Validating Quality of Business Object Based Requirement Analysis Framework: An Empirical Study

[1]Shreya Banerjee, [1]Anirban Sarkar, [2]Narayan C Debnath
[1]Department of Computer Applications, National Institute of Technology, Durgapur, India
[2]Department of Computer Science, Winona State University, MN, USA
{shreya.banerjee85@gmail.com, sarkar.anirban@gmail.com, ndebnath@winona.edu}

***Abstract*— Efficient software design and subsequently efficient software product development depends on the quality of the requirements engineering process. It is evident from the previous studies that effective requirements engineering process can reduce the risk of failure for development of large scale information system. This paper proposed a comprehensive set of quality measurements towards Object Oriented Software Requirements Analysis framework, specifically for Business Object based Requirements Analysis Framework. Moreover, the proposal includes mechanism for validating those measurements empirically to establish the practical usability of such metrics in requirements analysis phase.**

Keywords— Requirements Engineering, Object Oriented Requirements Engineering, Business Objects, Quality Metrics, Empirical Validation

I. INTRODUCTION

In the development of large scale information system, with the growing demand of Object Oriented paradigm, a "good" requirements engineering framework has become essential for analysis of requirements and related models for such system. In this context, object oriented requirements engineering is an approach to encapsulating information about the process and product, as well as functionality into a requirements object [1]. In object oriented paradigm requirements are directly represented as first-class objects and the notation of a "requirements object" is used to represent the problem domain object [2]. Requirements objects can be organized in generalization hierarchies that reflect different kinds of requirements [3]. They can be associated both with other requirements objects and domain objects, and they can have attributes.

Several requirements engineering frameworks have been proposed in recent literatures to model the requirements objects. In [9] these requirement engineering frameworks are evaluated based on some common features. Further, very few research proposals among those are included with quality evaluation schemes. However, those schemes are not very comprehensive. In [13], a set of generic quality measurements is described and like a) *Ambiguity*, b) *Correctness*, c) *Completeness*, d) *Consistency*, e) *Traceability*, f) *Maintainability*, g) *Importance* and *stability*, h) *Reliability*, i) *Efficiency*, j) *Productivity* k) *Visibility*, l) *Usability*, m) *Interoperability*. The proposed framework in [12, 14] supports only the factor of ambiguity. MORE [5] supports ambiguity but partially support the quality factors like complexity, consistency and traceability. On the other hand, AGORA [4] supports the quality factor of number (a), (b), (c), (d), (e) but partially support the factor of number (f) and (g). GORE [13] and BORA [15] also support ambiguity but they partially support some other qualities. However, none of these approaches are supported with validation mechanism for quality evaluation schemes of related requirements analysis framework. But a good requirements engineering framework must support the validation of certain quality features to evaluate the requirements objects and related models achieved from the framework.

In the context, a theoretical framework has been proposed in [7] for the quality evaluation for the requirements engineering process with the objective to assess the qualities of the requirements objects and related analysis models. In the proposal, separate sets of construct level, semantic level and framework level quality metrics have been defined specifically based on Business Object based Requirement Engineering framework [6]. Moreover, the set of quality metrics defined in [7] is useful for any general purpose requirements engineering framework.

In this paper, a comprehensive set of crucial quality measurements for Business Object based requirements analysis framework has been formally described as an extension of quality metrics defined in [7]. Further, this paper mainly focuses on the empirical validation of the proposed set of quality metrics for justifying the usefulness of the metrics and measurements to assess the understandability and analyzability factors of business object based requirements engineering framework defined in [6]. The experiment shows that there exist significant correlations among the proposed quality measurement and analyzability factor.

II. BUSINESS OBJECT BASED REQUIREMENT ENGINEERING FRAMEWORK: THE BASIC

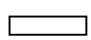
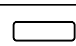
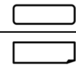
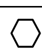
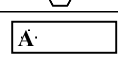
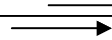
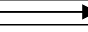
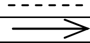
In [6], a process driven requirements analysis framework based on Common Business Objects [10] has been proposed for large scale information system. A business object (BO) captures information about a real world (business) concept, operations, constraints, and relationships between those concepts. The advantage of using this concept is that, the set of

BOs can be reusable in the context of business domain and can easily be transformed into system level objects for software realization of the specific business concept. With these perspectives, the framework consists of two phases, namely, (i) *Early Requirements Analysis Phase* and (ii) *Detailed Requirements Analysis Phase*. The former allows for modeling and analyzing the contextual setting of the business domain, in which the system will operate. In this step the involved Entity BOs, Actor BOs, Process BOs Collaborations and Interactions, those are relevant to the functional requirements of targeted information system domain, will be identified. In later phase, the early requirements specifications are refined with the structural, functional and nonfunctional features of the domain that is relevant to the stakeholders and their roles related to the intended information system. The refinement process is largely influenced by the concepts of Feature Oriented Domain Analysis (FODA) [11].

TABLE I. FORMAL NOTATIONS OF THE FRAMEWORK

Framework Component	Description
BO=PBO ∪ EBO ∪ EVBO	The set of business objects
R=BO×BO	The relationships between the concerned BOs.
IS={BO,R}	Any information system
EBOi = {id, D}	Any Entity BO within IS where, id refers to the identity of the entity BO and D is vector of attributes to characterize the Entity BO.
PBO={id,T}	An Process BO where, id refers to the identity of the process BO and T is vector of activities that may be performed by the process BO.
EvBOi = {id, IRj, C}	An Event BO can be resulted from one interaction and can be represented as where id refers to the identity of the event BO and IRjis the specific interaction relationship due to which the event BO resulted, Cis the constraint specification for occurrence of event BO and C $\neq \emptyset$.
CRi = {{ABOi.id, ABOi.Rp}, {ABOj.id, ABOj.Rq}, C}	A collaboration can be defined within any two Actor BOs where ABOi, ABOj∈ISand Cis constraint on that relationship.
IRi = {{ABOi.id, PBOj.id}, ABOi.Rq, G, C} or {{PBOj.id, ABOi.id}, ABOi.Rq, G,C}	An interaction relationship can be defined within an Actor BO and a Process BO based on some role of Actor BO where ABOi, PBOj∈IS, G is the objective of goal that can be achieved on performing that activity and Cis constraint on that relationship.[3]

TABLE II. GRAPHICAL NOTATIONS FOR BO BASED REQUIREMENT ANALYSIS FRAMEWORK

Taxonomy	Graphical Notation
Entity BO	
Process BO	
Event BO	
Attribute	
Actor BO	
Encapsulation	
Inheritance	
Collaboration	
Interaction	

Both the phases will take the stakeholder's roles, requirements and objectives towards the domain of interest as prime inputs. Identifications, semantic representations and refinements of related BOs and their inter-relationships will be done on the basis of such inputs.

TABLE III. CONSTRUCT LEVEL QUALITY METRICS

Metrics	Interpretation	Description
NPBO	Number of Process BOs in a system IS.	Let consider an information system IS with Process BOs PBO_1, PBO_2 …..,PBO_nthose are specified in the system. Then,$NPBO = \sum_{i=1}^{n} PBO_i$
NT	Number of activities or tasks may be performed by all Process BO in a system IS.	Let consider a Process BO PBO_i then the activities or tasks performed by the $PBO_i$are t_1, t_2,… t_n. Therefore, $NT_i = \sum_{k=1}^{n} t_k$.Now, $NT = \sum_{i=1}^{n} NT_i$
NEBO	Number of Entity BOs in a system IS.	Letconsider an IS with Entity BOs EBO_1, EBO_2, …..,EBO_n those are specified in the system. Then $NEBO = \sum_{i=1}^{n} EBO_i$
ND	Number of attributes of all Entity BOs in a syatem IS.	Letconsider an Entity BO (*EBO*).Suppose the attributes of the Entity BO is d_1, d_2,…, d_n. Therefore total number of attributes of an Entity BO (EBO_i) is$ND_i = \sum_{k=1}^{n} d_k$. Now,$ND = \sum_{i=1}^{n} ND_i$
NEVBO	Number of Event BOs in a system IS.	Let consider an IS with event BOs $EVBO_1$, $EVBO_2$, ,……, $EVBO_n$ those are specified in the system. Therefore,$NEVBO = \sum_{i=1}^{n} EVBO_I$
NABO	Number of Actor BOs in a system in a system IS.	Let consider an IS with Actor BOs ABO_1, ABO_2,…….,ABO_n, those are specified in the system. Therefore, $NABO = \sum_{i=1}^{n} ABO_i$
NRO	Number of requirement objects in a system	Let consider an IS with numbers of *PBO, EVBO* and *EBO*. Therefore *NRO=NPBO+ NEBO+NEVBO*

TABLE IV. SEMANTIC LEVEL QUALITY METRICS

Metrics	Interpretation	Description
NIR	Total Number of interaction relations in a system IS	Letconsider an IS with a PBO *i* and an ABO *j* and IR_1, IR_2,…….,IR_n are the interaction relations between PBO_i and ABO_j. Therefore,$NIR_{ij} = \sum_{k=1}^{n} IR_k$ and $NIR = \sum_{i=1\ j=1}^{n} NIR_{ij}$
NR	Number of roles performed by all Actor BO within a system IS	Let consider an IS with Actor BOs and roles performed by one Actor BO (ABO_i) are r_1, *r2*,…..,r_n. Therefore number of roles performed by one *ABO* (ABO_i) is $NR_i = \sum_{k=1}^{n} r_k$ and$NR = \sum_{i=1}^{n} NR_i$
NCR	Total Number of collaborations within a system IS	Let consider an IS with two Actor BOs *i* and *j* and CR_1, *CR2*,…..,CR_n are the collaboration relations among two Actor BOs ABO_i and ABO_j . Therefore the numbers of collaborations among two Actor BOs ABO_i and ABO_j are, $NCR_{ij} = \sum_{k=1}^{n} CR_k$.Now, $NCR = \sum_{i=1\ j=1}^{n} NCR_{ij}$
NIH	Number of total inheritance relationships in a system	Let consider an IS with numbers of inheritance relationships IH_1, *IH2*……,IH_n between *ABOs* of the system.Therefore,$NIH = \sum_{i=1}^{n} IH_i$

In the framework several requirements modeling elements like Process BO, Entity BO, Actor BO, Event BO, Interface, Interaction Diagram, Collaboration Diagram, Interaction Collaboration Network, Feature Tree etc. have been described to express different business concepts of the domain, relevant to targeted information system and in the real business scenario. The formal and graphical notations of the framework have been summarized in Table I and Table II respectively. In this context, formally, a Business Information System *IS* will be represented as a pair *{BO, R}*, where *BO* represents the set of business objects concerned to the targeted system *IS.* The set of BOs can be expressed as and $BO=PBO \cup EBO \cup EvBO,$ where *PBO* is the set of concerned Process BOs, *EBO* is the set of concerned Entity BOs including Actor BOs and *EvBO* is the set of concerned Event BOs*.* The *R* is the set of binary relations defined on BOs as $R \in BO \times BO$ representing the relationships between the concerned BOs.

III. Quality Evaluation Framework

To establish Business Object Requirement Engineering Framework as a good requirement engineering framework several basic quality metrics have been defined in [7]. The basic set of quality metrics have been described in two levels of perspectives namely, Construct Level and Semantic Level and have been summarized in Table III and Table IV. The quality evaluation measurements proposed in this paper are based on those basic set of metrics. In business object based requirements engineering framework, software requirement and its associated facets are being mapped by the concept of business objects in equivalent object-oriented representation. Quality metrics of such framework thus are based on set of business object constructs and its associated well-defined semantics.

A. Proposed Quality Measurements

Requirements engineering framework quality affects both the efficiency (time, cost, effort) and effectiveness (quality of results) of software system design and development. Further, the efficiency and effectiveness of such framework may be affected by several crucial quality measurements like, the complexity, completeness, correctness, Consistency, Maintainability, Importance and stability etc. Various such crucial quality measurements for business object based requirements engineering framework can be described based on the basic set of quality metrics and are as follows,

a) Static Complexity of a system (SC): This specifies the total static elements involved in the system. Let consider an *IS* with Event BO (*EVBO*), Entity BO (*EBO*) and Process BO (*PBO*). Therefore, *SC=NPBO+NEBO+NEVBO.*

b) Dynamic Complexity of a system (DC): This specifies the total dynamic constructs involved in the system. Let consider an *IS* with interaction relations (*NIR*) and collaboration relations (*NCR*).Now, *DC* of the system can be expressed as *DC=NIR+NCR*.

c) Complexity of a system (CM): This specifies the total complexity of the system. Let consider an *IS* with static complexity *SC* and dynamic complexity *DC*. So complexity of the system is *CM= DC+SC.*

d) Ambiguity of a system (AMB): It is a quality factor used to validate each requirements object in the specification that those are atomic and cannot have more than one interpretation. Let consider *URF* as a function which gives set of user requirements as output. Suppose the list of user requirements are $UR_1, UR_2, \ldots\ldots, UR_n$. Let also consider an *IS* with *PBO, ABO, EVBO, EBO* and *NUM*, are the summation of requirements which are not same. Therefore, $NUM = \left(\sum_{i=1}^{n} PBO_i + \sum_{i=1}^{n} EBO_i + \sum_{i=1}^{n} EVBO_i\right)$. Where, $PBO_i.T \neq PBO_j.T$, $EBO_i.D \neq EBO_i.D$, $EVBO_i.ID \neq EVBO_i.ID$ and total number of user requirements can be represented as, $NUR = \sum_{i=1}^{n} UR_i$. Now, *AMB= NUM/ NUR.*

e) Completeness of a system (COM): It is a quality factor which means necessary requirements objects are not lacking specification. Let consider an *IS* with *PBO*, *EBO*, *EVBO* and *URF()* returns the user requirements. Therefore total number of specified user requirements in the system is, *NSUR=NPBO+NEBO+NEVBO*. Therefore the completeness of the system is, *COM=NSUR/NUR.*

f) Correctness of a system (COR): It is a quality factor which means how many requirements in requirement specification meet customer's need. Let consider an *IS* with *PBO, EBO, EVBO*. Now one *BO* is correctly specified if it resembles with one user requirement. Consider numbers of correct BOs are *NCB*. Therefore, $NCB = \left(\sum_{i=1}^{n} PBO_i + \sum_{i=1}^{n} EBO_i + \sum_{i=1}^{n} EVBO_i\right)$Where, $PBO_i=UR_i$ for only one value of *i*, $EBO_i= UR_i$ for only one value of *i* and $EVBO_i= UR_i$ for only one value of *i*. Now, correctness of the system can be *COR= NCB/NUR.*

g) Maintainability of a system (MTN): It is a quality factor which means the effort required to locate and fix an error in requirement specification. Let consider an IS with number of requirement objects *RO* and their relationships *R* (Such as interaction, collaboration, inheritance, encapsulation). Let consider *NR* the total number of relations in the system. Let also consider *NARO* are the requirement objects and *NAR* are the total number of relationships between them within the system which are added to the system. Similarly *NDRO* and *NDR* are the requirement objects and relationships between the objects respectively which are deleted from the system during maintenance. Therefore,

$$MNT = \left(\frac{(NRO+NARO-NDRO)}{NRO} + \frac{(NR+NAR-NDR)}{NR}\right).$$

h) Consistency of a system (CON): It is a quality factor used to check the presence of the inconsistency among requirements objects in the specification. Let consider an *IS* with *PBO*, *EBO*, *EVBO* and *NCO* are the numbers of consistent objects within the system. Therefore, $NCO = \sum_{i=1}^{n}(PBO_i + EBO_i + EVBO_i)$. Where,$PBO_i$, EBO_i, and $EVBO_i$ are in the system IS unchanged due to its life time. Therefore consistency of *IS* can be expressed as *CON= NUR/NCO*.

i) Importance and stability of a system (IMS): This quality factor means how clearly the prioritization and stabilization of the requirements objects are described when they are necessary to be specified. Let consider a system *IS* with the number of requirement objects. Let consider *NROS* are requirement objects which are specified with clear specifications. Therefore importance and stability of system is $IMS = NROS/NRO$.

B. Illustration of Proposed Quality Measurements with Case Study

For the purpose of illustration of proposed requirements framework quality measurements a sample business in Retail Organization has been considered. It is comprised of several interested business processes like, *(i) Procurements* – for procuring the products for sale, *(ii) Sales* with the activities like, handle the customer orders and to sale the products as per order, and *(iii) Accounting* – to handle the bills, order payment, salaries etc.

Now, the business process will be mapped into the Process BOs. The candidate Process BOs and their activities can be (a) *Procurements*: Book Order, Process Order, Deliver Product, Received Product, Credit Amount, Received Amount.(b) *Accounts*: Raise Procurement Bill, Payment Adjust, Raise Bill for Order, Payment Clearance for Order.(c) *Sales*: Place Order, Handle Order, Deliver Order Product, Receipt of Ordered Product, Received Payment from Client, Clear Payment.

Based on semantics of the Business Object based Requirements Engineering [6], the domain level interaction diagram for the above example has been shows in Figure 1. Here it has been assumed the attributes of the Actor BO *VENDOR* are name, city, phone number, license number. Also assumed in *SALES* Process BO, the possible Event BOs may be Order Status, Order Processed, and Payment Processed. The collaboration relation between Actor BO *Sales Manager* and Actor BO *Customer* has been shown in Figure 2. The basic quality metrics and proposed measurements are illustrated with this case study in TableV.

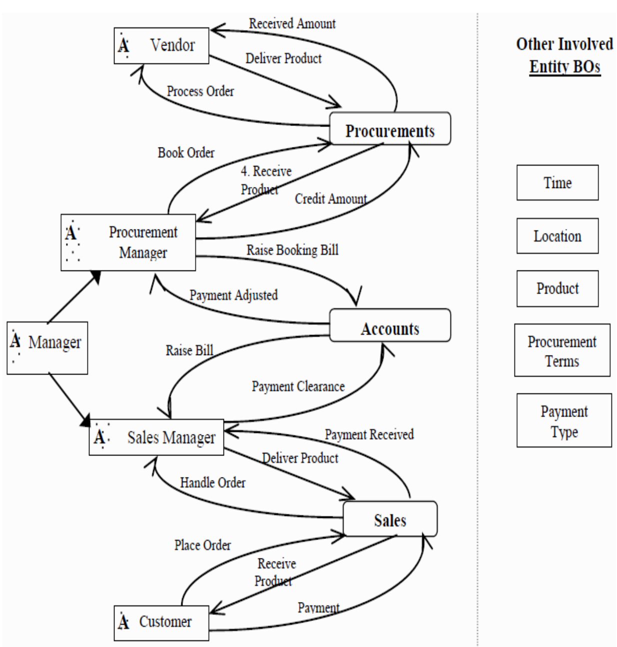


Figure 1: Domain Level Interaction Diagram

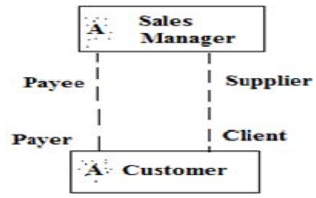


Figure 2: Collaboration Diagram

IV. CASE STUDY

TABLE V. ILLUSTRATION RESULT OF QUALITY METRICS BASED ON BUSINESS OBJECT BASED CASE STUDY[7]

Metrics	Value	Unit	REMARK
NPBO	5	PBO	Consider only five Process BOs.
NT	16	Number	Consider activities of all PBOs.
NEBO	9	EBO	Consider five Actor BOs and three Entity BOs
ND	9× a	Number	Consider that attributes of every Entity BOs are a.
NEVBO	4	EVBO	Consider the Event BOs for three PBOs Cars Issue, Book Return and Book Issue.
NABO	4	ABO	With respect the Domain Level Interaction Diagram.
NRO	16	BO	Consider all the PBOs, ABOs, EBOs in Figure 3 and the EVBOs in three afforementioned PBOs.
NIR	16	IR	Consider the interaction relations between all PBOs in the domain.
NR	4 × a	Number	Consider that all ABOs perform *a* number of roles.
NCR	4× 3× e	CR	Consider that between every ABOs there are collaboration relations and consider that value of collaboration relations between every ABOs are e.
NIH	2	IH	Consider all the inheritance ralationship between ABOs.
SC	16	BO	According to the Domain Level Interaction Diagram in Figure 3.
DC	16+(4× 3×e)	Number	Considering the collaboration relation between every ABOs.
CM	32+ (4 ×3×e)	Number	According to the value of SC and DC.
AMB	16/UR	Number	Consider that NUR is UR i.e. all the requirements proposed by the customer are UR.
COM	16/UR	Number	Consider that NUR is UR i.e. all the requirements proposed by the customer are UR.
COR	16/UR	Number	Consider that NUR is UR i.e. all the requirements proposed by the customer are UR.
CON	16/16= 1	Number	As all the BOs are unchanged due to its life time.
MNT	2	Number	Consider there no ROs or relations are added or deleted during maintenance.
IMS	v/16	Number	Consider *v* is the value of NROS.

V. EMPIRICAL VALIDATION OF PROPOSED MEASUREMENTS

This section is focused on the empirical validation of the basic set metrics and proposed quality measurements defined for business object based requirement engineering framework, to prove their practical utility. The objective of study is to verify through experiment whether the set of metrics and measurements can be used for controlling the quality of software analysis models through the framework or not. The intension of the experiment is also to identify the metrics and measurements from the proposed set which have significant influence on the understandability factor of the business object oriented requirements engineering framework.

The requirement engineering framework Understandability may be defined as *"the capability of the requirement engineering framework to enable the users and designers to analyze the specific application domain"*. An operation time is an appropriate measure for the understandability factor. Operation Time can be calculated by focusing on the functional aspect (both identifications and modification) of application domains and from the user's feedback on the same *understandability* factor applied on each application domain.

Experiment goal definition: The goal definition of the experiment using BO based requirement engineering framework can be summarized as:

To analyze the usefulness of the set of quality metrics and measurements for requirement engineering framework with respect to the Understandability, in the context of users.

Users: Twenty Five students from the institute and of different level of expertise have been participated in the experiment. They have knowledge in requirement engineering, object oriented design and concept of BO based requirement engineering framework. Total six cases, consist of few questions related to identification and modifications, have been supplied to each student and have been evaluated independently.

Cases: Six case studies of different application domains were used for performing this experiment. Although the domain of the applications was different, the selected case studies represent examples of real life cases.

Hypotheses: The following hypotheses are used for the experiments:

1. Null hypothesis **(H0)**: There is no significant correlation between the set of metrics and Quality Measurements as well as understandability factor of the requirement engineering framework.
2. Alternative hypothesis **(H1)**: There is a significant correlation between the set of metrics and Quality Measurements as well as understandability factor of the requirement engineering framework.

Variables in the study: *Independent variables* – The independent variables are the variables for which the effects should be evaluated. In our experiment the set of quality metrics are the independent variables, which corresponds to the proposed Quality Measurements as well as the understandability factor. *Dependent variable* – Correlation needs to be performed between the independent variables and the Quality Measurements like static complexity, dynamic complexity, complexity, correctness, consistency, maintainability and importance and stability as well as the Understandability Factor. Those variables are dependent variables.

The entire experiment is divided into *Two* phases. On the first phase, correlation between the basic quality metrics and average operation time has been evaluated to identify the set of metrics those have significant influence over the understandability factor of the requirement framework. On the final phase, the significant influence of the proposed measurements on the understandability factor of requirement engineering framework is identified.

As there is a very small group of cases and users for the experiment, it cannot be assured that the collected data (TABLE VI) followed a common statistical distribution. Hence it is decided to apply a non-parametric independency test and correlation analysis, by assuming the data are distribution free. The independency test using non parametric *Chi-Square* test and the correlation analysis using *Kendall's Tau* analysis method is performed. In both type of analysis a level of significance $\propto = 0.10$ is used. So in both type of analysis the null hypothesis ***H0*** will be rejected if p-value (2 tailed) < 0.10.

TABLE VI. COLLECTED OPERATION TIME

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
UI	210	330	297	265	315	200
U2	180	300	255	243	281	213
U3	222	315	240	227	287	228
U4	186	280	242	205	302	248
U5	229	300	258	239	259	225
U6	235	291	270	251	263	206
U7	206	323	250	263	310	237
U8	194	325	283	229	312	233
U9	190	275	260	216	254	243
U10	240	305	268	248	270	217
U11	230	318	284	226	300	239
U12	209	278	279	232	292	257
U13	217	320	272	220	309	230
U14	203	290	284	215	276	209
U15	182	332	290	207	260	219
U16	197	320	292	256	257	211
U17	228	285	277	240	266	246
U18	218	327	264	252	272	251
U19	237	305	257	260	286	207
U20	214	315	269	219	294	234
U21	200	306	259	235	296	222
U22	204	299	249	229	282	229
U23	218	297	253	231	278	227
U24	214	299	255	240	284	229
U25	216	310	265	246	286	225
AVG	211.16	305.8	266.88	235.76	283.64	227.4
SD	17.06	16.65	15.72	16.92	18.26	15.03

In first phase, correlation between the set of basic quality metrics and average operation time has been evaluated to identify the set of metrics those has significant influence over the understandability factor of the requirement engineering framework. The result shows (Table VII) that there exists a significant correlation between the operation time and quality metrics NT, NEVBO, NABO, NRO, NIR as the *p-value<0.10*.

In this second phase, correlation between proposed set of quality measurements and average operation time has been evaluated to identify the existence of any significant influence of the proposed measurements on the understandability factor of requirement engineering framework. From the result (Table VII) it can be concluded that there exist a strong correlation between quality measurements SC, DC, CM, COR, MNT, IMS and CON and operation time as *p-value<0.10*.

TABLE VII. KENDALL'S TAU CORRELATION BETWEEN THE QUALITY MEASUREMENTS AND AVERAGE OPERATION TIME

Basic Quality Metrics Vs. Average Operation Time		
	Corr. Coef.	**p-value**
NPBO	0.467	0.188
NT	0.867	0.015
NEBO	0.215	0.559
ND	-0.072	0.845
NEVBO	0.701	0.064
NABO	0.745	0.044
NRO	0.828	0.022
NIR	0.867	0.015
NR	0.298	0.421
NCR	0.298	0.421
NIH	-0.086	0.827
Quality Measurements Vs. Average Operation Time		
	Corr. Coef.	**p-value**
SC	0.828	0.022
DC	0.966	0.007
CM	0.867	0.015
COR	0.733	0.039
MNT	0.867	0.015
IMS	0.828	0.022
CON	-0.733	0.039

VI. CONCLUSION

In this paper several crucial quality measurements have been proposed for business object oriented requirements analysis framework. A mechanism for validating the set of quality metrics and measurements for such framework also has been described. The main objective of such empirical validation is to justify the practical usefulness of the proposed metrics and measurements to assess the understandability factors of business object based requirements engineering framework. The experiment results shows significant influence of several proposed metrics and the set of measurements on the operability factor for requirements engineering framework described in [6]. However, the proposed quality metrics and measurements are in general also implied to any other frameworks.

The future work may include implementation of the proposed quality evaluation framework using CASE tools.

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