One year experience with COSMIC FFP

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Abstract

In this paper we present the results of one year experience with COSMIC Full Function Points (CFFP). We have implemented CFFP in several organisations using our implementation model MOUSE. Some of the organisations had experience with function point analysis. Part of this paper will be the arguments of the choice for CFFP in relation to the experience with function point analysis.

From the supplier's perspective we go into detail for estimating, performance measurement and customer confidence. Estimating from the supplier's perspective is crucial for making realistic proposals, performance measurement is essential to gain insigth into the productivity of development projects. Knowing the productivity increases the predictability, which is the main issue in customer confidence.

From the customers perspective we look at implementation and estimating issues. Our implementation method MOUSE proved very useful for those clients that did not have experience with a functional sizing method to implement CFFP and to prepare the organisation to use size measurement as a method within performance measurement.

Customers with experience with a functional sizing method had very different demands. The Rabobank has over 10 years of experience with FPA and did not want to loose all experience figures so part of the implementation was to investigate reuse of FPA-figures. We found a correlation between FPA and CFFP so reuse of these figures possible under certain conditions. One other issue was benchmarking. Because of the importance of benchmarking Rabobank participates in ISBSG/COSMIC benchmark study 2003.

1. CFFP experience from the supplier's perspective

Sogeti Nederland B.V. is a Dutch software services company with 1700 employees. In august 2002 IQUIP Informatica, Gimbrere & Dohmen and Twinsoft merged to form Sogeti Nederland B.V. Since 1988 IQUIP is known in the Netherlands as a promoter and initiator of functional size measurement. Sogeti continues the leading role of IQUIP by means of the Expertise Centre Metrics of the Engineering & Projects division. Sogeti plays an active role in the promotion and further development of CFFP by participating in working groups of the NESMA (Netherlands Software Metrics Association) and the Measurement Practices Committee of COSMIC. Since 1999 Sogeti supplies the know-how and the manpower for the functional sizing of software projects also as an insourcing activity [1].

End 2002 Sogeti Nederland B.V. started using CFFP. The effects for the internal activities are described in next paragraphs. The effects for the activities for and with clients is decribed in section 2.

1.1. Estimating

The realisation of software is for most of our customers no longer an independent software project, but is part of a business case which includes all disciplines involved. This means that the cost of the software must be balanced by a profit somewhere else in the company. So clients want to have a good estimate of the cost of the software before the software is being built. To cover financial risks they want fixed-price contracts from their suppliers.

By offering fixed-price proposals the supplier needs to have a very good estimating process to be able to handle the financial risk he takes from the client. At Sogeti this process

takes the form of the E-street, where we have trained professionals to measure the functional size of software projects and to discover risks for the projects. Our experience is that if an expert in functional size measurement has difficulties in determining the size this usually means that the software requirements are not unambiguous. These ambiguities often lead to difficulties in the realisation of that part of the functionality. A methodical functional size estimate is a fixed part of our bid strategy for both reasons of project size and risk analysis.

With CFFP we can make our methodical functional sizings with one method for different kinds of projects, whether it is a traditional Cobolproject or a new .NET development. Being able to use one sizing method for all projects has the advantage that we can work with uniform size criteria in our project management and our bidding process.

1.2. Performance measurement

From the suppliers perspective it is not enough to know the project size and the possible risks. Often we are not the only supplier that makes a proposal, so we have to be competitive as well as precise. So our E-street is not only involved in the proposal process, but also monitors the performance of our projects, especially in our development streets where most of the fixed-price software is being built.

The development streets at Sogeti are controlled environments where software is being built as efficiently as possible. By measuring the performance of the projects in this environment we are able to track the cause(s) of differences in performance between projects. Knowing the cause of these differences we can start a software process improvement action to implement the practice which led to the best performance into our standards. So performance maesurement is the basis for being and staying competitive.

1.3. Customer confidence

More and more of our clients are working with preferred suppliers. A criterium most often used to select preferred suppliers is customer confidence. Since software projects are most often part of projects within a large part of the client's organisation predictability is a much more important factor than the lowest price.

Performance measurement is not only the basis for competitiveness but also for customer confidence. By tracking all projects we not only know how fast we can build software, but with the same process also how fast we wíll build the software. Because of the performance measurement process Sogeti can predict very well when projects will be ready, which means that we are able to offer proposals not only fixed-price but also fixed-date and that we will deliver at the agreed date. With this last aspect we gain a lot of customer confidence.

2. CFFP experience from the client's perspective

Since 1988 Sogeti does not only use functional sizing for its internal processes, but also makes functional sizings for its customers. For this article we picked four different customers which we support with CFFP in four different ways. For two of these clients CFFP is used in a traditional MIS environment. For the other two clients CFFP is used in areas where FPA cannot be applied.

2.1. Rabobank, conversion from FPA to CFFP

The changing market for financial products demands more complex products with a shorter time-to-market, which made Rabobank look for a new ICT-strategy. Information

systems should be able to focus on the client (a client with one or more products) instead of on the product (each product has its own clients). This meant a change from an architecture with dedicated product systems to an architecture that contains a shared data source for shared (client) data [2].

The *set* of dedicated product systems are migrating to a *net* of generic service components organized in (front-end) distribution systems, client systems and product systems. New information systems now usually contain links between various existing systems together with new service components. This means FPA no longer gives appropriate sizing figures for this architecture, since one of the basic principles of this technique is the coupling of data and functionality within the information system to be sized [3].

Within Sogeti it was verified that CFFP [4] met the technical requirements of Rabobank for a functional sizing method for the new architecture. However some questions remained that could not be answered beforehand:

- Is it possible to convert historic data from FPA to CFFP?
- Can CFFP be used for early estimation?
- How well can enhancement project be estimated with CFFP?

Sogeti and Rabobank together financed a research project to investigate the above questions and to rearrange the sizing and estimation process accordingly.

2.1.1. Reuse of FPA data

With FPA Rabobank had a complete support of the sizing and estimation process, with two levels of approximate estimating in the early stages of a software development project [3] and a functional sizing method for enhancement projects [5], supported by a measurement database with evaluation data from within the organization. For CFFP all three questions mentioned above could not be answered beforehand or were non-proven. Before CFFP could be accepted these aspects should be filled in.

The chosen approach was the following:

- Choose a number of projects already sized with FPA and size them again using CFFP.
- Determine whether there is a correlation between the size in function points and the size in COSMIC functional sizing units (cfsu) and derive a conversion formula.
- Use the measurement data in cfsu to derive the approximate versions of CFFP according to the guidelines in the Measurement Manual [4, chapter 7].

To determine a possible correlation between function points and cfsu only those projects were selected that had made an unadapted use of FPA. Within the Rabobank organization, all sizing reports contain a section that describes assumptions about the described functionality or interpretations of the counting rules that had to be made in order to be able to size the reported project. Assumptions about the described functionality are usually the result of ambiguous documentation. For a new sizing using CFFP the same assumptions must be used to get comparable results. Interpretations of the counting rules usually are the result of a mismatch between the principles of the functional sizing method and the development method used to design the software. Interpretations therefore are small adaptations of FPA. If this was the case a project would be dismissed from the conversion project because of adapted use of FPA.

Table 1 : Sizing results Rabobank

NESMA 2.2	COSMIC 2.2
39	23
52	29
260	81
170	109
120	115
249	173
218	181
224	182
380	368
766	810
1424	1662

If the preconditions were met a project could be resized using CFFP. The End User Viewpoint was used because this viewpoint uses a definition of the user that is the most similar to that of Function Point Analysis.

Up to now eleven projects have been sized with both methods (see table 1 and figure 1).

To evaluate whether there is any form of correlation between the size of a project in function points and in cfsu linear regression was used. Since both methods should describe the same attribute of a software project: the functional size as seen from the perspective of the end user, it seemed reasonable to expect a linear correlation between the two methods.

Using linear regression the conversion formula from function points to cfsu at this moment reads as:

Y (cfsu) = -87 + 1,2 X (fp)

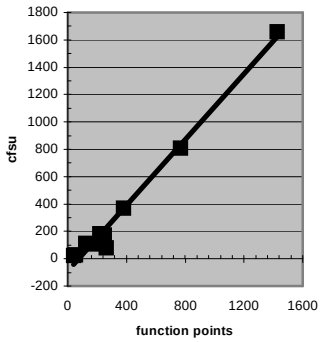


Figure 1 : Correlation between fp and cfsu

The correlation coefficient is 0,99 and the standard deviation in the Y-value is 59 so we can conclude that in the Rabobank environment there is a fairly good correlation between the size in function points and in cfsu. We hope that when more projects become available the correlation will increase and the standard deviation will decrease. Note that with more projects available also the values of the gradient and the offset might change.

The fact that there is an offset in this conversion formula might be explained by the fact that a substantial part of the size in function points (usually 30-40%) comes from the ILF and EIF. The existence of an ILF or EIF always leads to the same count in function points, whether they are fully maintained or not. CFFP counts the use of data: if some entity is not fully maintained (which is often the case in our set of projects) this will lead to less data movements per entity and thus to a negative offset in the conversion formula from function points to cfsu. As far as we are aware this theory has not yet been supported by evidence from research [2].

2.1.2. Early estimating

To support early estimation an approximate version of the CFFP method can be used. In the Measurement Manual the process to do so is described in detail [4, chapter 7]. The manual also states that the approximate version might be different for different environments. To check this statement we have derived our own approximate version, based on the data of the first ten projects that were sized to derive the conversion formula (see table 1).

The approximate version provides an average value for the size of a functional process. In the very early stages of software development only the number of functional processes is known. To estimate the size of an application the number of functional processes can be multiplied by the average size of a functional process. In the example in the measurement manual, based upon development of avionics of a military aircraft, the average size of a functional process is 8. From our data we have calculated the average size of a functional process to be 7,3.

In a later stage of the development process there is sufficient information about the functional processes to classify them into different categories. The method described in the Measurement Manual to classify functional processes uses four categories:

- small (e.g. retrieval of information about a single object of interest)
- medium (e.g. storage of a single object of interest with some extra checks)
- large (e.g. retrieval of information about multiple objects)
- complex

Table 2 : Comparison of averages

Quart	Avionics	Rabobank
small	3,9	3,6
medium	6,9	4,4
large	10,5	6,3
complex	23,7	14,9

These categories can be assigned average values by dividing the number of functional processes into four quarts and computing the average size of a functional process in each of the quarts. In table 3 we present the data from the Measurement Manual and our own data.

The fields from which both sets of data originate are very different and not surprisingly the results are not comparable. This is in contrast with one of our earlier publications [2]. After the publication of that article we found out that there was a difference between the method described in the measurement manual and the method used to calculate the values in the measurement manual. Therefore we decided to test three different methods of deriving an early estimation method:

[A] Dividing the total size into four quarts of equal size

[B] Dividing the total number of functional processes into four quarts of equal numbers

[C] Dividing the functional processes into four quarts based on the largest functional process (in our case 32 cfsu).

Table 3 : Comparison of quarts

Quart	Range	Avg.
Method [A]		
small	≤ 5	4,0
medium	5-8	6,2
large	8-14	10,8
complex	≥ 14	24,7
Method [B]		
small	≤ 4	3,6
medium	4-5	4,4
large	5-8	6,3
complex	≥ 8	14,9
Method [C]		
small	≤ 8	4,9
medium	9-16	11,5
large	17-24	19,8
complex	≥ 25	49,8

In table 2 the outcome is presented for the range of the quarts of each method. Method B gives ranges for small, medium and large that are so close together that it is not a practical method to use for early estimating. The ranges are so close together that there is a large risk of misqualifying a functional process into the wrong quart while making an early estimate. On the other hand the penalty for misqualifying small or medium functional processes is only 0,8 cfsu.

To test the predictability of these three methods we recalculated the size of the 11 projects in section 2.1.1 by substituting the real value with the average value of the corresponding quart of the early estimation method.

Table 4 : Comparison of precision

Method	Precision overall	Precision per project
[A]	6%	13%
[B]	9%	17%
[C]	4%	12%

We calculated the precision of the methods in two ways. The precision of the total size of all 11 projects or the average absolute precision for each project. Both calculation methods show the same trend that method [C] is the best predicting estimation method, followed by the method described in the measurement manual [A] and the method used in the measurement manual [B]. Because we only tested the predictability within one organisation further research is necessary to conclude if there is a general truth about the predictability of which method is best.

2.1.3. Benchmarking

Most of the software within Rabobank is being built by internal IT-departments. Since the realisation of software is part of larger projects this means that the cost of the software is part

of a company-wide balance. The IT-departments have to prove that they deliver value for money. One of the ways to do this is to compare their productivity with external standards.

For projects sized with FPA or Lines of Code there are enough benchmarking standards available. With the conversion formula from function points to cfsu these benchmarking standards can still be used for software projects that can be measured with both methods. Whether using FPA-benchmarks with converted figures for software projects that cannot be measured with FPA results in useful comparisons is still under investigation, but in the long run this is not an ideal situation. Rabobank therefore participates in setting up a database with CFFP-projects within the ISBSG repository [6]. First results from this project are expected in february.

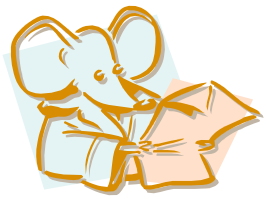
2.2. Insurance Company and Logistic Service Organisation, the ease of an SLA

Both the Insurance Company and the Logistic Service Organisation were new to the use of a functional sizing method. These two companies had much smaller IT-organisations than Rabobank, so installing a metrics team within the clients organisation was not an option. The best way to assist these clients took the form of a SLA between these clients and the E-street. To implement the use of the results from the E-street within the clients organisation we used the implementation model that had proved very useful with Rabobank: MOUSE.

2.2.1. Service Level Agreement

For internal projects Sogeti has set up the E-street (see section 1.1) to make functional size estimates and to produce performance figures. These activities are also done for clients like the Insurance Company and the Logistic Service Organisation. To ensure an implementation that fits the operational procedures of the client we describe the tasks and the responsabilities of both participants in a SLA. To determine which tasks and responsabilities could best be carried out by which participant we used our implementation model MOUSE.

2.2.2. MOUSE



Implementing a (functional size) method is more than just training people and prescribing the use of the method. All the lessons learned from organisations like Rabobank formed the basis for MOUSE, a model to help to set-up the right implementation, to create the environment the method fits in.

Implementing a method can be compared with implementing a new information system. For an information system the ‘business requirements’ have to be identified. Then the ‘functional requirements’ that need to fulfil these business needs have to be specified. The same applies for implementing a method. An organisation has to identify the business needs and then find a way to specify the required ‘functionality’ to fulfil the needs. MOUSE helps to identify that ‘functionality’. MOUSE describes all activities and services that need to be carried out to get a method up and running. A major aspect that needs to be filled in is how to get organised. Tasks, activities and especially responsibilities have to be assigned. When all variables are filled in the next step is to draw up the corresponding implementation steps into the SLA.

MOUSE comprises all activities and services required implementing a method successfully, clustering the activities and services into groups of key issues, described in table 5:

Table 5 : Key issues of the MOUSE implementation model

M	**O**	**U**	**S**	**E**
Market View	Operation	Utilisation	Service	Exploitation
1. Communication 2. Evaluation 3. Investigation 4. Improvement	1. Application 2. Review 3. Analysis 4. Advice	1. Training 2. Procedures 3. Organisation	1. Help Desk 2. Guidelines 3. Information 4. Promotion	1. Registration 2. Control

The only suitable structure organisational structure for functional size measurement is to concentrate expertise and knowledge in an independent body. This can be a person or a group within or outside the organisation. When activities are assigned to individuals in projects, many additional measures have to be taken to control the quality of the measurements and continuity of the measurement activities.

- **M**arket view

Communication in the context of MOUSE is a bi-directional exchange of information with both the own organisation (internal market) and external organisations (external market). Communication with external organisations is important to stay informed about the latest developments. COSMIC and NESMA (workgroup COSMIC) are platforms for CFFP. Because Sogeti has various connections with these organisations, the clients knows about developments through Sogeti and does not need to implement specific activities to keep up-to-date on the latest developments.

If the measurements are organised within the clients organisation, a direct and open discussion is possible with stakeholders of the projects. When the measurements are organised outside the clients organisation more formal ways to acquire information may be desirable, like evaluation, basically an assessment of the measurement process.

Some of the information is direct input for continuos improvement of the measurement process. Depending upon the type of signal (operational, conceptual or managerial) further investigation maybe required. Investigation can be theoretical and empirical. Theoretical investigation consists of studying literature, visiting seminars or following training sessions. Empirical investigation consists of trying selected tools for measurement and the analysis of experience data. Usually these two ways of investigation are used in combination. Sogeti carries out a lot of research and development for proprietary purposes. Results are passed on to the clients organisation through the E-street.

Signals that lead to enhancement or improvement of the measurement process or measurement method are discussed with all parties involved. When bottlenecks are reported, solutions or suggestions for a solution will be proposed.

- **O**peration

Operations include all activities, direct related to the application of the method. In this case activities like executing measurement activities (size measurementts, tallying hours spent and identifying project variables) are performed by the analysts of the E-street.

The best way to guarantee quality of the measurement data is by carrying out reviews. The purpose of reviewing is threefold:

- ensure correct use of the method (rules and concepts);
- keep track of applicability of the method;
- keep up-to-date with actual development.

In the SLA the moments for measurement are indicated. The measurement is executed at the start of a project (global size measurement), during the project (detailed size measurement) and when the project is finished (detailed size measurement). In the first two situations the results of the measurement are input for an estimation (advice) that helps the project manger to make a realistic project plan.

Apart from size the most important variable is the productivity rate. The productivity rate is the output of an analysis. The actual effort is corrected for project specific circumstances. The adjusted hours and the actual (delivered) size are used to calculate the productivity rate.

- **U**tilisation

Next to basic training it is necessary to maintain the knowledge at the appropriate level. The analysts should have refreshment training on a regular basis, referring to new developments in the area of the applied methods. When training is 'purchased', it is important to keep track of the training offered on the market. In case of the SLA, Sogeti is responsible for keeping the knowledge up-to-date.

To guarantee the correct use of a method procedures describing processes and activities related to measurement are necessary. Examples are:

- project management guidelines;
- change management control;
- project registration;
- (project) evaluation.

The decision to outsource knowledge and activities to the E-street simplifies the organisational process within the clients organisation.

- **S**ervice

To support the clients organisation a help desk needs to be in place. The help desk should be able to answer questions with limited impact immediately. It is important that the help desk reacts adequately to all kinds of requests related to operations. Decisions made regarding questions concerning the suitability of the guidelines of the methods need to be recorded in organisation specific guidelines.

The success of the measurement programme depends on the data gathered. It is important that suppliers of data are willing to provide this data. The best way to stimulate this is in return to give them information about the data analyses. This should provide answers to frequently asked questions, such-as: “What is the current productivity rate for this specific platform?”, “What is the reliability of the estimations?”, “What is the effect of team size?”. The experience database of Sogeti or the ISBSG can usually answer most of those questions.

A proactive stance is promotion; marketing the benefits of measurement (methods) and the ‘selling’ of the services. This is necessary for continuity and extension of the measurement programme.

- **E**xploitation

The administration and registration of the information related to the measurements consists of two components: the measurement results and the analysis data. Because all size measurements are registered in SIESTA, measurement results are already filed digitally. The analysis data needs to be stored in an experience database. It is important that the derived data (productivity rate, project characteristics and risk database) has to be made available for estimation.

Control is required for procedures, guidelines, SIESTA files and the experience database.

2.3. Telecom Company, datanetworks for videoconferencing

With a Telecom Company, Sogeti has started a pilot to use CFFP for software that controls data networks. A division of the Telecom Company provides software to control data networks for video conferencing. Several years ago this division tried to use FPA to measure the software but failed to get useful figures to control their software projects. With CFFP, the management of this division wants to try again to get grip on costs by implementing a size measurement method which should give useful functional size figures. The pilot has started in december and the first results are expected late february.

2.4. Insurance Company, new technologies – new metrics

The Insurance Company – a different one as described in section 2.2 – had similar experiences with FPA as the Telecom Company in the previous section. For projects with their proven technology (mainly Cobol) FPA worked fine, but with new technologies, using new development methods, they could not get useful sizing figures to get control over their projects. After a successful pilot they now make use of the services of Sogeti's E-street on a project to project basis.

3. Conclusions

In traditional environments CFFP works as well as FPA. Within Sogeti all projects that could be sized with FPA are now being sized with CFFP and more and more clients are following our lead.

Based on our own projects and comparison with other literature [2] we have sufficient evidence that there is a linear correlation between the size in function points and in cfsu for projects that can be sized with both methods. The conversion formula gives Sogeti and their clients the opportunity to reuse sizing and productivity figures from projects sized with FPA.

The first results of using the approximate versions of CFFP show good results. On larger portfolios we can see that the approximate versions of CFFP are almost as good as the approximate techniques from NESMA or IFPUG FPA [

With a year of practical experience the gamble of being an early adopter has paid off. The next test will be to assess the predictive value of CFFP for development projects that cannot be sized with FPA. We also want to verify our assumption that maintenance function points can be converted to cfsu using the same formula.

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