ESTIMATION OF SOFTWARE SIZE USING FUNCTION POINT ANALYSIS ON INVENTORY INFORMATION SYSTEMS

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Abstract

Indicators of good software development achievements are measured measurements on all aspects of software development, including the environment and systems of software. In this paper, indicators of the complexity of web-based software developed by the waterfall method with XML language-based entity database relations. This inventory information system functions as an integrated system with other systems in an integrated information system scope. Function point analysis (FPA) is used as a measuring device that can assess the complexity of components and functions of the software developed. The measurement results show that the overall value of the FPA is 180.83, which indicates that the application of inventory information systems is easy to use with low complexity. While the results of CFP and RCAF calculations also show that this application is quite simple so it is easy to use by various groups.

Keywords: *Function Point Analysis*, *Software Measurements*, *Software Performance*, *RCAF, AFP*

1. Introduction

The success of a software development project is due to the accuracy of the estimation and planning of the activities to be carried out, the estimated time, cost and quality. Indicator of the achievement of software project development can be done by measuring software built with several parameters from the user [1].

Function Point Analysis (FPA) [2] [3] is FPA is a standard method for measuring software development from the user side. The FPA method is based on the amount of functionality and a set of factors in a software project. It was introduced in 1979 until now and is continuously updated by the International Function Point User Group (IFPUG) [4] [5].

Yulianti's research [6] was carried out to make a Goods Inventory Application at PT. Surya Nusa Bhaktindo Bengkulu so that it can be used as supporting media in making information to the leadership. This information system will display information on material income and expenditure transactions based on a predetermined cost plan. All this information will be displayed in the form of a material report. Utami's research [7] shows that the inventory information system can help the process of managing goods transactions, inventory, and reporting periods every month or year quickly and accurately. Research conducted by Sukamdana [8] shows that with a web-based system, which has been connected to the database, it will certainly greatly facilitate the processing of data items in the warehouse and will be very helpful in terms of the process of entering and exiting goods into the warehouse.

As the result of observation, the Customs and Excise Service Office of Semarang Type A Customs is an agency engaged in the field of Customs and Excise Services in the city area of Semarang. Based on the results of interviews with related parties, the information obtained

about data processing of goods that are still partly done manually, namely by copying inventory data from the book into Microsoft Office Excel, where reports in the Excel format must be reported every day. Goods inventory data processing at the Customs and Excise Service Office Type A Semarang Semarang in some divisions is also still done manually which is for recording and processing data using inventory report books. This prevents the office in accessing and checking inventory items quickly and accurately. Wibowo [9] mentioned the inventory system of goods entering and exiting is an activity consisting of data entry of goods, return data and inventory data which reports on all transactions of goods entering and leaving from day to month. Therefore, a stockpile inventory information system (SIPBar) is built which can facilitate a company's administrative operations. However, after SIPBar has been developed and tested, it is necessary to have an assessment indicator for the software that has been developed. The function point method is proposed as part of the measurement of software performance indicators because it is seen as a very complete function and its accuracy is near perfect.

1.1. Inventory Information System (SIPBar)

Inventory is an asset or current asset owned by a company that usually conducts business activities by selling merchandise or its products. The following are some definitions of inventory according to experts, according to Iman Santoso [12] understanding inventory is assets that are designated for sale or further processing to become finished goods and then sold as the company's main activities.

According to Agus Sartono [13] inventory in general is one type of current assets which is quite large in a company. This is easy to understand because inventory is an important factor in determining the smooth operation of a company. In terms of the balance sheet of inventory are goods or materials that are still left at the balance sheet date, or goods that will be sold immediately, used or processed in the normal period of the company.

According to Hendra Kusuma [14] inventory is goods that are stored for use or sale in the future period. Inventories can be in the form of raw materials that are stored for processing, components that are processed, goods in process in the manufacturing process, and finished goods that are stored for sale. It can be concluded that inventory is a type of asset owned by the company until the balance sheet date and is used for the company's operational activities.

1.2. XML (Extensible Markup Language)

XML (eXtensible Markup Language) According to Ali Zaki [20] explains that XML is a language whose main function is as a data storage medium. XML is designed to be easily managed. The main keywords for XML are data. Unlike HTML, XML does not focus on how to display data. The main focus of XML is as a data storage format that is easily moved through a computer network or the internet. The hallmark of XML is its ability to store data but does not have the ability to display the data, so it needs a software to read XML.

According to Hunter et al [21] Extensible Markup Language (XML) is a technology with real-world applications, specifically for data management, display, and organization. XML works with the purpose of markup of each type of data but with eliminated complexity, XML is not really a language, but rather the syntax used to describe other markups. Simply put, XML is a language used to describe and manipulate documents in a structured way, and to provide certain formats for documents that have structured data.

1.3. Function Point Analysis Method

According to Olson [22] stated that Function Point is a method that is able to calculate the size of a software, Function Point method has a unit for size namely size / fp by knowing the size of a software, it will be easier to determine the estimated price of a software . Olson [22] further explained that the goal of the function point-based approach of analysis is to establish a measure of consistency that is useful for end users. The function point method can be used to

estimate time and cost based on requirements specifications. The function point method is calculated based on the size and complexity of the functions desired in the software project.

Function Point Estimation First introduced by Albrecht [23] in 1979, this method is based on the functional estimation of a system. Estimated size of a software is based on five components of a software system, namely: External Inputs, External Outputs, Internal Logical Files, External Interfaces Files, and External Inquery. Where each of these components there is a matrix calculation to get the UFO value (unjusted function point). The final value of the function point is obtained by multiplying the value of uf / p with the value of vaf (Value Adjustment Factor), this final value will be used as a measure of the size of a software.

The number of function points is obtained from direct measurement of the main information of the software and the estimation of the complexity of the Pressman software. The main information includes the number of internal, external, input, output, and inquiry files. Another case with measurement based on LOC, measurement based on function point was originally designed to be applied to business information systems so that it is not suitable for systems engineering or embedded systems.

Next, each characteristic is weighted and then added up, then the next step is the process of calculating to get the Function point (FP) value of the software built. To calculate Function Points using the formula [Dahlan, Sariyanti, & Soepomo, 2017].

FPA = CFP x [0.65 + 0.01 x RCAF] ……………………………………………………….[1]

Information:

FP = Function Point

CFP = Crude Function Point

RCAF = Relative Complexity Adjustment Factor

0.65 + 0.01 = Default constant

So basically, calculations based on function points are a way to measure the size of functionality directly generated by an application because it is derived by using a relationship to the direct size. main information about the software by estimating its complexity.

1.4. System Architecture of the FPA-based Software Measurement Model
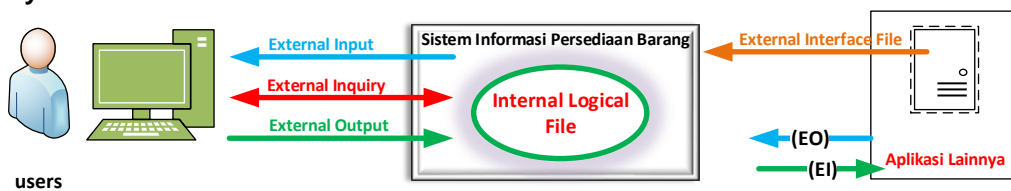
Arsitektur Model Sistem Pengukuran Sistem Informasi Persediaan Barang (SIPBar)

Figure 1. SIPBar software measurement architecture model

Information:
Exi: External Input
Exo: External Output
Exiq: External Inquiry
Ilof: Internal Logic File
Elof: External Logic File
UFP: Unadjusted Function Points
RCAF: Relative Complexity Adjustment
Factor
AFP: Adjusted Function Points

Systematically, the stages of the calculation of the Function Point method up to the estimation and distribution of business in units of people / hour. From the calculation of the estimated business, the authors compare it with the actual effort.
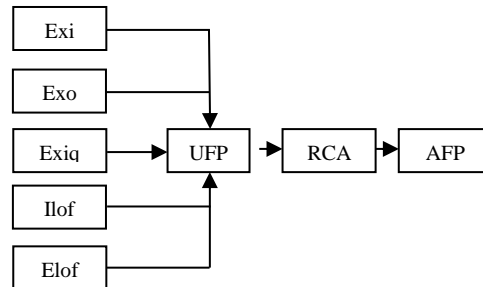

Figure 2. Function Points Methods

The following are FPA criteria based on functionality:

1) External Input (EI)

Is a basic process that processes data and control information that comes from outside the application's boundaries. Data may be used to maintain one or more internal logic files, which can change system behavior.

2) External Outputs (EO)

A basic process where the results of data are passed from inside to outside the application boundaries. An example application might generate XML or CSV files, EO updates ILF, but not maintain, displays information through processing logic, rather than just retrieving data. Data creates reports or output files sent to other applications. Reports and files are made from one or more ILF and external interface files.

3) External Inquiry (EQ)

Its main function is to provide information to users through data retrieval / processing or control information from ILF / EIF. The screen of several types of reports and searches is an appropriate component for EQ. Do not update ILF or EIF, only retrieve data for display.

4) Internal Logical File [ILF]

is a data group or control information group used in an application. The main role of ILF: storing data maintained by one or more processes in the application.

5) External Interface File (EIF)

is a group of related data or control information that is referenced by an application, but maintained by other applications. an EIF calculated for an application must be an ILF in another application.

Following are the complexity levels of User Function Point (UFP); after the identification process, each UFP in the software must be calculated for its complexity [8], including height, medium (average) and low. The value of each UFP in each complexity category is multiplied by the complexity weight that has been determined in Table 1.

Table 1. Complexity of Function Point Analysis [11]

User Function Types	Complexity Weight		
	Low	Medium	Height
External Input (EI)	3	4	6
External Output (EO)	4	5	7
Internal Logical File (ILF)	7	10	15
External Interface File (EIF)	5	7	10
External Inquiry (EQ)	3	4	6

Table 2. Value Adjustment Factors on the environment and software systems [11]

ID	Factor
C1	Data communications
C2	Distributed function
C3	Performance objectives
C4	Heavily used configuration
C5	Transaction rate
C6	On-line data entry
C7	End-user efficiency
C8	On-line update
C9	Complex processing
C10	Reusability
C11	Installation ease
C12	Operational ease
C13	Multiple sites
C14	Facilitate change

The calculation method in PFA is not only the amount of complexity of some functions given to the user, but also to the operating functions of the system and its environment including the communication network. There are 14 factors created to influence the level of difficulty associated with system implementation [6]. Each factor is given a value ranging from 0 to 5. The lowest value (zero) if the factor does not cause any effect and 5 if the factor is very influential in the measured software as shown in Table 2.

2. FPA Analysis

Based on the design of the inventory information system, several steps in the analysis of the implementation / effectiveness of the inventory information system using the Function Point method at the Customs and Excise Service Office Type A Semarang are carried out systematically, in order to obtain maximum analysis results. As in Figure 3 below, the first step in calculating CFP (Crude Function Points) is to find the number of functional components of the system first identified, then evaluate the results of the calculation of the level of complexity for each component. The weighting is then summed and becomes the CFP number. The next step is to calculate the function point by calculating the RCAF (Relative Complexity Adjustment Factor) stage. RCAF is calculated based on overall system complexity. The stages of RCAF calculation are using 14 (fourteen) GSC (General System Characteristics), where each GSC has a scale of 0 (zero) to 5 (five). A scale of 0 (zero) indicates no influence and a scale of 5 (five) indicates a broad influence on the entire project.
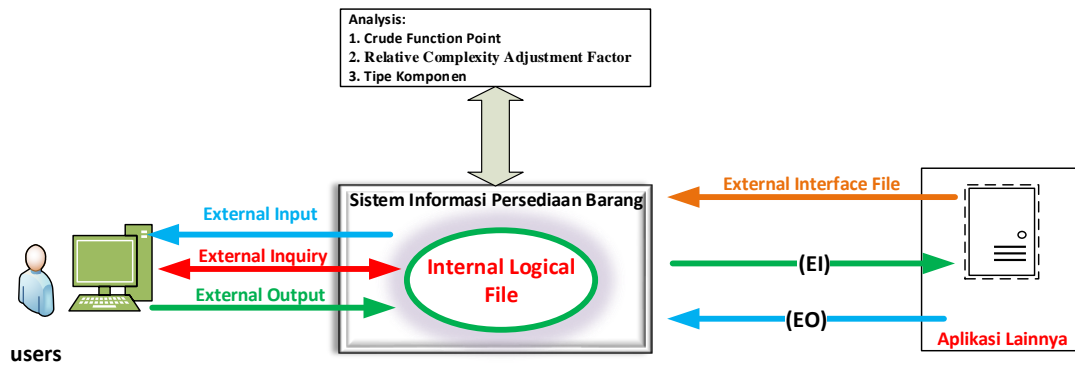
Arsitektur Model Sistem Pengukuran Sistem Informasi Persediaan Barang (SIPBar) Dengan Function Point Analysis (FPA)

Figure 3. Architectural analysis model of FP on SIPBar software

Stage 1: *Crude Function Points* **CFP Measurements**

Table 3. Measurement Results of CFP

Software Components	Complexity									Total CFP
	Lower			Middle			Complex			
	Count	Weighting Factor	Point	Count	Weighting Factor	Point	Count	Weighting Factor	Point	
Exi	4	4	16	7	6	42	3	2	6	**63**
Exo	0	5	0	3	6	18	0	4	0	18
Exiq	2	5	10	3	4	12	2	2	4	26
Ilof	4	6	24	2	7	14		10	0	38
Elof	0	2	0	0	5	0	4	6	24	**24**
Total										**169**

From Table 3 it is known that the total CFP is 169 and the greatest results are in the exi (input) component. When viewed in weighting, so many are included in the medium category so it can be concluded that this application is easy to use.

Tahap 2. *Accounting of Relative Complexity Adjustment Factor* **[RCAF]**

Tabel 4. Measurement Results of RCAF

No	Subyek	Value					
1	The level of complexity of backup / recovery reliability.	0	1	2	3	4	5
2	The level of complexity of data communication.	0	1	2	3	4	5
3	The level of complexity of distributed processing.	0	1	2	3	4	5
4	The level of complexity of the need for performance.	0	1	2	3	4	5
5	The level of operational environment requirements.	0	1	2	3	4	5
6	Level of developer knowledge needs.	0	1	2	3	4	5
7	The level of complexity is updating the master file.	0	1	2	3	4	5

8	The level of complexity of the installation.	0	1	2	3	4	5
9	The level of complexity of application input, output, online queries and files.	0	1	2	3	4	5
10	The level of complexity of data processing.	0	1	2	3	4	5
11	The level of reuse of the [reuse] code is not possible.	0	1	2	3	4	5
12	Level of complexity in changing / flexible.	0	1	2	3	4	5
13	Usability Youth Level of User.	0	1	2	3	4	5
14	Software Frequency Usage Level	0	1	2	3	4	5
	Total RCAF	42					

Based on Table 4 it is known that of the 14 subjects written, found a total RCAF of 42 points and the most frequent value is 3. This shows that this application has a very low level of complexity so it is very easy to use by various groups. The main factor in this calculation is the level of complexity of application input, output, online queries and files.

Stage 3: Function Point Calculation (FP)

The calculation results are obtained from formula 1 so that the following results can be found:

$$FP = 169 * [0.65 + 0.01 * 42]$$

FP = 169 * 1.07

FP = 180.83

This shows that the results obtained from the calculation of Function Point (FP) of 180.83FP, it can be concluded that the design of this application is easy to use by various groups.

The Function Point components consist of 5 aspects, as follows:

a. Input Type;

   Relating to the interface that the user / user in entering data in the application.

b. Output Type;

   Relates to the output generated by the application for the user / user which can be either a report printed or displayed on the screen.

c. Query / Search / View type;

   Concerned with querying stored data.

d. File / Table / Database Type;

   Related to data storage logic which can be in the form of a file or some kind of relational database.

e. Type of External Interface;

   Relating to data communication on other devices / machines.

Furthermore, each type of component is weighted based on its complexity, as shown in the table below.

Table 5. Measurements Results of Components Type

Types of Components	Level of Components			Total
	Lower	Middle	Complex	
Input Types	3	4	6	13
Output Types	4	5	7	16
Query/Search/View Types	3	4	6	13
File/Tabel/Database Types	7	10	15	32
Interface External Types	6	7	10	23
Total				97

Stage 4: Function Point (FP) Exchanging into Cost Value

In this study (for example) has a table containing the rates for each FP value as follows:

Table 6. Exchanging Results of Function Point (FP) into Cost Value

NO	Type of Project	TARIFF/FP	HOUR/FP	Human Allocation
1	Web Profile	Rp. 20.000	1	2
2	Information Systems	Rp. 100.000	1	5
3	E-Commerce	Rp. 40.000	1	2

The value of the tariff table 4 was generated based on historical data or experience from the institution itself in developing software or the experience of other institutions. Each company can vary its rates because it is subjective. Regarding the Rupiah Tariff per FP each institution can vary depending on the credibility of the institution in the field, the more successful completion of similar projects or having products that are marketable will make the tariff per FP increase.

The Software Project in the management of the Human Resources Information System is 180.83FP with IDR / FP tariff for the type of Information System is Rp. 100,000 Then it can be produced as follows.

    1. Estimated Software Development Costs: Rp 100,000 x 180.83 = Rp. 18,083,000.

    2. Specific Estimation of Software Production: 1 Hour x 180.83 = 180 Hours or 22.5 Working Days (Assuming 1 Working Day is equal to 8 Hours) or 5 Months (Assumption 1 month 25 working days).

Inventory information system design software at the Customs and Excise Service Office of Semarang A Customs Type is also tested using the Black Box method. Black Box testing approach is a testing method where test data comes from specified functional requirements without regard to the final program structure. This is also called data driven, input or output driven, or requirements based testing. Because only the function of the software module is of concern, Black-Box testing also refers to functional testing, the testing method emphasizes performing functions and checking input and output data.

In testing software with the Black Box method for errors in the Function can be seen in the following Table 7, namely:

Tabel 7. *Score Grade Partition* Software Testing Black-Box Method on Error Function

Form	Name of Form	Error Description of function	Number of *Error*	Score *error*
1	Login	The Login Form is used to enter the system at the level as, leadership, staff, and as administrator.	1	0
2	Main Menu	The Main Menu Form is used to display or control the existing application menu, by clicking on one of the forms you want to run, the test results are in accordance with its function.	0	0
3	The incoming goods form	The incoming goods form is used to display or control additional new items, by clicking on one of the forms you want to run, the test results are in accordance with their function.	0	0
4	Outgoing goods Form	Outgoing goods form is used for display or control of goods that are reduced, by clicking on one of the forms you want to run, the test results according to function.	0	0
5	Monthly Report Form	The month end report form is used to display or control the validity of the total number of items at the end of the month, by clicking on one of the forms you want to run, the test results are in accordance with their function.	0	0

Table 7 shows that the number of Forms tested was 5 forms with each form tested 5 times, so the total number of tests was 25 times, the number of forms found was 5 errors and 20 forms were not found errors. Based on testing the form on the software, shows that the software is considered good

3. Conclusions

Based on the results of the analysis and measurement using the Function Point Analysis (FPA) method used to measure the software with a case study of the implementation of inventory information systems at the Customs and Excise Service Office Type A Semarang shows the results of 180.83, thus indicating that the inventory information system application goods are easy to use by all kinds of circles because it is simple and easily understood by users. From the results of CFP and RCAF calculations also show that this application is quite simple so it is easy to use by various groups. The use of other software measurement methods as a comparison material from FPA methods such as Lines of Code (LOC) can be applied to testing this software.

References

[1] Andri Kristanto [2008] Perancangan Sistem Informasi dan Aplikasinya. Yogyakarta: Gava Media.
[2] Yakub [2012] Pengantar Sistem informasi. Yogyakarta: Graha Ilmu.
[3] Abdul Kadir, [2014]. Pengenalan Sistem Informasi Edisi Revisi. Yogyakarta: Andi.
[4] Jogiyanto, Hartono [2006]. Analisis & Desain Sistem Informasi : Pendekatan. Terstruktur Teori dan Praktek Aplikasi Bisnis, Andi Offset.
[5] Wibowo, Fred. [2009]. Teknik Produksi Program Televisi. Yogyakarta: PINUS BOOK.
[6] Yulianti, Liza [2012]. Sistem Informasi Persediaan Barang Pada Pt. Surya Nusa Bhaktindo Bengkulu. Jurnal Media Infotama Vol. 8 No. 1 Februari 2012.
[7] Utami [2018]. Sistem Informasi Inventori Barang PT. Tissan Nugraha Globalindo Berbasis Web. Surakarta: UNIMUS Press.
[8] Sukamdana [2011]. Perancangan Sistem Informasi Inventory Berbasis Web Pada PT. Citra Gemilang Prima. Jakarta: Jurnal Sistem Informasi FIK, Universitas Esa Unggul.
[9] Prayogi [2018]. Perancangan Sistem Informasi Manajemen Berbasis Komputer Untuk Transaksi, Laporan Keuangan, dan Stock Control di Rumah Makan Saung Pengkolan. e-Proceeding of Engineering : Vol.2, No.1.
[10] Pamungkas, dkk [2018]. Pengembangan Sistem Informasi Persediaan Barang, Harga Pokok Produksi, dan Transaksi Penjualan Berbasis Web (Studi Pada Son Screen Printing Sidoarjo)". Jurnal Pengembangan Teknologi Informasi dan Ilmu Komputer e-ISSN: 2548-964X Vol. 2, No. 6, Juni 2018, hlm. 2075-2084
[11] Andri Kristanto [2008]. Perancangan Sistem Informasi dan Aplikasinya. Yogyakarta: Gava Media.
[12] Iman Santoso [2010]. Akuntansi Keuangan Menengah (Intermediate Accounting), Bandung: Refika Aditama.
[13] Agus Sartono [2010]. Manajemen Keuangan Teori dan Aplikasi. Edisi. Keempat. Yogyakarta: BPFE.
[14] Hendra Kusuma [2009]. Perencanaan dan Pengendalian Produksi. Yogyakarta: Andi.