Are We Really That Bad?
A look at software estimation accuracy

1° IT Confidence Conference

Rio de Janeiro (Brazil), Oct 3 2013

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About Presenter's Firm

The ISBSG is a not-for-profit organisation that has the mission of helping to improve the performance of IT by collecting data on software projects and on software maintenance & support activities.

The ISBSG makes this data available at a reasonable cost for use in estimating, planning, benchmarking, management and research.

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What we will cover

Using data from completed software projects in the ISBSG repository, we will look at how people have gone about estimating their software projects and how well they did it. We will look at estimation techniques used, the accuracy of estimates and relationships between the estimates.

We will then offer practical tips and some steps you can take to determine how realistic your own estimates are.

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Principles of the ISBSG

- ✓ independent
- ✓ data integrity
- ✓ submitter anonymity
- ✓ practitioner driven
- ✓ practitioner accessible
- ✓ not-for-profit

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About the ISBSG data

The ISBSG data probably represents the top 25% of the industry. It does not reflect the industry “average” as the data has been submitted voluntarily and all the projects have been completed.

Any organisation that chooses to submit data to the ISBSG has sufficient process maturity to have a metrics program and is likely to be above average in its IT performance.

It is important to be aware of this when using the data.

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What estimation data do we collect?

The ISBSG collects data on estimates for:

- Project duration
- Project effort
- Project cost
- Project size

Not all the projects in the data set have data for all four types of estimates.

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Estimates of project effort & delivery

- 25% of projects met both estimates
  - 11% were better than expected
  - 14% were as expected
- 39% of the projects met one estimate but not the other
  - 25% were on time but used more effort
  - 14% were late but didn't exceed the effort estimate
- 36% missed both estimates – they were delivered late and ran more than 10% over the effort estimated.

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Observations

- Smaller projects with short durations were estimated the most accurately.
- Poor estimates, particularly of delivery date, tended to be for new developments and for client-server projects with a large number of users.

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Observation: Cost estimates

Errors in estimating cost correlate with errors in estimating effort (as you would expect).

Statistically, effort and cost are strongly related – this supports the intuition that cost is mainly determined by effort.

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Observation: Productivity and estimates

There is no relationship between project delivery rate (PDR), measured in hours per function point, and the accuracy of estimates.

Perhaps we would expect that projects delivered ahead of schedule would have a good PRD (low hours per FP delivered) but there is no evidence of that.

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How were the estimates done?

For delivery date, effort and cost:

- 38% used only work breakdown based estimates
- 16% used only functional sizing based estimates
- 27% of projects used both
- 18% used neither of the above but used tools or life-cycle models
- For 17% of projects management decreed when the project should be completed

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Observation

If a project has been functionally sized, the size is almost always used to help estimate delivery, effort, and/or cost.

For projects that were not sized, work breakdown or a management directive determined delivery, effort, and/or cost.

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Observation

Generally, projects that were estimated using a functional size approach slightly out-performed those based on work breakdown techniques.

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Individual estimates

Let's have a look at each of the four types of estimate (effort, duration, cost and size) individually.

- How often are projects underestimated and overestimated?
- What over-runs and under-runs are typical?
- What types of projects are likely to be overestimated or underestimated?

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Effort estimates

- 19% of projects **overestimated** effort by at least 10%
- 23.5% estimated effort within 10% of what was achieved
- 57.5% underestimated effort by at least 10%

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Observation

Effort estimates are the worst.

For effort, less than one quarter of projects are estimated accurately.

For projects with effort underestimated, on average the actual effort was **double** the estimate!

The worst case was an underestimate by a factor of 20.

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Observation

The is no relationship between which techniques were used to estimate effort and the accuracy of the estimate.

There were no patterns of which types of projects are estimated better or worse than others.

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Delivery date & project duration

- 4.5% of projects were delivered early
- 51.5% were delivered on time
- 44% were delivered late

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Observations

Projects that were late averaged **100% overrun** in duration!

For projects delivered early the average was around 22% better than the estimate (e.g. a project estimated at 9 months would have taken 7 months)

In most cases the cost of early delivery was increased effort

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Estimating duration

If a functional size is available it is almost always used as an input for the duration estimate.

Where no size is available duration is normally determined by management directive or by work breakdown.

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Observations

If functional size measurement is used in conjunction with an estimating tool, the estimates of duration improve – 60% of estimates are accurate.

Where management directed the date of delivery most were delivered on time or within 1 month of the date. Only 10% were more than 2 months late.

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Cost estimates

- 16% of projects overestimated cost by at least 10%
- 49% of projects estimated cost within 10%
- 35% underestimated cost by at least 10%

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Observations

When functional sized based techniques are used for a cost estimate, the estimate is within 20% of the actual cost 90% of the time.

Big errors in estimating effort go with big errors in estimating cost.

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Size estimates

Question:

If size in function points was estimated early in a project, how does the estimate compare to the final, delivered project size?

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Size estimate inaccuracies

- When an estimate is produced from incomplete information
- Inaccuracies can be caused by using a poor sizing technique
- ‘Scope creep’ can cause the final size to exceed the estimated size.

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Size estimation techniques

Three main techniques are used for estimating size. These cover 85% of the projects:

- For 40% of projects size was estimated from a data model
- 28% were estimated from a functional specification
- 17% estimated by analogy (comparison with a previous project)

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Size estimation accuracy

- 12.5% overestimated size by at least 10%
- 50% were estimated within 10%
- 37.5% underestimated by at least 10%

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Observations

Size estimates produced from a functional specification are more likely to be accurate.

For underestimated projects, on average, the actual size was 44% greater than the estimated size.

In the worst case the actual size was five times the estimate.

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Estimating: General observations

Enhancement projects are estimated more accurately than new developments.

Smaller projects are more likely to be estimated accurately or overestimated.

Estimates appear to be less accurate for projects involving new technologies; new languages; or with large user bases.

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Estimating Tips

- Use a combination of both micro and macro estimating techniques to improve estimates.
- Functionally size your project and use the size as input to your estimate.
- Consider using an estimation tool with functional size as an input.

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Reality check your estimates

- Be aware of the results of this research when you are checking an estimate
- Use some Rules of Thumb
- Compare your estimate to similar projects in the ISBSG repository
- Use the ISBSG Reality Checker tool (available to ISBSG web subscribers)

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Rule of thumb for project size

The Rule of the "Thirties" - Logical Tables and Logical Files

The number of logical tables in a logical data model equates approximately to the number of IFPUG Internal Logical Files

Various organisations have come up with a rule of thumb of one logical file equaling "thirty something" unadjusted function points of total software size for a development project.

You can use this to obtain a rough size estimate. The range is between 31 to 35 function points per logical file. So a system with 40 logical files can be very roughly sized as follows: 40 x 35 = 1,400 function points. This sort of rough estimate should have an allowance of + or -30%

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Rule of thumb for size

The Rule of the "Thirties" - Use Cases

There is a rule of thumb of one Use Case being approximately 35 function points. Obviously this is a very rough approximation as Use Case sizes can vary significantly.

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Rule of thumb – scope creep

Systems tend to grow at a rate of about 2% per month during the development cycle. (Capers Jones)

So for example, if you start with functionality that requires an effort 50,000 hours then in 12 months that will grow to ~63,000 hours

You must allow for this growth.

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Rule of thumb for duration

There are some “natural” durations for ranges of project size and effort, confirming that there is a limit to how far you can reduce duration by adding staff.

	Effort Hours	Duration Mths	Mths Av.
200hrs	100 - 800	1 to 8	1mth per 100- 5
	800 - 2000	3 to 7	7
	2000 – 3200	4 to 9	10
	3200 – 20000	8 to 12	24
	> 20000	>14	

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Where you can get the ISBSG data

- http://www.isbsg.org/portal
- ISBSG Release 12 D&E data
- ISBSG Corporate Subscription

The Reality Checker is an on-line tool available to ISBSG web subscribers.

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Estimation tools that use the ISBSG data

- Seer – http://www.**galorath**.com/
- **True**Planning - http://www.pricesystems.com
- ISBSG Comparative Estimating Tool – www.isbsg.org

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Questions?

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