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**A DATA TRANSFORMATION MODEL FOR RELATIONAL  
AND NON-RELATIONAL DATA**

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Forat Falih Hasan

28 February 2022



## Abstrak

Sistem maklumat yang menyokong organisasi kecil, sederhana dan besar memerlukan penyelesaian transformasi data daripada pelbagai sumber data untuk memenuhi keperluan aplikasi baharu bagi membuat keputusan untuk kekal berdaya saing. Data hubungan ialah asas bagi kebanyakan program aplikasi, manakala data bukan hubungan ialah asas bagi kebanyakan aplikasi yang baru dihasilkan. Model hubungan adalah yang paling elegan namun, pangkalan data jenis ini mempunyai kelemahan apabila ia berkaitan dengan pengurusan jumlah data yang sangat besar. Memandangkan model data bukan hubungan boleh mengendalikan jumlah data yang besar, pangkalan data bukan hubungan telah berkembang menjadi pengganti pangkalan data hubungan. Isu utama ialah garis panduan untuk proses transformasi data merentas pelbagai jenis data menjadi kurang jelas, yang membawa kepada penurunan kualiti data yang stabil. Oleh itu, untuk mengendalikan data hubungan dan bukan hubungan dan memenuhi keperluan kualiti data, satu model empirikal dalam bidang ilmu ini diperlukan. Kajian ini bertujuan untuk mencadangkan dan membangunkan model transformasi data daripada pelbagai sumber dengan mengambikira kualiti data, khususnya proses transformasi maklumat dalam persekitaran homogen atau heterogen. Model yang diusulkan dalam kajian ini dikenali sebagai Data Transformation with Two ETL Phase and Central-Library (DTTEPC). Model ini terdiri daripada pelbagai peringkat dan kaedah yang digunakan untuk mengolah sumber data yang berbeza. Model yang diusulkan telah disahkan melalui penilaian pakar dan pembangunan sistem prototaip telah dibuat berdasarkan versi akhir model yang dibangunkan. Satu sistem prototaip telah dibangunkan berdasarkan model yang diusulkan dalam kajian dan dilaksanakan dalam dua kajian kes dalam sektor yang berbeza iaitu dalam sektor pendidikan dan sektor kesihatan. Hasil penilaian prototaip yang ditunjukkan melalui ujian kebolegunaan menunjukkan model yang diusulkan dapat menyokong dari segi kebolegunaan dan meningkatkan prestasi sistem maklumat dalam organisasi yang berbeza melalui penyelesaian data transformasi. Selain itu, model DTTEPC digunakan untuk meningkatkan prestasi sistem maklumat dalam proses transformasi data dan membantu aktiviti membuat keputusan dengan penyampaian data daripada pelbagai sumber data dalam keperluan masa nyata.

**Kata Kunci:** Tranformasi data, Kualiti data, ETL, Model Hubungan dan Tidak Hubungan, Data heterogen

## Abstract

The information systems that support small, medium, and large organisations need data transformation solutions from multiple data sources to fulfill the requirements of new applications and decision-making to stay competitive. Relational data is the foundation for the majority of applications programme, whereas non-relational data is the foundation for the majority of newly produced applications. The relational model is the most elegant one; nonetheless, this kind of database has a drawback when it comes to managing very large volumes of data. Because they can handle massive volumes of data, non-relational databases have evolved into relational database substitutes. The key issue is that rules for data transformation processes across various data types are becoming less well-defined, leading to a steady decline in data quality. Therefore, to handle relational and non-relational data and satisfy the requirements for data quality, an empirical model in this domain knowledge is required. This study seeks to develop a data transformation model used for different data sources while satisfying data quality requirements, especially the transformation processes in relational and non-relational model, named Data Transformation with Two ETL Phases and Central-Library (DTTEPC). The different stages and methods in the developed model are used to transform the metadata information and stored data from relational to non-relational systems, and vice versa. The model is developed and validated through expert review, and the prototype based on the final version is employed in two case studies: education and healthcare. The results of the usability test demonstrate that the developed model is capable of transforming metadata data and stored data across systems. So enhancing the information systems in various organizations through data transformation solutions. The DTTEPC model improved the integrity and completeness of the data transformation processes. Moreover, supports decision-makers by utilizing information from various sources and systems in real-time demands.

**Keywords:** Data transformation, Data quality, ETL, Relational and Non-Relational Model, Heterogeneous data.

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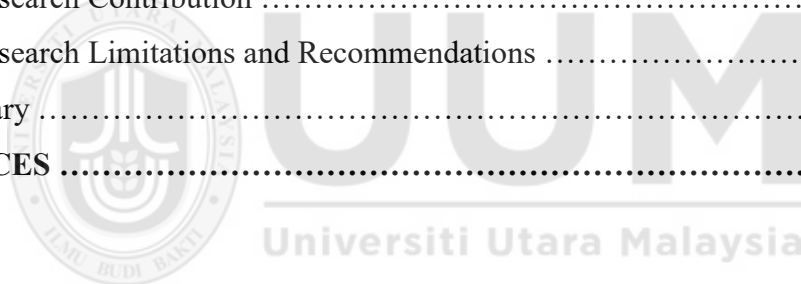
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## List of Abbreviations

DBT	Database Technology
DBMS	Database Management System
RDBMS	Relational-Database Management System
DW	Data Warehousing
Non-RDBMS	Non-Relational-Database Management System
NoSQL	Not Only SQL
RWA	Row-Wise-Approach
CWA	Column-Wise-Approach
SQL	Structured Query Language
IS	Information Systems
DQ	Data Quality
DQD	Data Quality Dimensions
ETL	Extract, Transform, and Load
MVDBMS	Multi-Valued-Database Management System
MIS	Management Information Systems
HoIS	Homogeneous Information Systems
HeIS	Heterogeneous Information Systems
DB	Database
DSRM	Design Science Research Methodology
WHO	World Health Organization
LMS	Learning Management Systems
SysML	Systems Modeling Language
UML	Unified Modeling Language
ReDEM	Relational Data Extraction Method
NReDEM	Non-Relational Data Extraction Method
SeDEM	Semi-Structured Data Extraction Method
OLGS	Original Logical Structure
OSDS	Original Stored Data As In The Sources System
ODTS	Original Data Transformation Strategy
DDTS	Desired Data Transformation Strategy
DDTM	Desired Data Transformation Method
DLGS	Desired Logical Structure

LGS	Logical Structure
DSR	Design Science Research
ReDTM	Relational Data Transformation Method
NReDTM	Non-Relational Data Transformation Method
SABR	Survey Algorithm Based On R Programming Language
ACID	Atomicity, Consistency, Isolation, And Durability
BASE	Basically Available, Soft State, And Eventual Consistency
P.K	Primary Key
F.K	Foreign Key
ETL	Extract, Transform, And Load
RAM	Random Access Memory
AOG	Attribute Oriented Generalization
DQF	Dynamic Query Form
JSON	JavaScript Object Notation
ISO	International Organization For Standardization
DQM	Data Quality Management
LAV	Local As View
GAV	Global As View
GLAV	Global and Local As View
ODS	Operational Data Store

## List of Publications

### Journals:

- Hasan, F. F., & Abu Bakar, M. S. (2019).** An optimised method for fetching and transforming survey data based on SQL and R programming language. *Baghdad Science Journal*, 16(2(SI)), 0436. doi:10.21123/bsj.2019.16.2(si).0436
- Hasan, F. F., & Bakar, M. S. (2022).** Relational data extraction and transformation: A study to enhance information systems performance. *Journal of Information and Communication Convergence Engineering*, 20(4), 265-272. doi:10.56977/jicce.2022.20.4.265
- Hasan, F. F., & Abu Bakar, M. S. (2022).** An approach for metadata extraction and transformation for various data sources using R programming language. *Indonesian Journal of Electrical Engineering and Computer Science*, 26(3), 1520. doi:10.11591/ijeecs.v26.i3.pp1520-1529

### Proceedings:

- Hasan, F. F., & Abu Bakar, M. S. (2021).** An approach for data transformation in homogeneous and heterogeneous information systems. *2021 3rd International Congress on Human-Computer Interaction, Optimization and Robotic Applications (HORA)*. doi:10.1109/hora52670.2021.9461287
- Hasan, F. F., & Abu Bakar, M. S. (2021).** Data transformation from SQL to NOSQL MONGODB based on R programming language. *2021 5th International Symposium on Multidisciplinary Studies and Innovative Technologies (ISMSIT)*. doi:10.1109/ismsit52890.2021.9604548
- Hasan, F. F., & Abu Bakar, M. S. (2022).** From google forms to data repository: A new methodology in data collecting, data transforming, and Information Systems Evaluation. *2022 International Symposium on Multidisciplinary Studies and Innovative Technologies (ISMSIT)*. doi:10.1109/ismsit56059.2022.9932809

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background of Study

The background of the study consists of four main sections and can be classified as: section 1.1.1 database system, section 1.1.2 data sources, section 1.1.3 data quality, section 1.1.4 data transformation.

#### 1.1.1 Database Systems

Nowadays, database technology (DBT) can be found in almost all modern devices. DBT simply refers to a set of data that can be stored or retrieved by a device. A list of names stored in a mobile SIM Card is considered an example of DBT uses. Most applications that deal with DBT are implemented on PCs, with or without internet (Winter, 2016). This technology is usually constructed from one or more tables; each consists of two dimensions, a row and a column, used to store the data in cells. Those cells are produced by the intersection available between the dimensions of the table (Shigarov, 2015). The combination of functions of managing, monitoring, updating, deleting, retrieving and controlling data performed by specific software for interactions purposes between the DBT and the end user is called a database management system (DBMS); examples of DBMS include Oracle, Microsoft Access, and MySQL (Liyanage, 2017; Makris et al., 2016).

Notably, data generation is increasing daily, and the manner in which data flows in many applications and across social, scientific and military fields can generate a huge amount of data. Consequently, many DBT models are used in order to handle the data stored in computers. Therefore, for a small amount of raw data, a relational-database management system (RDBMS) is considered a good solution in terms of accuracy and

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## Appendix A

### Summarizing The Approaches in Section 2.7 Data Transformation

The table consists of the following points:

- First point: programming language and tool, the programming language used to generate the codes
- Second point: works on, the data types that are able to deal with it.
- Third point: uses metadata, whether the approach uses a metadata schema
- Fourth point: data transformation, the database type before and after the migration
- Fifth point: uses statistical functions, whether the approach uses statistical methods in data migration
- Sixth point: data migration (DM) approach, the approach used in converting data from relational to non-relational. DMP refers to direct mapping from the first to the second system; in this approach, the data is translated into a structure of the target system with minimal change in the schema. In IMP, the whole source system is translated to an intermediate environment, usually a denormalized schema, and then to the target system.

## Appendix A

No	Authors	Programming language and tool	Works on	Uses metadata	Data transformation	Uses statistical functions	DM approach (DMP/IMP)	
1	Zhao, Li, Li, & Lin, 2014	Java API	Structured data only (table)	<b>Yes</b>	From RDB to NoSQL only	<b>No</b>	DMP	
2	Karnitis & Arnicans, 2015	Developed model based on the Java programme					DMP	
3	Liang, Lin, & Ding, 2015	Developed algorithm inside DigiBrowser tool					IMP	
4	El Alami & Bahaj, 2016b	Bridge based on JDBC					DMP	
5	El Alami & Bahaj, 2016a	Java API					DMP	
6	Hasan & Huq, 2016	Java programming language					Working on combined data (structured and unstructured)	From multi-value database to RDB
7	Stanescu, Brezovan, & Burdescu, 2016	Talend open studio	Structured data only (table)		From RDB to NoSQL only		DMP	
8	Goyal, Swaminathan, Pande, & Attar, 2016	Developed algorithm based on Java programme	Structured data only (table)				DMP	
9	Ibrahim, Youssef, & El Fakharany, 2017	Developed version of C# programme	Working on combined data (structured and unstructured)				DMP	
10	Hamouda & Zainol, 2017	C# with visual studio programme	Structured data only (table)				DMP	
11	Ouanouki, April, Abran, Gomez, & Desharnais, 2017	Java programming language					DMP	
12	Kim, Ko, Jeon, & Lee, 2018	Apache Phoenix					DMP	
13	Mior, Salem, Aboulnaga, & Liu, 2017	Java programming language	Unstructured data				<b>No</b>	No
14	Jia, Zhao, Wang, Gong, & Ding, 2016	Developed tool called "ERwin HAWK" based on Java programme	Structured data only (table)				<b>No</b>	Yes

## Appendix B

### Summarizing The Approaches in Section 2.8 Data Access Languages and Retrieving Information

No	Authors	Programming language and tool	Auto mapping of joining constraints	Decreases the complexity of nested queries	Adds intelligent features	Auto tracks result	Works on	Purpose
1	Chasseur, Li, & Patel, 2013	Java API	No	No	No	No	Structured and unstructured data	Reducing the gap between SQL and NoSQL
2	Tahara, Diamond, & Abadi, 2014	Java API	No	No	No	No		
3	Liu, Hammerschmidt, & McMahon, 2014	Java API	No	No	No	No		
4	Liu, Hammerschmidt, McMahon, Liu, & Chang, 2016	Java API	No	No	No	No		
5	Petković, 2017	Java API	No	No	No	No		
6	Vathy-Fogarassy & Húgyák, 2017	Java API	No	No	No	No		
7	Xu & Yang, 2010	Java programming language	No	No	Yes	No	Structured data only	SQL performance improvement
8	Ines & Habib, 2015	Java and OWL language.	Yes	No	Yes	No		
9	Chandra et al., 2015	Java programming language	No	No	No	No		
10	Mithani, Machchhar, & Jasdanwala, 2016	Java programming language	No	No	No	No		

11	Gupta, Goswami, Koul, & Sartape, 2017	Java programming language and SQL oracle	Yes	No	Yes	No		
12	Koshti, Sen, & Jadhav, 2017	Microsoft Visual Studio	No	No	Yes	No		
13	Lu et al., 2017	Java programming language	Yes	No	No	No		
14	Guo, Li, Offutt, & Motro, 2018	Java programming language	Yes	Yes	No	No		
15	Schulte & Qian, 2018	Java programming language	No	No	Yes	No		
16	Subali & Rochimah, 2018	Java programming language	No	No	No	No		



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**Appendix C**  
**EXPERT REVIEW FORM**



**UUM**  
**Universiti Utara Malaysia**

**EXPERT REVIEW  
FORM FOR MODEL  
VALIDATION**

**Universiti Utara Malaysia**  
**School of Computing (SOC)**  
**Information Technology Department**

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**Purpose of the expert review:**

This document's goal is to gather assumptions and expert opinions for the proposed model. This is a new proposed model that can be used to unify data accessing and transformation in relational and non-relational data sources and information systems. Please fill out the questionnaire and offer your feedback on the model in the form below to assist us in reviewing it.

**There are two sections to this questionnaire:**

- I. Section A- Expert Personal Information.
- II. Section B- Validation Questions.

## Section A- Expert Personal Information

<b>Full Name:</b> _____
-------------------------

<b>Gender:</b> <b>Male</b> (    ) <b>Female</b> (    )
--

<b>Age:</b>	<b>18 – 24</b> (    )
	<b>25 – 34</b> (    )
	<b>35 – 44</b> (    )
	<b>45 – 54</b> (    )
	<b>55 – 64</b> (    )

<b>Country:</b> _____
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<b>Organization Name:</b> _____
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<b>Department :</b> _____
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<b>Years of Working Experience :</b> _____
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<b>Highest Level of Education:</b>	<b>Diploma Degree</b> (    )
	<b>Bachelor Degree</b> (    )
	<b>Master Degree</b> (    )
	<b>Ph.D.</b> (    )

<b>Signature:</b> _____
-------------------------

Note: Please respond to all of the questions listed above.

## Section B- Validation Questions

No	THE QUESTIONNAIRE ITEMS	LEVEL OF AGREEMENT				
		Strongly Agree	Agree	Average	Disagree	Strongly Disagree
		(5)	(4)	(3)	(2)	(1)
1	This model is easy to understand.					
2	The DTTEPC model provided clear steps and processes to follow.					
3	This model is relevant to the data accessing and transformation.					
4	This model is able to provide relational database accessing and transformation.					
5	This model is able to provide non-relational database accessing and transformation.					
6	This model is able to provide semi-structured spreadsheets data accessing and transformation.					
7	This model is able to provide unified data accessing and transformation between different data sources systems.					
8	This model can meet the data quality requirements in data transformation between homogeneous and heterogeneous information systems (data completeness and integrity)					
9	This model is able to provide metadata information for different data sources systems.					
10	This model is able to meet the data transformation needs of an organization in different fields and contexts.					
11	This model is able to provide a near-real-time data transformation.					



**Appendix D**  
**THE QUESTIONNAIRE**

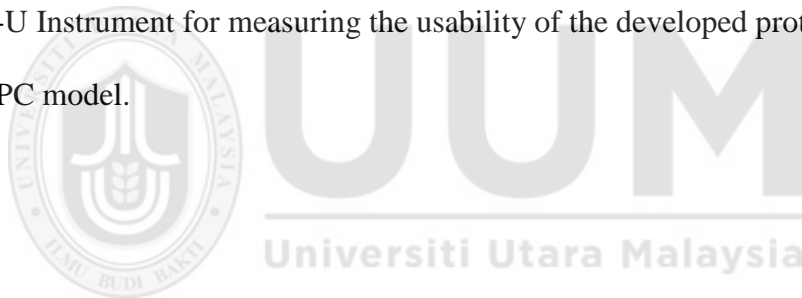


**Universiti Utara Malaysia**

**School of Computing (SOC)**

**Information Technology Department**

The Q-U Instrument for measuring the usability of the developed prototype under the DTTEPC model.



**There are two sections to this questionnaire:**

- I. Section A- Respondent Profile**
- II. Section B- Usability Evaluation**

## Section A- Respondent Profile

<b>Full Name:</b> _____
-------------------------

<b>Gender:</b> <b>Male</b> (   ) <b>Female</b> (   )
--

<b>Age:</b>	<b>18 – 24</b> (   )
	<b>25 – 34</b> (   )
	<b>35 – 44</b> (   )
	<b>45 – 54</b> (   )
	<b>55 – 64</b> (   )

<b>Department :</b> _____
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<b>Years of Working Experience :</b> _____
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<b>Highest Level of Education:</b>	<b>Diploma Degree</b> (   )
	<b>Bachelor Degree</b> (   )
	<b>Master Degree</b> (   )
	<b>Ph.D.</b> (   )

Note: Please respond to all of the questions listed above.

## Section B- Usability Evaluation

THE QUESTIONNAIRE ITEMS		LEVEL OF AGREEMENT				
1	Usefulness	Strongly Agree	Agree	Average	Disagree	Strongly Disagree
		(5)	(4)	(3)	(2)	(1)
1	Using this system in my job would enable me to accomplish tasks more quickly.					
2	Using this system would improve my job performance.					
3	Using this system would enhance my effectiveness on the job.					
4	Using this system would make it easier to do my job.					
5	I would find this system useful in my job.					
2	Ease of use	Strongly Agree	Agree	Average	Disagree	Strongly Disagree
		(5)	(4)	(3)	(2)	(1)
1	Learning to operate this system would be easy for me.					
2	I would find it easy to get this system to do what I want it to do.					
3	My interaction with this system would be clear and understandable.					
4	I would find this system to be flexible to interact with.					
5	It would be easy for me to become skillful at using this system.					
6	I would find this system easy to use.					

3	Errors	Strongly Agree	Agree	Average	Disagree	Strongly Disagree
		(5)	(4)	(3)	(2)	(1)
1	In this system, I can recover from mistakes quickly.					
2	This system prevents me from making errors.					
3	With this system, I can recover from mistakes quickly.					
4	The system provides a help on demand.					
5	Overall, I'm satisfied with this system					
4	Flexibility	Strongly Agree	Agree	Average	Disagree	Strongly Disagree
		(5)	(4)	(3)	(2)	(1)
1	It is easy to move from one part of a task to another.					
2	I do not notice any inconsistency as I use this system.					
3	All operations in this system can be carried out in a systematically similar way					
4	This system is more flexible and required minimum planning					
5	This system has the ability to be adaptable for future use					

“Please use this space to write any suggestions regarding the developed work”

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Thank you for taking the time to respond to this questionnaire.

## Appendix E

### The Usability Testing for the First Case Study

**Responses Table 1**

No	Responses	Usefulness.1: Using this system in my job would enable me to accomplish tasks more quickly.	Usefulness.2: Using this system would improve my job performance.	Usefulness.3: Using this system would enhance my effectiveness on the job.	Usefulness.4: Using this system would make it easier to do my job.	Usefulness.5: I would find this system useful in my job.
1	Case1: Respons1	Strongly Agree	Strongly Agree	Agree	Agree	Strongly Agree
2	Case1: Respons2	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
3	Case1: Respons3	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
4	Case1: Respons4	Agree	Agree	Agree	Agree	Agree
5	Case1: Respons5	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
6	Case1: Respons6	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
7	Case1: Respons7	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
8	Case1: Respons8	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
9	Case1: Respons9	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
10	Case1: Respons10	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
11	Case1: Respons11	Agree	Agree	Strongly Agree	Agree	Strongly Agree
12	Case1: Respons12	Agree	Strongly Agree	Strongly Agree	Agree	Agree
13	Case1: Respons13	Agree	Strongly Agree	Agree	Agree	Agree
14	Case1: Respons14	Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree

15	Case1: Respons15	Strongly Agree	Agree	Strongly Agree	Strongly Agree	Strongly Agree
16	Case1: Respons16	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
17	Case1: Respons17	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
18	Case1: Respons18	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
19	Case1: Respons19	Strongly Agree	Agree	Strongly Agree	Strongly Agree	Average
20	Case1: Respons20	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
21	Case1: Respons21	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
22	Case1: Respons22	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
23	Case1: Respons23	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
24	Case1: Respons24	Agree	Strongly Agree	Strongly Agree	Agree	Strongly Agree
25	Case1: Respons25	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
26	Case1: Respons26	Strongly Agree	Agree	Agree	Strongly Agree	Strongly Agree
27	Case1: Respons27	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
28	Case1: Respons28	Agree	Agree	Agree	Strongly Agree	Agree
29	Case1: Respons29	Agree	Agree	Agree	Strongly Agree	Agree
30	Case1: Respons30	Agree	Agree	Strongly Agree	Strongly Agree	Agree
31	Case1: Respons31	Strongly Agree	Agree	Agree	Agree	Strongly Agree
32	Case1: Respons32	Strongly Agree	Agree	Strongly Agree	Agree	Agree
33	Case1: Respons33	Agree	Agree	Strongly Agree	Agree	Agree

34	Case1: Respons34	Strongly Agree	Agree	Agree	Agree	Strongly Agree
35	Case1: Respons35	Agree	Agree	Agree	Agree	Agree
Count		35	35	35	35	35
Strongly Agree		24	22	26	24	25
Agree		11	13	9	11	9
Average		0	0	0	0	1
Disagree		0	0	0	0	0
Strongly Disagree		0	0	0	0	0
Sum		35	35	35	35	35
Strongly Agree %		69	63	74	69	71
Agree %		31	37	26	31	26
Average %		0	0	0	0	3
Disagree %		0	0	0	0	0
Strongly Disagree %		0	0	0	0	0

**Responses Table 2**

No	Responses	Ease of use.1: Learning to operate this system would be easy for me.	Ease of use.2: I would find it easy to get this system to do what I want it to do.	Ease of use.3: My interaction with this system would be clear and understand able.	Ease of use.4: I would find this system to be flexible to interact with.	Ease of use.5: It would be easy for me to become skillful at using this system.	Ease of use.6: I would find this system easy to use.
1	Case1: Respons1	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
2	Case1: Respons2	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
3	Case1: Respons3	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree

4	Case1: Respons4	Agree	Agree	Agree	Agree	Agree	Agree
5	Case1: Respons5	Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
6	Case1: Respons6	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
7	Case1: Respons7	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
8	Case1: Respons8	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
9	Case1: Respons9	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
10	Case1: Respons10	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
11	Case1: Respons11	Agree	Strongly Agree	Strongly Agree	Agree	Agree	Strongly Agree
12	Case1: Respons12	Strongly Agree	Agree	Strongly Agree	Agree	Agree	Strongly Agree
13	Case1: Respons13	Strongly Agree	Strongly Agree	Agree	Agree	Agree	Strongly Agree
14	Case1: Respons14	Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
15	Case1: Respons15	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
16	Case1: Respons16	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
17	Case1: Respons17	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Agree
18	Case1: Respons18	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
19	Case1: Respons19	Strongly Agree	Average	Strongly Agree	Agree	Strongly Agree	Agree
20	Case1: Respons20	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
21	Case1: Respons21	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
22	Case1: Respons22	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Agree

23	Case1: Respons23	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
24	Case1: Respons24	Agree	Strongly Agree	Agree	Agree	Strongly Agree	Agree
25	Case1: Respons25	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
26	Case1: Respons26	Average	Average	Strongly Agree	Agree	Strongly Agree	Strongly Agree
27	Case1: Respons27	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
28	Case1: Respons28	Agree	Strongly Agree	Agree	Agree	Agree	Agree
29	Case1: Respons29	Agree	Agree	Agree	Agree	Agree	Agree
30	Case1: Respons30	Agree	Agree	Agree	Strongly Agree	Agree	Agree
31	Case1: Respons31	Agree	Agree	Strongly Agree	Agree	Agree	Agree
32	Case1: Respons32	Agree	Agree	Agree	Agree	Agree	Strongly Agree
33	Case1: Respons33	Strongly Agree	Agree	Agree	Agree	Average	Agree
34	Case1: Respons34	Agree	Strongly Agree	Agree	Agree	Agree	Strongly Agree
35	Case1: Respons35	Agree	Strongly Agree	Agree	Agree	Agree	Agree
Count		35	35	35	35	35	35
Strongly Agree		22	26	25	21	23	24
Agree		12	7	10	14	11	11
Average		1	2	0	0	1	0
Disagree		0	0	0	0	0	0
Strongly Disagree		0	0	0	0	0	0
Sum2		35	35	35	35	35	35
Strongly Agree %		62.86	74.29	71.43	60.00	65.71	68.57
Agree %		34.29	20.00	28.57	40.00	31.43	31.43
Average %		2.86	5.71	0.00	0.00	2.86	0.00
Disagree %		0.00	0.00	0.00	0.00	0.00	0.00

Strongly Disagree %	0.00	0.00	0.00	0.00	0.00	0.00
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**Responses Table 3**

No	Responses	Errors.1: In this system, I can recover from mistakes quickly.	Errors.2: This system prevents me from making errors.	Errors.3: With this system, I can recover from mistakes quickly.	Errors.4: The system provides a help on demand	Errors.5: Overall, I'm satisfied with this system
1	Case1: Respons1	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
2	Case1: Respons2	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
3	Case1: Respons3	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
4	Case1: Respons4	Agree	Agree	Agree	Agree	Agree
5	Case1: Respons5	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
6	Case1: Respons6	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
7	Case1: Respons7	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
8	Case1: Respons8	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
9	Case1: Respons9	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
10	Case1: Respons10	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
11	Case1: Respons11	Agree	Agree	Agree	Strongly Agree	Agree
12	Case1: Respons12	Agree	Agree	Agree	Agree	Agree
13	Case1: Respons13	Agree	Agree	Agree	Strongly Agree	Agree
14	Case1: Respons14	Agree	Agree	Agree	Agree	Agree

15	Case1: Respons15	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
16	Case1: Respons16	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
17	Case1: Respons17	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
18	Case1: Respons18	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
19	Case1: Respons19	Average	Strongly Agree	Strongly Agree	Agree	Strongly Agree
20	Case1: Respons20	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
21	Case1: Respons21	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
22	Case1: Respons22	Strongly Agree	Agree	Agree	Strongly Agree	Strongly Agree
23	Case1: Respons23	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
24	Case1: Respons24	Strongly Agree	Agree	Agree	Strongly Agree	Strongly Agree
25	Case1: Respons25	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
26	Case1: Respons26	Strongly Agree	Strongly Agree	Average	Agree	Average
27	Case1: Respons27	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
28	Case1: Respons28	Agree	Agree	Strongly Agree	Agree	Agree
29	Case1: Respons29	Agree	Agree	Agree	Strongly Agree	Agree
30	Case1: Respons30	Agree	Agree	Strongly Agree	Agree	Agree
31	Case1: Respons31	Agree	Strongly Agree	Strongly Agree	Agree	Agree
32	Case1: Respons32	Agree	Agree	Agree	Agree	Strongly Agree
33	Case1: Respons33	Strongly Agree	Average	Agree	Agree	Average

34	Case1: Respons34	Agree	Agree	Agree	Agree	Strongly Agree
35	Case1: Respons35	Agree	Agree	Agree	Agree	Strongly Agree
Count		35	35	35	35	35
Strongly Agree		22	21	22	23	24
Agree		12	13	12	12	9
Average		1	1	1	0	2
Disagree		0	0	0	0	0
Strongly Disagree		0	0	0	0	0
Sum2		35	35	35	35	35
Strongly Agree %		62.86	60.00	62.86	65.71	68.57
Agree %		34.29	37.14	34.29	34.29	25.71
Average %		2.86	2.86	2.86	0.00	5.71
Disagree %		0.00	0.00	0.00	0.00	0.00
Strongly Disagree %		0.00	0.00	0.00	0.00	0.00

**Responses Table 4**

No	Responses	<b>Flexibility.1</b> : It is easy to move from one part of a task to another.	<b>Flexibility.2:</b> I do not notice any inconsistency as I use this system.	<b>Flexibility.3:</b> All operations in this system can be carried out in a systematic way.	<b>Flexibility.4</b> : This system is more flexible and required minimum planning.	<b>Flexibility.5</b> : This system has the ability to be adaptable for future use.
1	Case1: Respons1	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
2	Case1: Respons2	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
3	Case1: Respons3	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
4	Case1: Respons4	Agree	Agree	Agree	Agree	Agree
5	Case1: Respons5	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree

6	Case1: Respons6	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
7	Case1: Respons7	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
8	Case1: Respons8	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
9	Case1: Respons9	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
10	Case1: Respons10	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
11	Case1: Respons11	Agree	Agree	Agree	Agree	Strongly Agree
12	Case1: Respons12	Agree	Strongly Agree	Agree	Agree	Strongly Agree
13	Case1: Respons13	Agree	Strongly Agree	Strongly Agree	Agree	Agree
14	Case1: Respons14	Agree	Agree	Agree	Agree	Agree
15	Case1: Respons15	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
16	Case1: Respons16	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
17	Case1: Respons17	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
18	Case1: Respons18	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
19	Case1: Respons19	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Average
20	Case1: Respons20	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
21	Case1: Respons21	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
22	Case1: Respons22	Strongly Agree	Strongly Agree	Agree	Strongly Agree	Strongly Agree
23	Case1: Respons23	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
24	Case1: Respons24	Agree	Agree	Agree	Strongly Agree	Strongly Agree

25	Case1: Respons25	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
26	Case1: Respons26	Agree	Average	Agree	Average	Average
27	Case1: Respons27	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
28	Case1: Respons28	Agree	Agree	Agree	Agree	Agree
29	Case1: Respons29	Agree	Strongly Agree	Agree	Agree	Agree
30	Case1: Respons30	Agree	Agree	Agree	Agree	Agree
31	Case1: Respons31	Strongly Agree	Agree	Agree	Agree	Strongly Agree
32	Case1: Respons32	Agree	Agree	Strongly Agree	Agree	Agree
33	Case1: Respons33	Agree	Average	Agree	Average	Average
34	Case1: Respons34	Agree	Agree	Strongly Agree	Strongly Agree	Strongly Agree
35	Case1: Respons35	Agree	Agree	Agree	Strongly Agree	Agree
Count		35	35	35	35	35
Strongly Agree		21	23	22	23	24
Agree		14	10	13	10	8
Average		0	2	0	2	3
Disagree		0	0	0	0	0
Strongly Disagree		0	0	0	0	0
Sum2		35	35	35	35	35
Strongly Agree %		60.00	65.71	62.86	65.71	68.57
Agree %		40.00	28.57	37.14	28.57	22.86
Average %		0.00	5.71	0.00	5.71	8.57
Disagree %		0.00	0.00	0.00	0.00	0.00
Strongly Disagree %		0.00	0.00	0.00	0.00	0.00

## Appendix F

### The Usability Testing for the Second Case Study

**Responses Table 1**

No	Responses	Usefulness.1: Using this system in my job would enable me to accomplish tasks more quickly.	Usefulness.2: Using this system would improve my job performance .	Usefulness.3 : Using this system would enhance my effectiveness on the job.	Usefulness.4 : Using this system would make it easier to do my job.	Usefulness.5 : I would find this system useful in my job.
1	Case2: Respons1	Agree	Agree	Agree	Agree	Strongly Agree
2	Case2: Respons2	Agree	Strongly Agree	Strongly Agree	Strongly Agree	Agree
3	Case2: Respons3	Strongly Agree	Strongly Agree	Agree	Agree	Agree
4	Case2: Respons4	Agree	Agree	Agree	Agree	Agree
5	Case2: Respons5	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
6	Case2: Respons6	Agree	Agree	Strongly Agree	Agree	Strongly Agree
7	Case2: Respons7	Strongly Agree	Strongly Agree	Agree	Strongly Agree	Strongly Agree
8	Case2: Respons8	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Agree
9	Case2: Respons9	Agree	Agree	Strongly Agree	Strongly Agree	Strongly Agree
10	Case2: Respons10	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
11	Case2: Respons11	Agree	Agree	Agree	Agree	Strongly Agree
12	Case2: Respons12	Agree	Strongly Agree	Strongly Agree	Agree	Agree
13	Case2: Respons13	Agree	Strongly Agree	Agree	Agree	Agree

14	Case2: Respons14	Agree	Agree	Strongly Agree	Strongly Agree	Strongly Agree
15	Case2: Respons15	Strongly Agree	Agree	Strongly Agree	Agree	Agree
16	Case2: Respons16	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
17	Case2: Respons17	Strongly Agree	Strongly Agree	Agree	Agree	Strongly Agree
18	Case2: Respons18	Agree	Strongly Agree	Strongly Agree	Strongly Agree	Agree
19	Case2: Respons19	Strongly Agree	Agree	Strongly Agree	Strongly Agree	Strongly Agree
20	Case2: Respons20	Strongly Agree	Agree	Agree	Strongly Agree	Strongly Agree
21	Case2: Respons21	Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
22	Case2: Respons22	Strongly Agree	Agree	Strongly Agree	Agree	Strongly Agree
23	Case2: Respons23	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Agree
24	Case2: Respons24	Agree	Strongly Agree	Strongly Agree	Agree	Strongly Agree
25	Case2: Respons25	Agree	Agree	Strongly Agree	Strongly Agree	Agree
26	Case2: Respons26	Strongly Agree	Agree	Agree	Strongly Agree	Strongly Agree
27	Case2: Respons27	Strongly Agree	Strongly Agree	Strongly Agree	Agree	Strongly Agree
28	Case2: Respons28	Agree	Agree	Agree	Strongly Agree	Agree
29	Case2: Respons29	Agree	Agree	Agree	Strongly Agree	Agree
30	Case2: Respons30	Strongly Agree	Agree	Strongly Agree	Agree	Agree
31	Case2: Respons31	Agree	Agree	Agree	Agree	Strongly Agree
32	Case2: Respons32	Strongly Agree	Agree	Strongly Agree	Agree	Agree

33	Case2: Respons33	Strongly Agree	Agree	Strongly Agree	Agree	Agree
Count		33	33	33	33	33
Strongly Agree		17	15	21	16	18
Agree		16	18	12	17	15
Average		0	0	0	0	0
Disagree		0	0	0	0	0
Strongly Disagree		0	0	0	0	0
Sum2		33	33	33	33	33
Strongly Agree %		52	45	64	48	55
Agree %		48	55	36	52	45
Average %		0	0	0	0	0
Disagree %		0	0	0	0	0
Strongly Disagree %		0	0	0	0	0

**Responses Table 2**

No	Responses	Ease of use.1: Learning to operate this system would be easy for me.	Ease of use.2: I would find it easy to get this system to do what I want it to do.	Ease of use.3: My interaction with this system would be clear and understan dable.	Ease of use.4: I would find this system to be flexible to interact with.	Ease of use.5: It would be easy for me to become skillful at using this system.	Ease of use.6: I would find this system easy to use.
1	Case2: Respons1	Average	Strongly Agree	Average	Strongly Agree	Strongly Agree	Agree
2	Case2: Respons2	Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
3	Case2: Respons3	Strongly Agree	Strongly Agree	Agree	Agree	Strongly Agree	Strongly Agree
4	Case2: Respons4	Agree	Agree	Strongly Agree	Strongly Agree	Agree	Agree
5	Case2: Respons5	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Average

6	Case2: Respons6	Average	Strongly Agree	Agree	Agree	Agree	Strongly Agree
7	Case2: Respons7	Strongly Agree	Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
8	Case2: Respons8	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Agree
9	Case2: Respons9	Strongly Agree	Average	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
10	Case2: Respons10	Agree	Strongly Agree	Agree	Strongly Agree	Average	Strongly Agree
11	Case2: Respons11	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Agree	Strongly Agree
12	Case2: Respons12	Strongly Agree	Agree	Strongly Agree	Agree	Strongly Agree	Strongly Agree
13	Case2: Respons13	Agree	Strongly Agree	Strongly Agree	Agree	Agree	Strongly Agree
14	Case2: Respons14	Agree	Strongly Agree	Agree	Strongly Agree	Strongly Agree	Agree
15	Case2: Respons15	Average	Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
16	Case2: Respons16	Strongly Agree	Strongly Agree	Strongly Agree	Agree	Average	Strongly Agree
17	Case2: Respons17	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Agree
18	Case2: Respons18	Agree	Strongly Agree	Agree	Strongly Agree	Strongly Agree	Strongly Agree
19	Case2: Respons19	Strongly Agree	Strongly Agree	Strongly Agree	Agree	Strongly Agree	Agree
20	Case2: Respons20	Average	Agree	Agree	Strongly Agree	Strongly Agree	Strongly Agree
21	Case2: Respons21	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Agree	Strongly Agree
22	Case2: Respons22	Strongly Agree	Agree	Strongly Agree	Agree	Strongly Agree	Agree
23	Case2: Respons23	Agree	Strongly Agree	Average	Strongly Agree	Strongly Agree	Strongly Agree
24	Case2: Respons24	Agree	Agree	Agree	Agree	Strongly Agree	Strongly Agree

25	Case2: Respons25	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Agree	Agree
26	Case2: Respons26	Agree	Agree	Strongly Agree	Agree	Strongly Agree	Strongly Agree
27	Case2: Respons27	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
28	Case2: Respons28	Agree	Agree	Agree	Strongly Agree	Agree	Agree
29	Case2: Respons29	Strongly Agree	Agree	Strongly Agree	Average	Agree	Strongly Agree
30	Case2: Respons30	Strongly Agree	Strongly Agree	Agree	Strongly Agree	Strongly Agree	Agree
31	Case2: Respons31	Agree	Agree	Strongly Agree	Agree	Agree	Agree
32	Case2: Respons32	Strongly Agree	Strongly Agree	Strongly Agree	Agree	Strongly Agree	Strongly Agree
33	Case2: Respons33	Agree	Agree	Agree	Agree	Agree	Agree
Count		33	33	33	33	33	33
Strongly Agree		17	19	21	20	21	20
Agree		12	13	10	12	10	12
Average		4	1	2	1	2	1
Disagree		0	0	0	0	0	0
Strongly Disagree		0	0	0	0	0	0
Sum2		33	33	33	33	33	33
Strongly Agree %		48.57	54.29	60.00	57.14	60.00	57.14
Agree %		34.29	37.14	28.57	34.29	28.57	34.29
Average %		11.43	2.86	5.71	2.86	5.71	2.86
Disagree %		0.00	0.00	0.00	0.00	0.00	0.00
Strongly Disagree %		0.00	0.00	0.00	0.00	0.00	0.00

**Responses Table 3**

<b>No</b>	<b>Responses</b>	<b>Errors.1: In this system, I can recover from mistakes quickly.</b>	<b>Errors.2: This system prevents me from making errors.</b>	<b>Errors.3: With this system, I can recover from mistakes quickly.</b>	<b>Errors.4: The system provides a help on demand</b>	<b>Errors.5: Overall, I'm satisfied with this system</b>
1	Case2: Respons1	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
2	Case2: Respons2	Agree	Agree	Agree	Strongly Agree	Strongly Agree
3	Case2: Respons3	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
4	Case2: Respons4	Strongly Agree	Agree	Strongly Agree	Agree	Agree
5	Case2: Respons5	Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
6	Case2: Respons6	Strongly Agree	Agree	Strongly Agree	Strongly Agree	Strongly Agree
7	Case2: Respons7	Agree	Strongly Agree	Agree	Agree	Agree
8	Case2: Respons8	Strongly Agree	Agree	Strongly Agree	Strongly Agree	Strongly Agree
9	Case2: Respons9	Strongly Agree	Strongly Agree	Strongly Agree	Agree	Strongly Agree
10	Case2: Respons10	Strongly Agree	Strongly Agree	Agree	Strongly Agree	Agree
11	Case2: Respons11	Agree	Agree	Agree	Strongly Agree	Strongly Agree
12	Case2: Respons12	Strongly Agree	Strongly Agree	Agree	Agree	Agree
13	Case2: Respons13	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
14	Case2: Respons14	Agree	Agree	Strongly Agree	Agree	Agree
15	Case2: Respons15	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree

16	Case2: Respons16	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
17	Case2: Respons17	Agree	Strongly Agree	Agree	Strongly Agree	Agree
18	Case2: Respons18	Strongly Agree	Strongly Agree	Agree	Strongly Agree	Strongly Agree
19	Case2: Respons19	Agree	Strongly Agree	Strongly Agree	Agree	Strongly Agree
20	Case2: Respons20	Strongly Agree	Agree	Strongly Agree	Strongly Agree	Strongly Agree
21	Case2: Respons21	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Agree
22	Case2: Respons22	Strongly Agree	Strongly Agree	Agree	Strongly Agree	Strongly Agree
23	Case2: Respons23	Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
24	Case2: Respons24	Strongly Agree	Agree	Agree	Agree	Strongly Agree
25	Case2: Respons25	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Agree
26	Case2: Respons26	Strongly Agree	Strongly Agree	Agree	Agree	Agree
27	Case2: Respons27	Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
28	Case2: Respons28	Agree	Agree	Strongly Agree	Agree	Strongly Agree
29	Case2: Respons29	Agree	Strongly Agree	Agree	Strongly Agree	Agree
30	Case2: Respons30	Strongly Agree	Agree	Strongly Agree	Agree	Strongly Agree
31	Case2: Respons31	Agree	Strongly Agree	Strongly Agree	Strongly Agree	Agree
32	Case2: Respons32	Strongly Agree	Agree	Agree	Agree	Strongly Agree
33	Case2: Respons33	Agree	Agree	Agree	Agree	Agree
Count		33	33	33	33	33
Strongly Agree		20	21	20	21	21
Agree		13	12	13	12	12

Average	0	0	0	0	0
Disagree	0	0	0	0	0
Strongly Disagree	0	0	0	0	0
Sum2	33	33	33	33	33
Strongly Agree %	57.14	60.00	57.14	60.00	60.00
Agree %	37.14	34.29	37.14	34.29	34.29
Average %	0.00	0.00	0.00	0.00	0.00
Disagree %	0.00	0.00	0.00	0.00	0.00
Strongly Disagree %	0.00	0.00	0.00	0.00	0.00

**Responses Table 4**

No	Responses	<b>Flexibility.1</b> : It is easy to move from one part of a task to another.	<b>Flexibility.2:</b> I do not notice any inconsistency as I use this system.	<b>Flexibility.3:</b> All operations in this system can be carried out in a systematically similar way.	<b>Flexibility.4</b> : This system is more flexible and required minimum planning.	<b>Flexibility.5</b> : This system has the ability to be adaptable for future use.
1	Case2: Respons1	Strongly Agree	Agree	Strongly Agree	Agree	Strongly Agree
2	Case2: Respons2	Agree	Average	Agree	Strongly Agree	Strongly Agree
3	Case2: Respons3	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Agree
4	Case2: Respons4	Strongly Agree	Agree	Strongly Agree	Agree	Strongly Agree
5	Case2: Respons5	Agree	Strongly Agree	Average	Strongly Agree	Strongly Agree
6	Case2: Respons6	Agree	Average	Strongly Agree	Agree	Agree
7	Case2: Respons7	Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
8	Case2: Respons8	Strongly Agree	Strongly Agree	Strongly Agree	Agree	Average

9	Case2: Respons9	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
10	Case2: Respons10	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
11	Case2: Respons11	Agree	Strongly Agree	Agree	Strongly Agree	Agree
12	Case2: Respons12	Average	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
13	Case2: Respons13	Strongly Agree	Strongly Agree	Agree	Strongly Agree	Strongly Agree
14	Case2: Respons14	Strongly Agree	Strongly Agree	Average	Strongly Agree	Strongly Agree
15	Case2: Respons15	Agree	Agree	Agree	Strongly Agree	Strongly Agree
16	Case2: Respons16	Strongly Agree	Strongly Agree	Strongly Agree	Average	Agree
17	Case2: Respons17	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
18	Case2: Respons18	Agree	Agree	Strongly Agree	Strongly Agree	Agree
19	Case2: Respons19	Strongly Agree	Agree	Strongly Agree	Strongly Agree	Agree
20	Case2: Respons20	Strongly Agree	Strongly Agree	Agree	Agree	Agree
21	Case2: Respons21	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
22	Case2: Respons22	Agree	Strongly Agree	Agree	Agree	Strongly Agree
23	Case2: Respons23	Average	Agree	Strongly Agree	Agree	Strongly Agree
24	Case2: Respons24	Strongly Agree	Agree	Agree	Strongly Agree	Average
25	Case2: Respons25	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
26	Case2: Respons26	Agree	Agree	Agree	Average	Agree
27	Case2: Respons27	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree

28	Case2: Respons28	Agree	Agree	Agree	Agree	Agree
29	Case2: Respons29	Strongly Agree	Agree	Strongly Agree	Strongly Agree	Strongly Agree
30	Case2: Respons30	Strongly Agree	Agree	Strongly Agree	Agree	Agree
31	Case2: Respons31	Agree	Strongly Agree	Agree	Strongly Agree	Strongly Agree
32	Case2: Respons32	Strongly Agree	Agree	Strongly Agree	Strongly Agree	Agree
33	Case2: Respons33	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
Count		33	33	33	33	33
Strongly Agree		20	19	21	22	20
Agree		11	12	10	9	11
Average		2	2	2	2	2
Disagree		0	0	0	0	0
Strongly Disagree		0	0	0	0	0
Sum2		33	33	33	33	33
Strongly Agree %		57.14	54.29	60.00	62.86	57.14
Agree %		31.43	34.29	28.57	25.71	31.43
Average %		5.71	5.71	5.71	5.71	5.71
Disagree %		0.00	0.00	0.00	0.00	0.00
Strongly Disagree %		0.00	0.00	0.00	0.00	0.00