

by
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Introduction

The collecting and analyzing of data for purposes of measuring performance and managing software deliverables is fast becoming a common practice within the software development community. One of the critical pieces of data is size. Size can be defined as software work products (number of programs, lines of code, objects, etc) or it can be defined relative to the functionality delivered to the customer (input transactions, reports, inquiries). A proper sizing mechanism is necessary to be able to truly measure performance productivity, as level of effort or cost alone does not equate to productivity. Productivity is calculated as a cost (or effort) per a unit of work (size).

Function Point Analysis (FPA) is an industry accepted sizing technique that was developed by IBM in the mid-seventies. It has been adopted worldwide and is supported by a unified governing body, the International Function Point Users Group (IFPUG). IFPUG maintains the defined FPA methodology, supports the current counting practices and certifies professional counters.

However, not everyone has adopted FPA as their sizing technique of choice. Past criticisms of the methodology have included concerns that it takes too long; it requires too much detail; it is too difficult to implement; and it costs too much. A recent study has shown that an adaptation of the FPA methodology – FP Lite™ – is a reasonable alternative to the detailed FPA method, and in fact, addresses many of the criticisms that have been levied in the past. This paper introduces the FP Lite™ methodology in correlation with two studies designed to statistically understand the accuracy of the FP Lite™ methodology in contrast to the detailed FPA method.

The Need for Sizing

Amongst mature organizations there is seldom a debate around the fact that sizing is an important aspect of managing and controlling project delivery. At a minimum we must size our work product in order to effectively estimate the level of effort needed to build the required deliverable. The importance of having an accurate (or accurate enough) sizing mechanism has a direct impact on the efficiency of how we utilize our resources and how we manage our budgets. Furthermore, properly sizing the work product allows us to reasonably manage our customer's expectations with regard to clarifying requirements and managing scope.

Using Function Points

One of the most effective sizing techniques available is Function Point Analysis (FPA). Developed by IBM in the mid-seventies, FPA has evolved into the most flexible standard of software sizing in the information technology (IT) domain today. While there are several characteristics which drive the popularity and usage of the FPA methodology, its foremost appeal lies in the ability to measure the size of any software deliverable in logical, user-oriented terms. FPA measures the *functionality* being delivered to the customer by identifying, evaluating and weighting functional entities (inputs, outputs, inquiries and data usage) from a *user* perspective. [The term *user* is defined to be any person and/or thing that interacts with the software. Clearly, the user could even be another system or even a machine.] By applying this approach, function points can be universally applied regardless of platform, environment, language, or other technical considerations.

FPA has been successfully used to size a wide spectrum of applications and projects, including general business, complex financial and accounting, logistics and communications systems. It has been proven on a variety of development platforms and/or environments (e.g. mainframe, client-server, web, stand-alone PC, data warehouse); for a variety of development types (real-time, batch, interactive or control systems);

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for internal or external development efforts (e.g. on-shore, off-shore, contractor-based); and for vendor and/or COTS package integrations. Resulting measures based upon function point sizing [e.g. delivery rate (hours/function point), defect rate (defects/1000 function points)] are effectively being used as the cornerstone in metrics initiatives (IT balanced scorecards, benchmarking against industry standards) and also as the basis for IT performance measures in outsourcing agreements.

In addition, FPA also serves the dual role of being user friendly (sizings are expressed in terms the customer can understand) and providing value to the developer as a consistent and quantitative measure of work product size. So why isn't everyone using it?

Issues Regarding Function Point Analysis

Since its inception there have been a number of reasonable and rational 'complaints' or criticisms regarding the use of the FPA methodology. We often hear such comments as

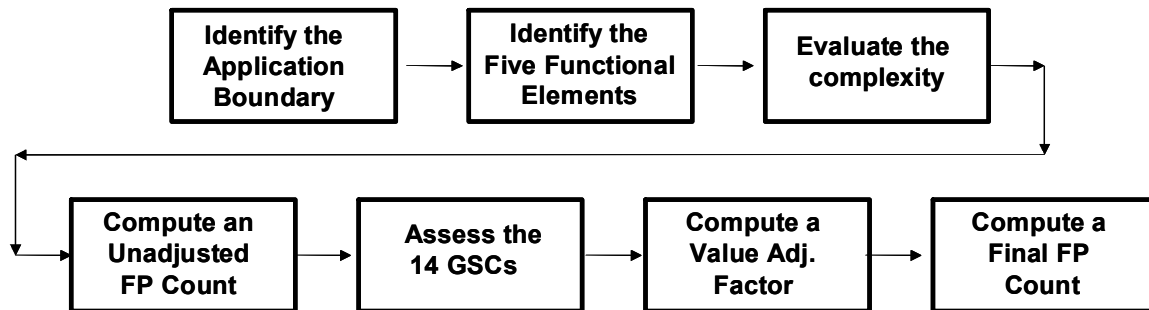
- FPA methodology terms are confusing
- It takes too long to learn, we need to hire an expert
- The methodology needs too much detailed data that is simply not available
- FP does not reflect the complexity of the application
- It takes too much time

If these are the core excuses for not sizing (using FPA) then by eliminating these concerns there should be a wider acceptance and use of the FPA methodology.

[One important note about the 'it takes too much time' comment. This is either a statement made based on a total lack of understanding on the importance of accurately sizing and estimating a deliverable or it is in fact based on the concern that time is of the essence and the ability to produce an accurate and acceptable size measure needs to be quicker, cheaper and better than the current FPA approach. The question really should be: how much time should you invest in the sizing and estimating of a product deliverable? Answer – if you could significantly reduce the amount of time spent managing schedule and cost overruns and improve your credibility with your users - would an investment of less than 1% of the total project effort be a reasonable investment of your time?]

An Alternative Approach

The current FPA approach involves a series of steps that lead you through a detailed analysis of the various functional elements, their applied weights and an assessment of the general systems characteristics that influence the functionality being delivered. The process flow looks like this.



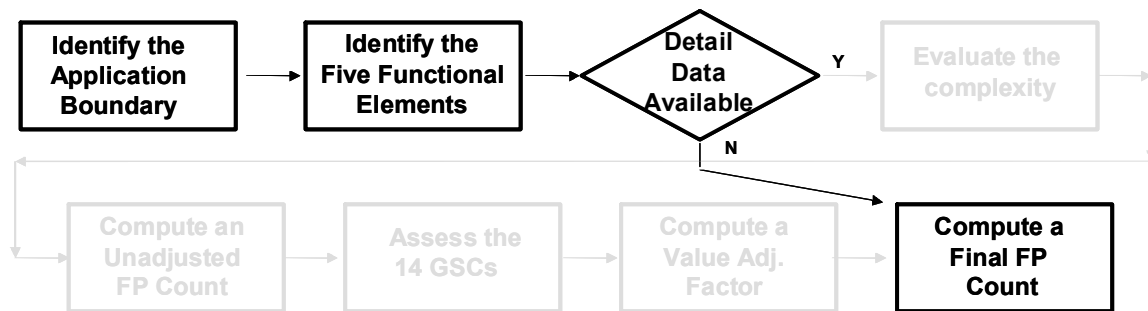
Identifying the five functional elements (inputs - EI, outputs - EO, inquiries - EQ, data stores - ILF and interfaces - EIF) is beneficial in that it relates directly to the functionality that the user has requested and expects to receive. The subsequent step to evaluate the complexity of each of these functional elements is

dependent upon having the necessary detailed system documentation available in order to perform a series of calculations to derive a weighted value for each of the elements. This is the part of the FPA process that typically is the most time consuming.

Since this “complexity evaluation” is the source for some of the criticisms about FPAs then it is a logical leap to consider - what is the impact on the accuracy of our size estimate if when performing a FP count we simply assume everything is of average complexity? If in fact a ‘Lite’ version of the FP methodology could be proven to be statistically accurate enough then we might suggest one could use this FP Lite™ method when:

- You don’t have enough detail data to determine the complexity
- You don’t have the time to perform a full count
- You don’t have the skill (or motivation) to perform a full count

A proposed FP Lite™ process flow would be as follows.



If detailed system documentation is not available then we simply assign average complexity values for all identified elements. In order to understand the feasibility of promoting a technique such as FP Lite™ we conducted an analytical study to determine the impact on the accuracy of the resulting size.

FP Lite™ Study

The intent of the study was to determine -

- What is the statistical variability between a detailed function point count (FPA) and a FP Lite™ count
- What is the effort involved for a detailed function point count vs. a FP Lite™ count

The table below shows the function point value for each of the five functional elements (EI, EO, EQ, ILF, EIF) depending upon their low, average or high weighting. For example in Table 1, an Input (EI) identified as “Low” complexity has a function point value of 3, an average complexity input has an assigned value of 4 and a high complexity input has a value of 6. There is a natural variability that exists within the methodology dependent upon the weightings applied to the various elements.

Table 1 - PROFILE

FP Entities	Low	Var.	Avg.	Var.	High
EI	3	+33%	4	-33%	6
EO	4	+25%	5	-28%	7
EQ	3	+33%	4	-33%	6
ILF	7	+42%	10	-33%	15
EIF	5	+40%	7	-30%	10

With this in mind, it stands to reason that a detailed function point count that has a majority of low complexity entities will result in a function point size that would be less than the function point size derived by using the

FP Lite™ method which assumes everything to be average. Conversely, the FP Lite™ method will understate a detailed function point count that has a majority of high complexity entities. However, are function point counts typically weighted towards one extreme or the other?

By looking at a random sampling of projects we were able to determine the resulting level of accuracy when applying the FP Lite™ method in contrast to the detailed method of counting.

Our approach consisted of the following steps.

- Collected data from two separate sources (identified as Group 1 and Group 2)
- Counts were performed by experienced function point counters all counting consistently but independently
- Counts were randomly selected from a larger group of counts

Projects were all counted independently by a coordinated group of Certified Function Point Counters. Counts were performed for a client and were subject to several QA reviews to ensure proper accounting for all functionality.

Group 1 Projects

Group 1 Profile

Total number of projects - 30 Enhancement projects from (30) different applications

FP Size Range	# of Projects	Distribution of Size	
0 - 50 fps	11	Smallest	3
51-150 fps	10	Largest	1,916
Over 150 fps	9	Average Size	198.47
Total	30		

Distribution of FP Entities (% to total)

EI	37%
EO	20%
EQ	16%
ILF	24%
EIF	3%
	100%

Projects by Platform

Client Server	14
Web	6
Mainframe	9
PC	1

The above profile is a fairly typical representation of enhancement projects for a commercial based IT shop. An average size of 198 function points for an enhancement project is in line with our previous counting experiences.

Group I Statistics

Assumption: Statistics based on adjusted function points.

Total of all Projects	
Detail Count	5954 FPs
FP Lite™	5471 FPs

Variance* at the Project Level

Range	Extreme		Median	
	Low	High	Low	High
All Projects	-23.69%	32.16%	-8.90%	12.90%
0 - 50 fps	-21.42%	32.16%	-8.62%	26.07%
51-150 fps	-23.69%	19.72%	-10.22%	12.23%
Over 150 fps	-22.77%	4.18%	-8.91%	3.65%

*Variance expresses the performance of FP Lite™ relative to the actual (detail) count.

The total number of function points counted using the two counting techniques (detailed and FP Lite™) had an acceptable variance (8%). But we are less concerned about the total project portfolio count and instead we want to focus on the results at the project level.

The Extreme Low and High values represent the low and high variations among the size groupings. For example, across all projects, the greatest extent to which the FP Lite™ method understated the size was -23.69%.

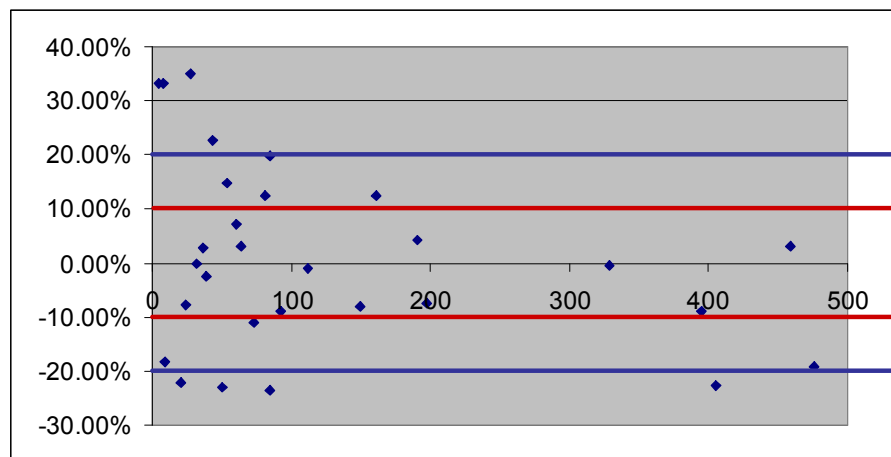
The Median Low and High represents the median values within each of the size groupings.

What we observed with the Group 1 projects (median values) was that projects that were less than 50 function points had the greatest variance while those projects greater than 150 function points had the least amount of variance (-8.9% to 3.65%).

Group 1 Distribution

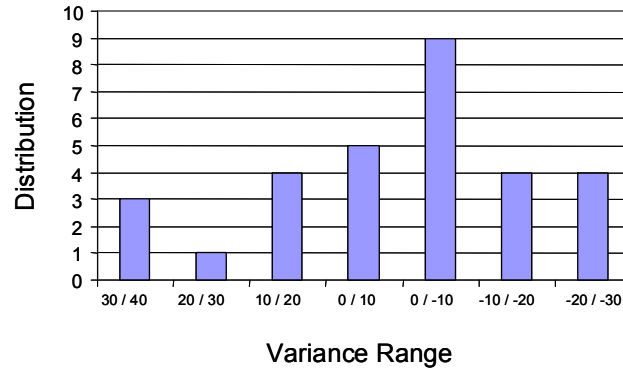
The graphical display below shows the distribution of the Group 1 projects. The y axis represents the percent variance and the x axis represents the project size. Note that one project of 1916 function points is not represented in the graph but it is in the statistics.

We observed that 47% of the projects had a less than +/- 10% variance using the FP Lite™ in contrast to the detailed counts. 74% of the projects were less than +/- 20% and 26% were greater than +/- 20%. To carry this forward we could say that nearly 75% of the time the FP Lite™ method resulted in counts that were +/- 20% of the detailed function point count.



The graphical display below shows the distribution of projects within a variance range. The Group 1 projects followed a (relatively) normal distribution centered on the 0 / -10% range.

Group 1



Group 1 Summary

The Group 1 results were looked upon favorably from several perspectives.

- The mean variance at the project level, particularly on projects over 150 function points is very favorable
- The distribution of projects resulting in a majority of projects with a variation no greater than +/- 20% is also very favorable
- The final highlight of the Group 1 data was the resulting normal distribution centered on the 0/-10% range.

The next step in our study was to expand the sample size and select an additional set of projects from a different source and with different resources performing the counts. We identified this second group of projects as Group 2.

Group 2 Projects

Group 2 Profile

Total number of projects - 95 Enhancement projects from (70) different applications

FP Size Range	# of Projects	Distribution of Size	
0 - 50 fps	0	Smallest	52
51-150 fps	44	Largest	1,572
Over 150 fps	51	Average Size	207.70
Total	95		

Distribution of FP Entities

EI	32%
EO	27%
EQ	19%
ILF	17%
EIF	5%
	100%

Projects by Platform

Client Server	61
Web	25
Mainframe	9
PC	0

Group 2 projects were also typical in their representation of enhancement projects. One interesting observation of Group 2 projects to Group 1 projects is the difference in the distribution of FP entities. Group 1 ILFs are significantly greater than Group 2. We made no conclusions based on this observation; however some additional analysis may be advised to learn of any possible impact this type of distribution may have on the variability between the two methods of counting.

Assumption: Statistics based on adjusted function points.

Total of all Projects

Detail Count	19733
FP Lite™	17738

Variance* at the Project Level

Range	Extreme		Median	
	Low	High	Low	High
All Projects	-33.04%	25.81%	-16.21%	11.32%
0 - 50 fps	-----	-----		
51-150 fps	-33.04%	18.44%	-14.17%	11.32%
Over 150 fps	-32.82%	25.81%	-16.73%	10.41%

*Variance expresses the performance of FP Lite™ relative to the actual (detail) count.

The total number of function points counted using the two counting techniques had a greater variance (10%); however, still within an acceptable range.

As in Group 1 projects, the Extreme Low and High values represent the low and high variations among the size groupings.

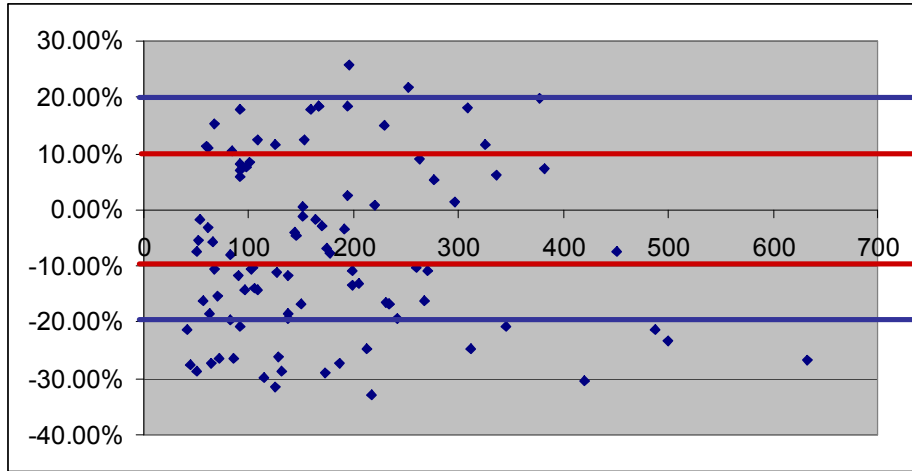
The Median represents the median value within the size groupings. Group 2 did not have any small (< 50 FPs) projects. The variability in the other two size groupings was greater with the Group 2 projects than what we observed in Group 1. Furthermore we did not observe a narrowing of the variance range as the project size increased.

Group 2 Distribution

The graphical display below shows the distribution of the Group 2 projects. The y axis represents the percent variance and the x axis represents the project size. Note that two of the larger projects (865, 1572) are not represented in the graph but they are part of the statistics.

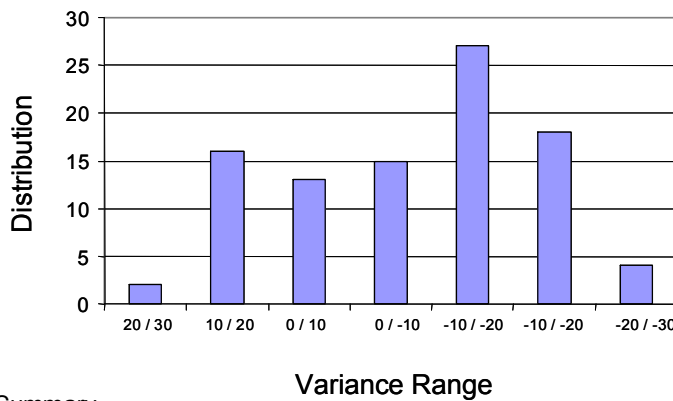
We observed that 30% of the projects had a less than +/- 10% variance using the FP Lite in contrast to the detailed counts. 75% of the projects were less than +/- 20% and 25% were greater than +/- 20%.

These observations are similar to what we saw with the Group 1 projects.



The graphical display below shows the distribution of projects with in a variance range. The Group 1 projects followed a relatively normal distribution centered on the 0 / -10% range. The Group 2 distribution can not be considered a normal distribution. Additional analysis of the data is suggested to determine if a more normal distribution might be realized within sub-groups of data such as size.

Group 2



Group 2 Summary

The Group 2 data points show some interesting results.

- This larger data group maintains some consistency with the Group 1 findings
- The mean variance at the project level continues to look encouraging
- The distribution of projects – 75% are within +/- 20% of the detailed count – is favorable

General Observations

We concluded the study with the following observations

- With FP Lite™ the variance tends to decrease as the size of the project increases
- Size counts under 50 FPs may have a higher variance. In part this could be due to the relative nature of small numbers and the influence of any one variable.
- A high frequency of changes to certain functional elements may have an impact on variability; e.g. ILFs
- 70 +% of the FP Lite™ size estimates were within +/- 20% of the detail counts
- GSCs were not statistically significant relative to the results of the final count (not documented in this paper).

Counting Productivity

The second question we wanted to answer was whether or not the FP Lite method of counting was more productive (quicker) than the detailed counting method.

To answer this question we surveyed 9 Certified Function Point Specialists. The data points noted below reflect their notional view of how much time it takes to count various sized projects. The effort included documentation review of available requirements, moderate interviewing/reviews to clarify and/or confirm requirements, a detailed capture of function point entities, and production of resulting function point reports (normally using a tool repository), and joint review for accuracy.

Size	Effort (hrs.) on average		Productivity
	Detail FP	FP Lite™	
<50	2.5	2.0	20.0%
50 – 150	4.3	3.5	18.6%
>150 < 300	8.8	5.5	37.6%
300 – 650	13.9	9.6	30.9%
>650 <1000	20.8	14.3	31.3%

For projects greater than 150 function points, a reasonable time savings can be achieved. Therefore we suggest that using the FP Lite™ approach may be more productive.

Conclusions

We have observed that the FP Lite™ method can in fact address the criticisms of FPA sizing and hopefully remove some of the barriers for sizing projects and portfolios. FP Lite™ does not require the level of detail one would need to do a detailed FPA count. We also observed that it can be performed in a shorter timeframe.

The Group 2 results demonstrate that further data collection and analysis should be considered. Additional statistical models may help to further support the validity and use of FP Lite™.

We recommend that FP Lite™ be adopted by any organization that has realized the importance of and the need for a proper sizing methodology. For those organizations already using FPA we hope that you will see FP Lite™ as a statistically acceptable method for conducting early life cycle counts. For any organization



FP Lite™ – An Alternative Approach to Sizing

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that has avoided using function points we present FP Lite™ as an opportunity to start gaining better control and management of your projects.

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