5.76 and 6.17 centred on 5.96

Correlation is 0.995


Line Fit Plot
15000
10000
5000
0
Size FP
0
500
1000
1500
2000
2500
Functions
Predicted

Estimating from Business Functions

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Given the data presented it would seem reasonable to

Give an effort estimate based upon business functions.

There are problems in defining and understanding what a business function is, but if this can be achieved we have quite a good tool.

Given an estimate of 79 business functions we get a predicted size of 482 this is within the Medium range and given certain other data such as language platform etc a range estimate of effort can be provided.

ISBSG Contribution Ratios

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Analysis of the ISBSG data repository reveals that the various IFPUG transaction types contribute the following percentage To the overall size of the size of a software artefact.
It further reveals that the 'average' complexity of a file is 'Low'
For all other transactions we assume 'Average' complexity

Transaction Type	Contribution	Multiplier	sum
ILF	22%	32	4.54 * 7 = 31.8
EIF	8%	63	12.5*5= 62.5
EI	33%	12	3.03*4=12.12
EO	23%	22	4.34*5= 21.7
EQ	14%	29	7.14*4=28.56
	100%		

Apply the multiplier to the number of each transaction type
so if we have 8 ILF's then we have 8 * 32 = 256 FP

Project Functional Attribute Questions

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If we know the answer to these questions we can make some assumptions about the number and type of transactions in the system

1. Number of Screens
2. Number of Reports
3. Number of Interfaces
4. Number of Business entities

Assumptions of No of transactions

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2. A screen is likely to represent: 3 EI's, 1 EQ
3. A Report is likely to represent: 1 EO
4. An interface is likely to represent: 1 EI and 1 EO
5. A Business entity is likely to represent an ILF

But be careful many developers represent an interface as the transaction that takes place across an interface. However they may equally mean there is an interface between A and B which might involve several transactions

Sizing from functional Attributes

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If we take the assumptions to be correct then if we have a system which is reported as having:

2. 4 screens
3. 6 reports
4. 2 Interfaces
5. 7 business entities

We have:

2 EI's (12 screens & 2 interfaces)

4 EQ's (screens)

8 EO's (2 Interface 6 Reports)

7 ILF's

# transaction	Contribution	Mult	Est Size
14	4	12	168
4	4	29	119
8	5	22	176
7	7	32	224

The Reckoner will report this a being of Size MS

table

Functional Attributes

This estimate depends upon several factors

3. That the ISBSG breakdowns are reasonably accurate
    1. They seem to have remained consistent over several years
4. That the assumption regarding the No of transactions associated with the various functional attributes is realistic – in most cases they will be a minimum

Estimation From FP Transactions

If we know or can reasonably estimate the number of any particular transaction then we can use the knowledge we have already explored:

ISBSG Component Ratios

Multipliers shown earlier

Relative clothing size scale.

Component Bands

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The breakdown using ISBSG component bands are shown below:

Size Band	FP Lo	FP Hi	ILF	EIF	EI	EO	EQ	Size Bands
XXS	**0**	**10**	**0**	**0**	**1**	**0.5**	**0.3**	**XXS**
XS	**10**	**30**	**1**	**0.5**	**2**	**1**	**1**	**XS**
S	**30**	**100**	**3**	**2**	**7**	**5**	**3**	**S**
MS	**100**	**300**	**9**	**5**	**20**	**14**	**8**	**MS**
M	**300**	**600**	**19**	**10**	**40**	**28**	**17**	**M**
ML	**600**	**1000**	**31**	**16**	**66**	**46**	**28**	**ML**
L	**1000**	**3000**	**94**	**48**	**198**	**138**	**84**	**L**
XL	**3000**	**10000**	**314**	**160**	**660**	**460**	**280**	**XL**
XXL	**10000**	**18000**	**566**	**288**	**1188**	**828**	**504**	**XXL**

The implications of this data is that if we estimate 15 ILF's, then, as this is between 9 and 19 the size lies between 300 and 600 function points. That is it size Medium

Example of Effort – Cost Estimates

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		New Development		Fully Burdened Cost
Size	Wh/fp = 15, 6.4hr/day(80%eff)			FTE day = 300 GBP
Band	FP	Wh	FTE Days	Cost
XXS	< 10	150	23	6,900
XS	<30	450	70	21,000
S	<100	1,500	234	70,200
MS	<300	4,500	703	210,900
M	<600	9,000	1406	421,800
ML	<1000	15,000	2344	703,200
L	<3000	45,000	7031	2,109,300
XL	<9000	135,000	21094	6,328,200
XXL	<18000	270,000	42188	12,656,400
XXXL	More	Lots	Lots & Lots	Lots & Lots & Lots

Calculating Effort Estimates

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Once the attributes have been entered:

The Reckoner will calculate which band the project lies in and this band will be displayed to the User.

The Reckoner will provide a message regarding the level of error and recommended steps to refine it

If the user accepts the size then the reckoner will use the ***modified*** Reality checker to search the data base and provide a report for the range of size indicated .

Alternatively the user may use the size (MS in the example given) and search a spreadsheet to obtain data to suit their own needs.

The Sizes SX,M,L,XL, etc are based on the Rules Relative size scale

Conclusion

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The Proposal for this ready reckoner

Will need to be considered by the ISBSG board

I believe it to be feasible.

It should NOT be seen as a substitute for an estimation process

It should be seen as a rapid check on the effort estimates arrived at.

The way it is presented it will have an accuracy no better than+-50%

However if your estimation process gives an estimate within the same band as the ready reckoner then it may increase your confidence