



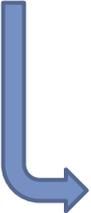
REVIEW OF SOFTWARE METRICS, COSMIC PROGRESS, VISION AND 2019 OBJECTIVES

**UK COSMIC Special Interest Group Meeting 9
UCL London, 8th February 2019**

Charles Symons

Agenda – Why are we having this meeting?

- Formal software metrics/estimating practices are not widely used in business (private and public sectors)
 - Software projects continue to fail to deliver on time and budget
- 
- COSMIC has achieved all the objectives set in 1998 for its FSM method, but the method has not achieved its market-potential
 - The COSMIC organization needs revitalising (likewise UKSMA)



Meeting Goals: to discuss

- Why the lack of interest in measurement?
- COSMIC 2019 objectives and emerging ideas
- how to grow interest again, internationally and in the UK



Why aren't standard software metrics used to measure and improve performance?

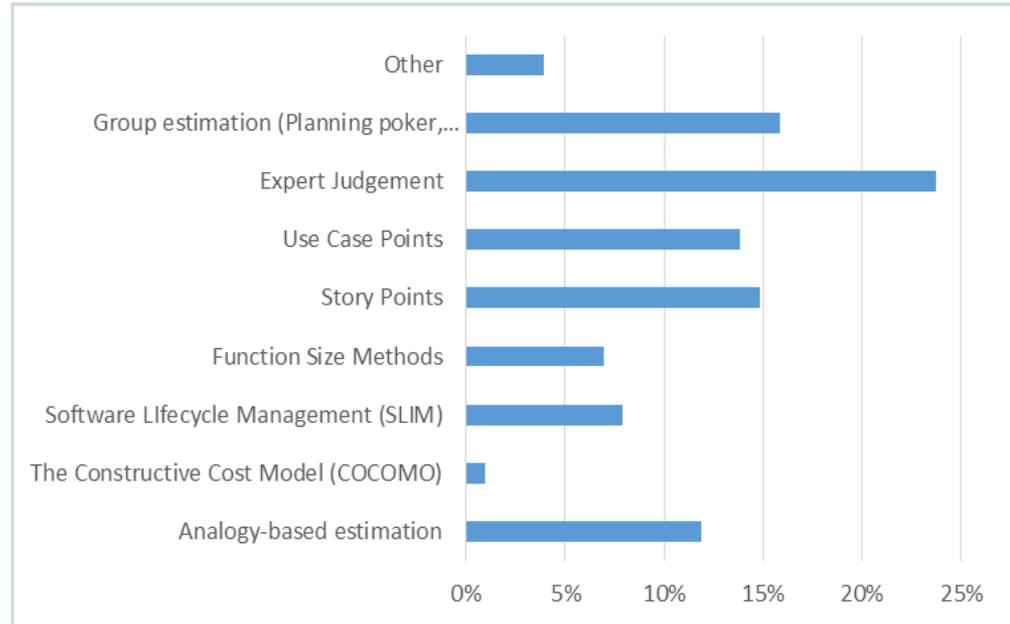
- (Quality measurement is widely practiced)
- Other standard metrics may not be easy to apply, e.g. for software assembled from components, or they need too much effort to apply, etc.
- Agile and DevOps practices don't like standard metrics
- Many software developers don't think like engineers (especially in the business application domain)
- Most (?) UK Universities do not teach basic software metrics
- There is little new outside academia

Symptoms: Decline of Software Metrics Associations, disappearance of SPI

Formal methods for estimating are not widely used in business

Jorgenson/Shepperd surveys, c 2002: 'effort estimation is mostly by expert judgement & analogy'

Kassab survey of 131 projects, mainly N. America, 2013





Why are formal estimating methods so little used?

- (Black-box estimating tools, have had some commercial success. SLOC-based estimating is also used in some sectors)
- Estimates are needed before requirements are known in sufficient detail to apply standard FSM sizing.
- Organizations do not capture performance data to calibrate standard methods. People want instant answers for estimates.
- Publicly-available benchmark data are not widely known used, and cannot give accurate estimates
- Agile practices – the ‘No estimate’ movement



However, there is still interest in software metrics and estimating

- Managers would like better estimates for budget purposes
- Interest in Agile-at-Scale. ISO work on architecture standards
- ICEAA is working on a SWEBOK for estimating
- Some Governments insist on FSM metrics (e.g. Brazil, Italy, Mexico, Poland)
- Interest in academic research on estimating, e.g.
 - using machine-learning
 - automation of COSMIC FSM
- Google and Microsoft will shortly publish 'Re-thinking Productivity in Software Engineering'



Summary and conclusions about formal software metrics and estimating methods

Summary:

Software quality is critical in many ways (security, availability, safety-criticality, etc.). So quality measurement is taken seriously.

BUT

Software projects still over-run and much money is wasted on them (though maybe less now due to Agile practices?)

Conclusions:

There is much work still to do to on formal methods of measuring performance and for estimating:

- To improve awareness of what exists
- To update formal methods on how to apply them in modern software practice

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We have progressed beyond our 1998 objectives, but the method is still not widely used

What have we achieved?

- The FSM method is mature and frozen (v4.0.2)
- Excellent CFP size/effort correlations found in multiple domains
- Use for effort-estimation demonstrated, + for estimation of memory-size and execution run-times (for real-time embedded software)
- Method variants are available for early approximate sizing
- Automated CFP size measurement for:
 - Requirements in UML, Matlab Simulink (in use)
 - Code in Java (in university research)
 - Requirements in natural languages or CNL (starting to appear?)

Strong interest in COSMIC FSM in China, Mexico, Poland, Turkey
Very limited use in the heartlands of Europe and N. America.



The COSMIC organization has become moribund

- Year-after-year we have said we must:
 - establish a Marketing effort
 - develop an Expert-level certification exam
 - get more benchmark data into ISBSG
 - produce publicly-available training material on CFP measurement..... **and nothing was done or achieved**
- The Exco has been almost self-perpetuating
- Except for the work of the MPC on the FSM method, progress has been made by individual effort, not by collective team-work



Late last year, I presented options for the COSMIC's objectives for the next 20 years

Option 0: Close down the COSMIC organization, leaving the web-site as a resource-centre (rejected by me!)

1. Continue as we are at present, supporting the FSM method and the IWSM conference, making occasional progress
2. Continue as Option 1 but aim to achieve all the goals we have repeatedly set ourselves
3. Continue as Option 2, but over time *“to shift the emphasis of COSMIC’s marketing from promoting not just the COSMIC method but to promoting software metrics as a means to improve the professionalism in software engineering”*.

COSMIC IAC members from 17 countries voted for Option 3!



COSMIC will need to collaborate longer-term with other organizations to achieve the goals of Option 3

The software metrics/estimating community is very fragmented:

- Three FSM method suppliers who compete more than they collaborate
- Several other software sizing/estimating methods are ill-founded but nevertheless are in use, e.g. USP, UCP, OOP, COCOMO
- Few viable SMAs, decreasing in number;
- Few large software metrics consultancies in Europe
- A few commercial suppliers of cost estimating tools and one of an automated FP measurement tool (CAST);



IMO, we must first demonstrate we can walk before we try to run

Current activities (IAC and MPC Members):

- Agreeing 2019 goals, short and medium-term
- Started work to achieve the goals

Later in 2019

- I believe candidates for revitalising the Leadership will emerge
- We can start to define our future Vision and to seek collaboration with other organizations in the supply-side of our market

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Summary of COSMIC 2019 objectives

Short-term

A. Communications

Includes a facility to e-mail COSMIC 'Members' which Products/Services for a fee, if any?

B. Finances

FOCUS

Medium-term



C. Market Development ..

How should we 'sell' COSMIC Ps/Ss? To whom?



D. Training Material

What material should we make available?



E. MPC Tasks

To improve accessibility, and what else?

F. Certification.....

Do we need Expert-level exams? Scope?



G. Research

How to stimulate researchers?

Later in 2019

H. New Vision/Leaders ...

I expect new Leaders will emerge

I. Benchmarking

(Only if time)



C: 'Market development' ideas (p1 of 3).

Widen the message about the value of CFP measurement

Traditionally, we have promoted COSMIC FSM as superior to other methods of size measurement, for use in measuring productivity and for estimating, to developers.

We should now widen our message to developers, i.e. the COSMIC FSM method:

- is 'future-proof' – applicable to existing and emerging processes and technologies, e.g. Agile, DevOps, IoT, micro-services, and for innovations yet-to-come
- can be used for a wider set of purposes, e.g. test planning, quality control of requirements, quality measurement, etc.
- has been and is being automated



C: 'Market development' ideas (p2 of 3).

Promote COSMIC FSM to tool vendors

We should promote COSMIC FSM to vendors of tools that support developers.

Examples:

- Vendors of estimating tools.
- Vendors such as CAST, SonarQube, MicroFocus, claim that developers will save money thanks to the measurements their tools provide, which show how to build software that is easier to maintain, less buggy, etc.
- Open software tool vendors such as Kubernetes, Jenkins, SonarCube users, who will measure in the future



C: 'Market development' ideas (p3 of 3).

Sell the benefits of measurement

Don't sell 'CFP measurement'. Sell 'the benefits of measurement'.

Examples:

- FSM is not an overhead. Applying CFP measurement can reduce costs, e.g. by helping to find severe defects early; this helps build business confidence
- Successful introduction of COSMIC into Polish Government circles: *"Measurement was part of our solution for how to make a win-win supplier - client relationship for software delivery. We never went to anyone with the idea 'I will tell you about the COSMIC method'.*

We talked about how to move from 'our projects fail - in scope, costs or duration' to 'IT is not magical, it is engineering; we have science, we have data, we have experience and your projects can be successful if you start to use that.'"

There's a wide range of potential target groups, each needing a customized message

Communities of potential users of metrics

- Software developers, e.g. Agile/DevOps
- Cost estimators (e.g. ICEAA)
- Project managers
- Professional societies e.g. BCS-SIGs, Software Metrics Associations
- Researchers, mainly in academia
- IT Directors (very hard to reach)

Specific organizations - to be approached individually to use CFP's

- Tool vendors
- Companies using CFP, e.g. that could publish helpful success stories
- Consultancies that currently only support IFPUG or Nesma methods
- 'Multipliers' – organizations that could influence others
 - BCS, National Audit Office, National Statistics Office



We must exploit new, 'active' channels to market

Our current main way of communicating with the potential market is almost entirely passive – principally our web-site
(+ research papers in academic journals and conferences)

Possible new active channels:

- Facility to e-mail new publications, news, etc., to 'Members'
- Use of podcasts, blogs, Twitter, maybe other social media
- Videos on YouTube, or Apps, that introduce and/or provide basic training in CFP measurement
- Standard letters that can be used by the COSMIC President, or adapted and sent locally by 'Members', to target specific organizations
- Develop standard marketing messages that can be used in all our communications



Some proposed marketing messages (p1 of 4)

1. COSMIC FSM is 'modern best practice, the state of the art'.

Use of SLOC is 50 years old, Albrecht's method is 30 years old, Story Points are no better than estimating by analogy, etc.

2. Measurement of software activities helps reduce costs; it is not an overhead

3. Measuring CFP sizes **adds value** to software activities due to: **'its wide variety of uses in decision-making + ease of use'**

Some proposed marketing messages (p2 of 4)

4. Message used successfully in Mexico

CFP measurement is:

BASIC because it is an accepted international standard that allows the generation of future derived metrics;

UNIVERSAL because it enables all economic actors and software development roles to perform their functions (development, test, D&A, self-management, etc.) and transactions (buying and selling, bids, etc.);

TRANSCENDENT because being basic, the metrics allow comparisons over time (forward and backward) and through different practices and technologies, which are always changing.

Some proposed marketing messages (p3 of 4)

5. The **'Metrics Manifesto'** (by analogy with the 'Agile Manifesto')

"We prefer:

Objective over subjective measurement methods;

Effort estimates from objective facts over estimates by opinion, or 'No Estimate';

Learning from other teams over re-learning by individual teams;

Accountability for delivering customer-value over accountability for producing software

That is, while there is value in the items on the right, we value the items on the **left** more."

This proposal has provoked much debate, e.g. should the Manifesto aim only to sell CFP to Agilists, or should it be generalised, including on quality and effectiveness, to sell measurement to all?

Some proposed marketing messages (p4 of 4)

6. Do not sell software metrics and estimating.

Sell the **benefits** of an engineering approach to producing software, e.g. (with acknowledgement to the Polish message):

Delivering software-intensive systems is not a mysterious 'black art'. It is engineering. With proven methods, with data, discipline and experience, you can deliver software-intensive systems successfully.

Objective D. Training issues and ideas(p1 of 2)

Do-able?

How should COSMIC supply training material to the market?

- 'Open', freely available, may be translated or adapted to local audiences?
- Licence use of standard COSMIC material to third parties
 - hence also a source of income?
- Offer to certify Third Parties' own material?

✓

?

✗

What type(s) of training material should COSMIC Offer to the market?

How should the material be delivered? Media? Channels?

Objective D. Training issues and ideas(p2 of 2)

Types of training material to be offered:

- Audience? General, IT Management, Developers, Students
- Level? Awareness, Introductory, Measurers
- Software domain? All, business, real-time
- Delivery medium? Slides, videos, with/without narration?
- Study mode? Self-study, or needs a qualified lecturer to deliver?

My view on priorities:

- Awareness-video / General audience / marketing goal / via YouTube
- Introductory series of videos / Slide format with narration / Self-study, aiming to 'hook' potential developers & measurers. Aim to get them to the level where, with off-line self-study, they can pass the Foundation-level exam

Other views?

Objective E: Measurement Practices Committee tasks

Recent work has focused on improving the accessibility of our documents and bringing them all in line with v4.0.2.

Next priorities (my personal view)

- Update the ‘Guideline for the use of COSMIC FSM to manage Agile projects’
 - Describe actual experience of CFP use in Agile projects
 - Show results of CFP size/effort relationships at Sprint level
 - How CFP can add value in Agile-at-Scale and in DevOps environments
- Publish a ‘Guideline on the use of COSMIC FSM in Estimating’
- Publish Guideline(s) on use of CFP with new technologies, e.g. component-assembled software such mobile apps
- Other views?

Objective G: 'Research'

Research Objective Goal: To create a better research infrastructure, aiming to 'let a thousand flowers bloom' in the research community.

- Provide sample problems
- Provide data sets
- Attract new scientists
- Make the IWSM/Mensura conference a 'Scientist meets Industry' event

(A related proposal: to provide an annual Award for the best paper at the IWSM on automation of CFP measurement.)

Note: next IWSM/Mensura 2019: 8/9th October, Haarlem, Netherlands.

Call for Papers: <https://easychair.org/cfp/iwsm-mensura-2019>



Final discussion. What can we do to stimulate interest in software metrics again in the UK?

Which type(s) of marketing initiatives?

Aimed at which audiences, organizations?

In collaboration with which other organizations?

Future of UKSMA? (Continue 'as-is'? Become a BCS SIG? Or?
Establish new SIG's?)

Future of UK COSMIC SIG? (Continue 'as-is'? Training days? What meetings would be useful? Speakers? Venue(s)?

What
ACTIONS
can we
take?