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HUMAN ERROR REDUCTION PROGRAM IN SILTERRA MALAYSIA SDN BHD: APPLYING CANONICAL ACTION RESEARCH (CAR)

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Universiti Utara Malaysia

DOCTOR OF MANAGEMENT

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By

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ABSTRACT

SilTerra Malaysia Sdn Bhd (SMSB) is a Malaysian's premier wafer fabrication, a high technology company owns by Khazanah Nasional Berhad. Although there are engineering platforms and automation systems in place, human errors still occur among the wafer fabrication personnel, causing a huge loss every year. This research aimed to determine the factors that contribute to human errors. The factors then serve as the input for establishing SilTerra Small Group Activity (SSGA) to reduce human error excursion events in the Manufacturing Department. Canonical action research (CAR) was used as the basis in the research methodology. This research employed both the quantitative and the qualitative approaches, whereby 119 technicians participated in a survey that represented 25% of the total manufacturing population in SMSB. The survey was conducted to identify the factors that contribute to human errors in the Manufacturing Department. In addition, secondary data and feedback from the focus group that consisted of top management personnel were gathered to support the understanding of human error contributors. The research findings indicated that there are two main Human Error Classifications in SMSB, and they are Decision Error as well as Perceptual Error. The SSGA program, which has been continuously conducted, has shown a significant reduction in human error excursion events. The theoretical contribution in the Human Factors Analysis and Classification System (HFACS) applied in this research has significantly contributed to a meaningful result. This research focused mainly on human errors contributed by errors and violations. Other factors such as environmental factors, condition of operators and personal factors can be investigated in future studies. Besides, it will be interesting to extend the research to other types of manufacturing industries.

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Keywords: Human error, Canonical Action Research, Human Factors Analysis and Classification System, SilTerra Small Group Activity

ABSTRAK

SilTerra Malaysia Sdn Bhd (SMSB) adalah sebuah syarikat fabrikasi *wafer* utama yang berteknologi tinggi di Malaysia, dimiliki oleh Khazanah Nasional Berhad. Walaupun terdapat platform kejuruteraan dan sistem automasi, kesilapan manusia masih berlaku dalam kalangan pekerja fabrikasi *wafer* yang menyebabkan kerugian yang sangat besar setiap tahun. Justeru, tujuan kajian ini dilakukan adalah untuk menentukan faktor-faktor yang menyumbang kepada kesilapan manusia. Faktor tersebut berfungsi sebagai input dalam mewujudkan program Aktiviti Kumpulan Kecil SilTerra (*SilTerra Small Group Activity* - SSGA), yang bertujuan untuk mengurangkan kesilapan manusia di bahagian pembuatan. Kajian Tindakan Kanonik (*Canonical Action Research* - CAR) telah digunakan sebagai asas dalam metodologi penyelidikan. Kajian ini juga menggunakan pendekatan kuantitatif dan kualitatif, iaitu seramai 119 orang juruteknik telah mengambil bahagian dalam tinjauan yang mewakili seramai 25% daripada jumlah populasi sumber tenaga di bahagian pembuatan di SMSB. Tinjauan ini dilakukan untuk mengenal pasti faktor yang menyumbang kepada kesilapan manusia. Di samping itu, data sekunder dan maklum balas daripada kumpulan fokus yang terdiri daripada kakitangan pengurusan atasan dikumpulkan untuk menyokong pemahaman terhadap faktor penyumbang kesilapan manusia. Hasil kajian menunjukkan bahawa terdapat dua klasifikasi utama kesilapan manusia, iaitu Kesilapan Keputusan dan Kesilapan Persepsi. Program SSGA yang dijalankan secara berterusan telah menunjukkan penurunan yang signifikan dalam kes-kes yang melibatkan kesilapan manusia. Sumbangan teori dalam Sistem Analisis dan Klasifikasi Faktor Manusia (Human Factors Analysis and Classification System – HFACS) yang diterapkan dalam penyelidikan ini telah memberi sumbangan yang signifikan. Penyelidikan ini hanya memberikan tumpuan utama kepada kesilapan manusia yang disebabkan oleh kesalahan dan ketidakpatuhan. Namun, faktor lain seperti faktor persekitaran, keadaan pengendali dan faktor peribadi boleh diselidiki untuk kajian pada masa akan datang. Kajian akan menjadi lebih menarik sekiranya dapat dikembangkan ke industri pembuatan yang lain.

Kata Kunci: Kesilapan manusia, Kajian Tindakan Kanonik, Sistem Analisis dan Klasifikasi Faktor Manusia, Aktiviti Kumpulan Kecil SilTerra

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LIST OF ABBREVIATIONS

Abbreviation	Description of Abbreviation
8D	8 Discipline
ALAR	Action learning and action research
AR	Action research
CAR	Canonical action research
CCA	Contact category analysis
CE	Customer engineering
CIC	Continuous improvement competition
CIM	Computer integrated manufacturing system
CMOS	Complementary metal oxide semiconductor
CMP	Chemical mechanical planarization
COO	Chief operating officer
CPM	Cyclical process model
CREAM	Cognitive and error analysis method
CWB	Counterproductive work behavior
DMAIC	Define, measure, analyze, improve, and control
EU	European union
FDI	Foreign direct investment
FMEA	Failure mode effect analysis
HAZOP	Hazard and operability
HEA	Human error analysis
HEART	Human error assessment and reduction technique
HEP	Human error probability
HFACS	Human factor analysis and classification system
HDFs	Human dependent failures
HRM	Human resource management
HRD	Human resource development
ICs	Integrated circuits
IRIS	Integrity and trust, respect and responsibility, innovation, and service excellence
IS	Information security
IT	Information technology
KRA	Key result areas
MCR	Main control room
MIMOS	Malaysia institute of microelectronic system
MIT	Massachusetts institute of technology
MNC	Multinational company
MPC	Malaysian productivity cooperation
MRB	Material review board
MTs	Manufacturing technicians
NPP	Nuclear power plant
OEM	Original equipment manufacturer
OOW	Officer on watch
OP	Optimize performance
OPL	One point lesson

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PAR	Participatory action research
PCB	Printed circuit board
PCBA	Printed circuit board assembly
PDCA	Plan do check action
PEEK	Polyether Ether Ketone
PEM	Performance evaluation matrix
PSFs	Performance shaping factors
QA	Quality assurance
QBR	Quarterly business review
RBV	Resource-based view
RCA	Research client agreement
RO	Reactor operator
ROI	Return on the investment
RASCI	Responsible, accountable, supporting, consulted and informed
SCM	Swiss-cheese model
SLIM	Success likehood index methodology
SMIF	Standard mechanical interface
SMSB	Silterra Malaysia Sdn. Bhd.
SOP	Standard operating procedure
SPSS	Statistical package for the social sciences
SSGA	SilTerra small group activity
TFD	Thin Film Dielectric
TFM	Thin film metal
THERP	Technique for human error prediction
TRACE	Technique for retrospective analysis of cognitive error
TQM	Total quality management
UK	United Kingdom
UK CAA	UK Civil aviation authority
USA	United State of America
USD	United State Dollar
VCL	Virtual collaborative learning
VMS	Visual management system
YES	Yield, Excursion and Scrap

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CHAPTER ONE

INTRODUCTION

1.1 Research Background

Human beings make errors because humans are not perfect. As such, human error is normal and sure to occur (Anfield, 2007). Human error cannot be completely eliminated (Edmondson, 1996). However, social scientists believe that human error can be reduced with both management and engineering methods (Haight, 2003; Harvey, 2013; O'Donnell, 2009; Poska, 2010; Reason, 1990; Stewart & Chase, 1999). Reason (1990) has estimated that the percentage of human errors varies among industries. The percentage of human error estimation is 65% to 85% for jet transport, 90% for air traffic control, 80% to 85% for maritime vessels, 70% for nuclear power plants, and 85% for road transportation. Also, it has been reported that in these few decades, there have been a few nuclear power plant accidents in the world due to human error. These have resulted in mankind and the environment experiencing catastrophic losses (Disasterium.com, 2013). For instance, the Three Mile Island nuclear reactor experienced a partial core meltdown that did not only cause disasters to the environment; it also affected the emotional, behavioral, and physiological effects of chronic stress in Three Mile Island (Baum, Gatchel & Schaeffer, 1983). On April 26, 1986, the Chernobyl Plant in the Ukrainian Soviet Socialist Republic encountered a major disaster that resulted in many cases of cancer among the nearby residents (Shibata, Itoh, Ohmori, Shinga & Taira, 2001).

Moreover, on December 2, 1984, the Union Carbide pesticide plant in Bhopal, India began to leak methyl isocyanate gas and other poisonous toxins into the atmosphere.

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APPENDIX

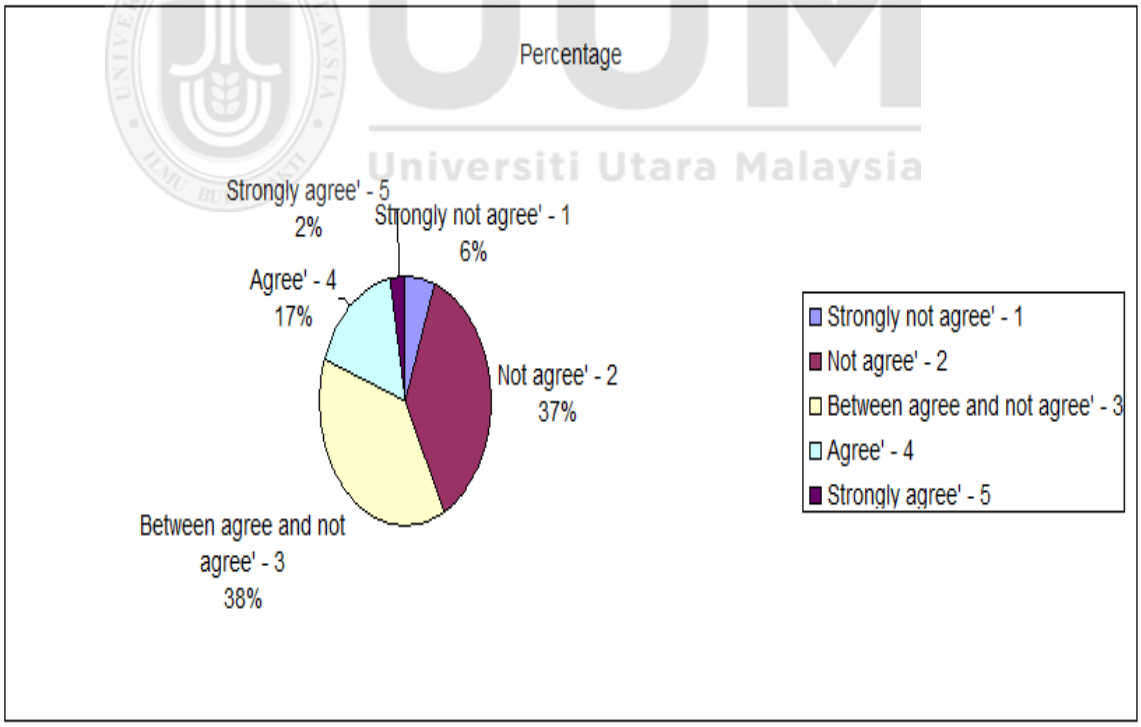
Appendix A: On Line Survey Result

Question#1:

Employee who involved in human error is not certified to run the process / equipment.

Result:

Total of Disagreement (Strongly Disagree & Not Agree) is 43%, where total of Agreement (Strongly Agree & Agree) is only 19%. Average score is 2.74, with a standard deviation of 0.89.



Question#1 Pie Chart by Percentage

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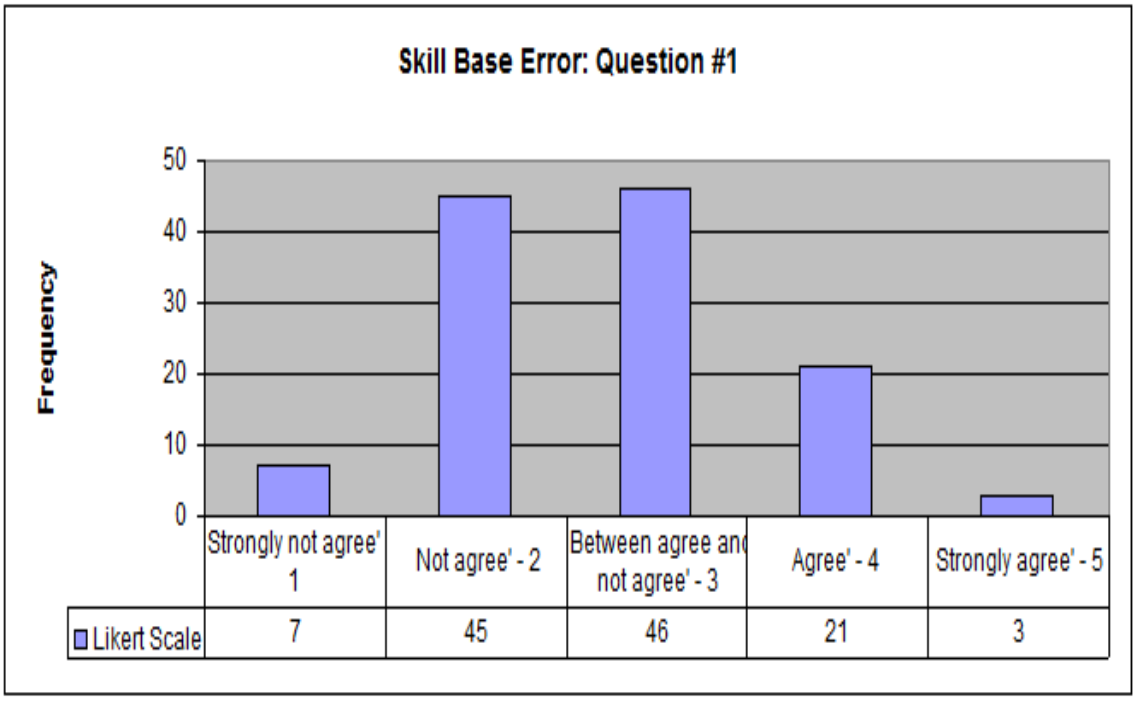
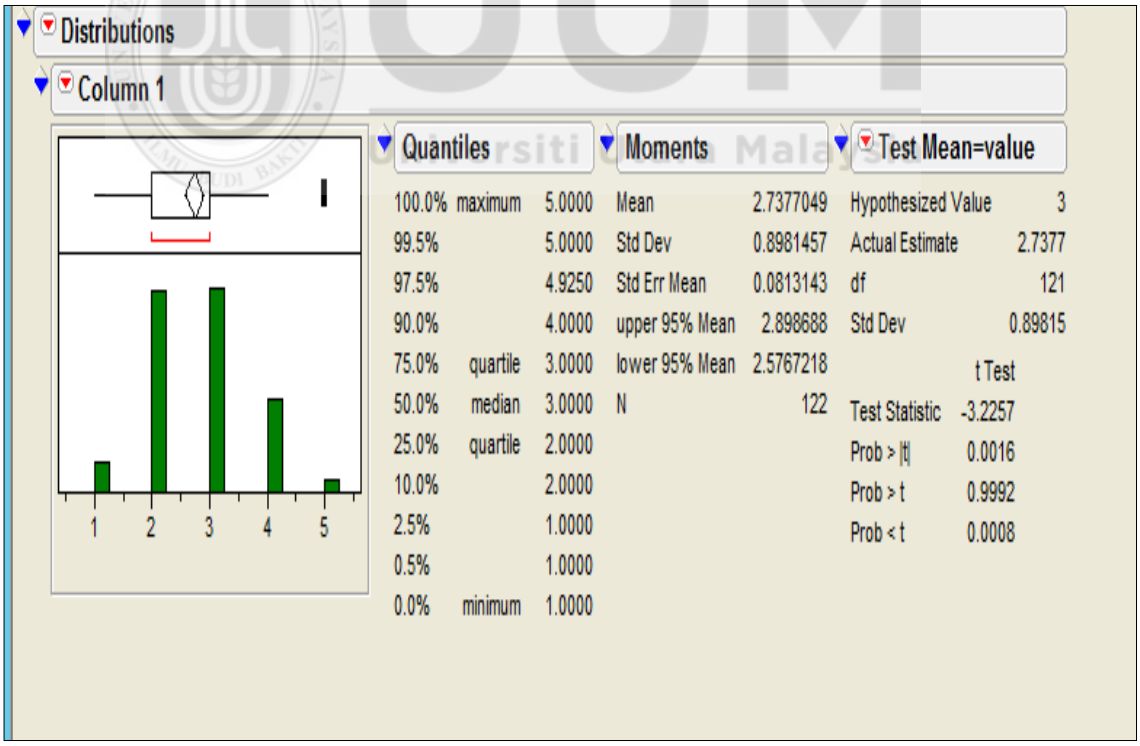


Question#1 Frequency Bar Chart



Question#1 by using JMP, Statistical Tool

Finding:

Respondents believe the person who committed to Human Error is certified in the area of responsibility.

Question#2:

Employee who involved in human error has followed procedure, yet they are lack of experience and skill.

Result:

Total of Disagreement (Strongly Disagree & Not Agree) is only 21%, where total of Agreement (Strongly Agree & Agree) is 49%. Average score is 3.34, with a standard deviation of 0.877.

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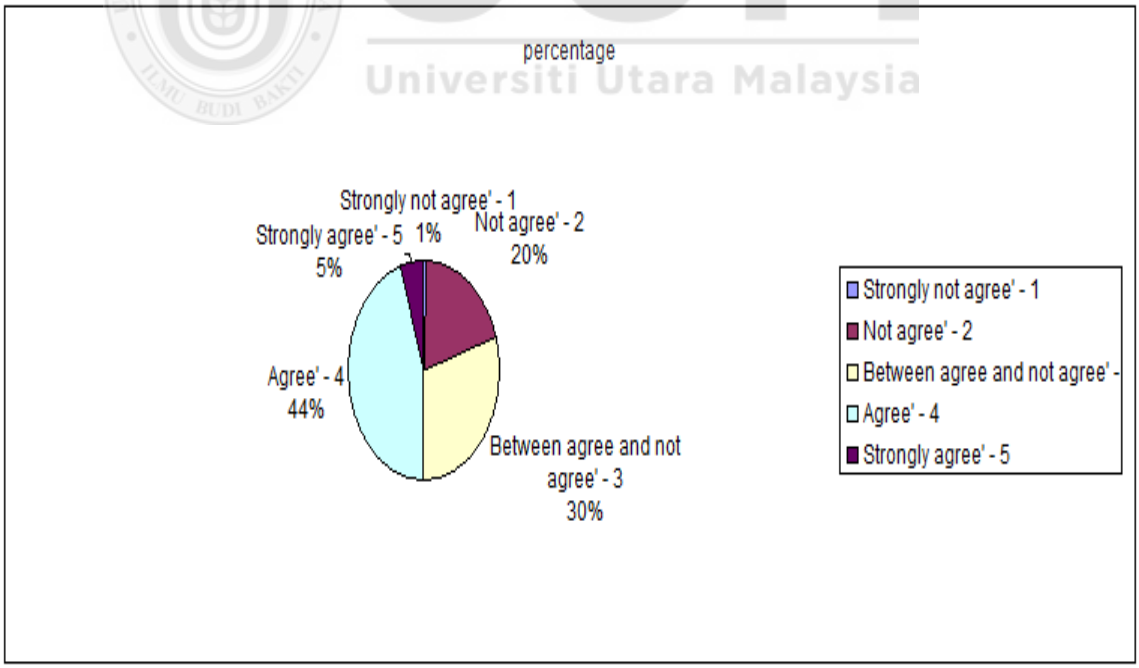
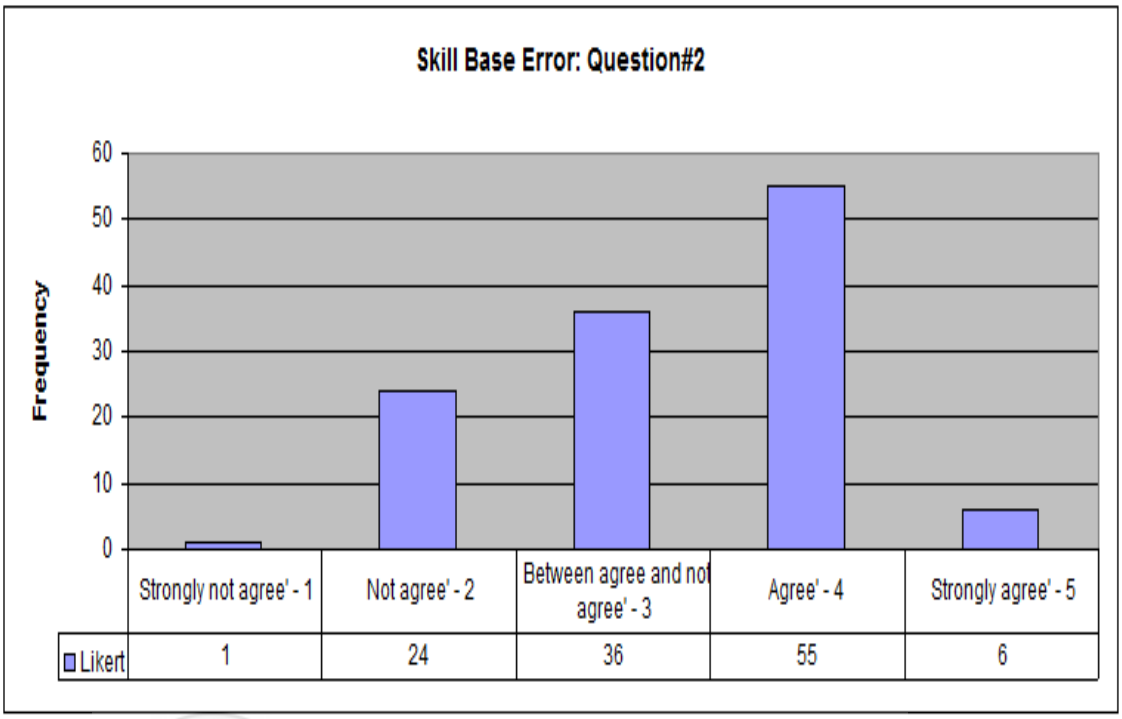
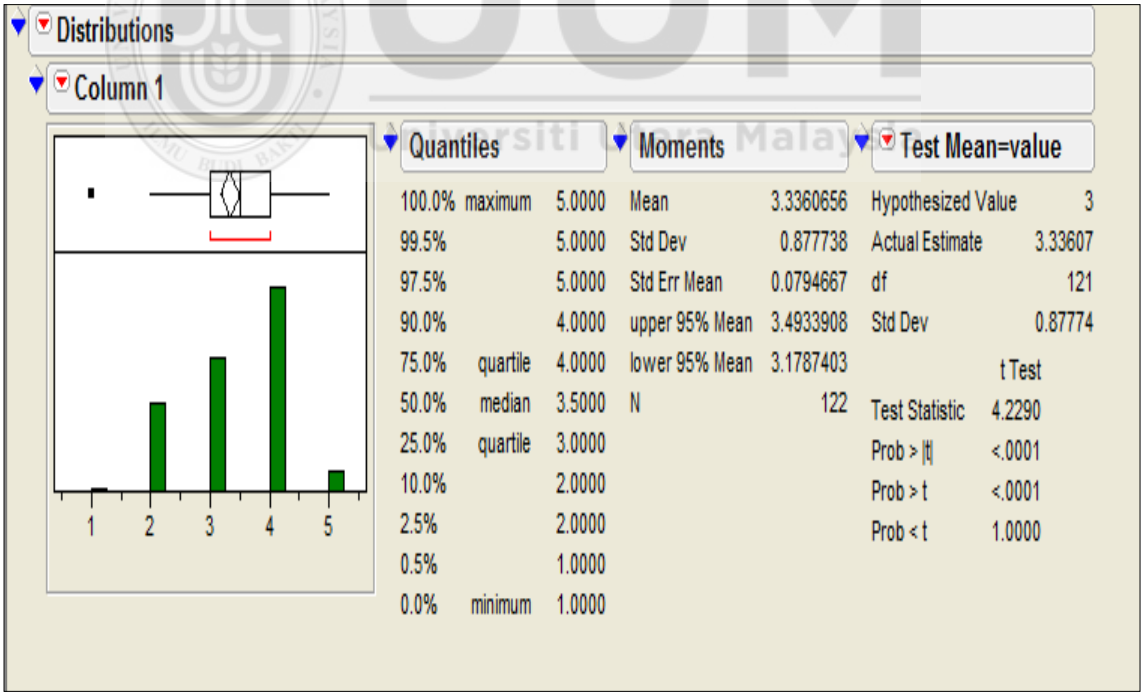


Question#2 - Pie Chart by Percentage



Question#2 – Frequency Bar Chart



Question#2 by using JMP, Statistical Tool

Finding:

Respondents believe employee who involved in human error followed the procedure, but they are lack of skill (not enough practice).

Question#3:

Employee who involved in human error, doesn't understand the system , process / equipment etc, well.

Result:

Total of Disagreement (Strongly Disagree & Not Agree) is 35%, where total of Agreement (Strongly Agree & Agree) is 44%. Average score is 3.11, with a standard deviation of 1.084

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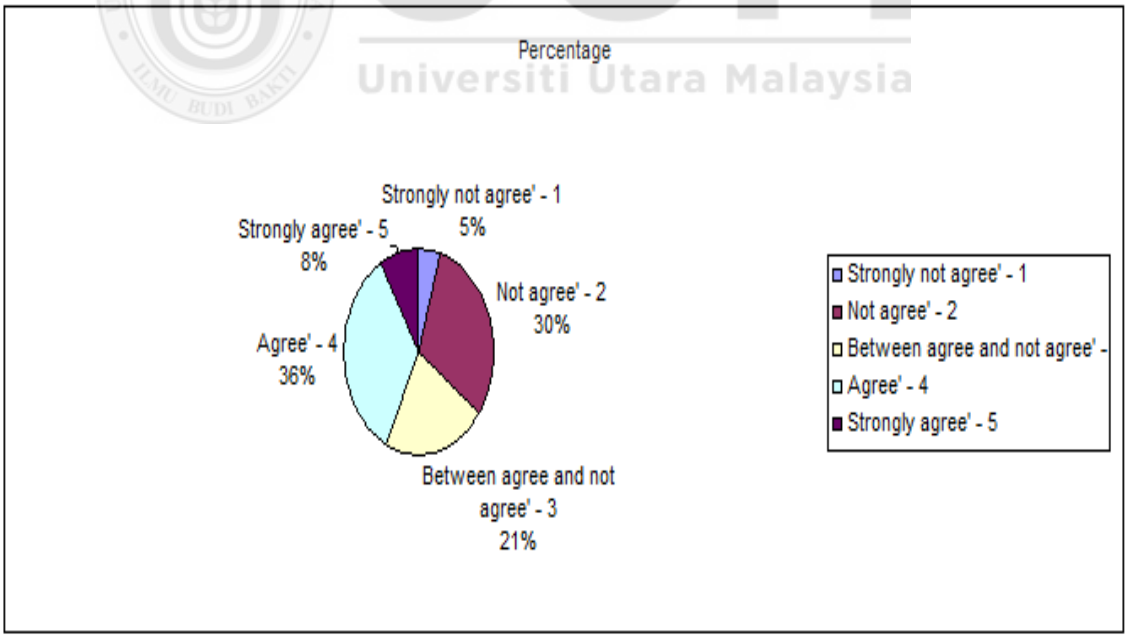
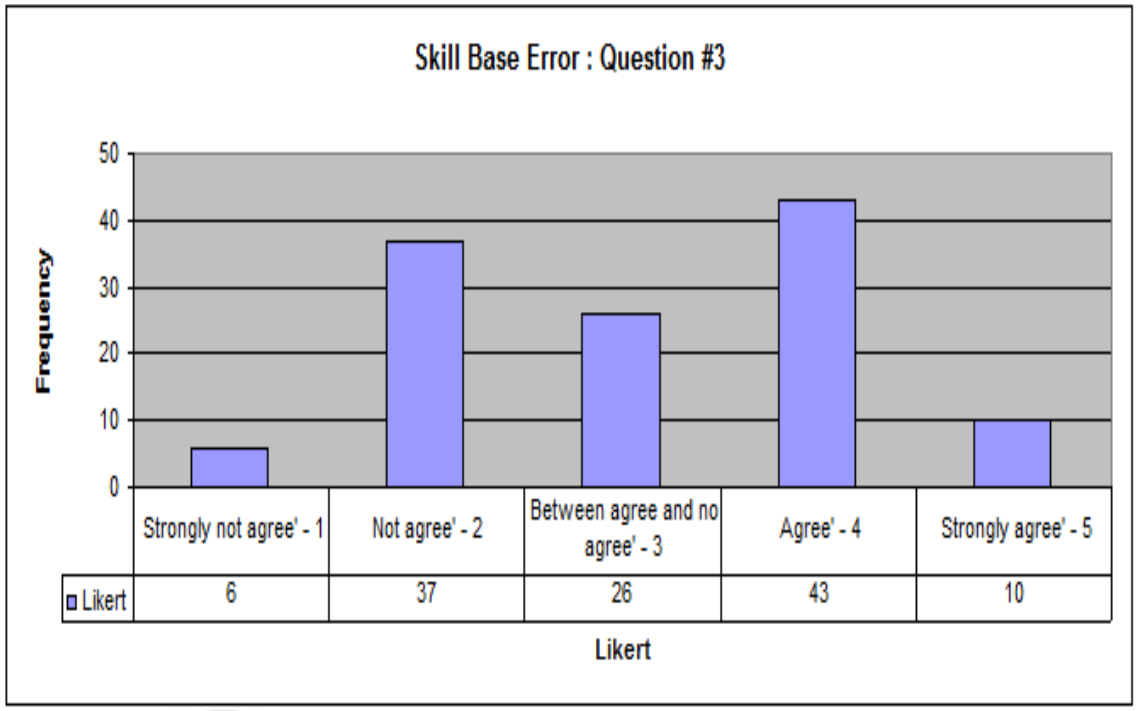
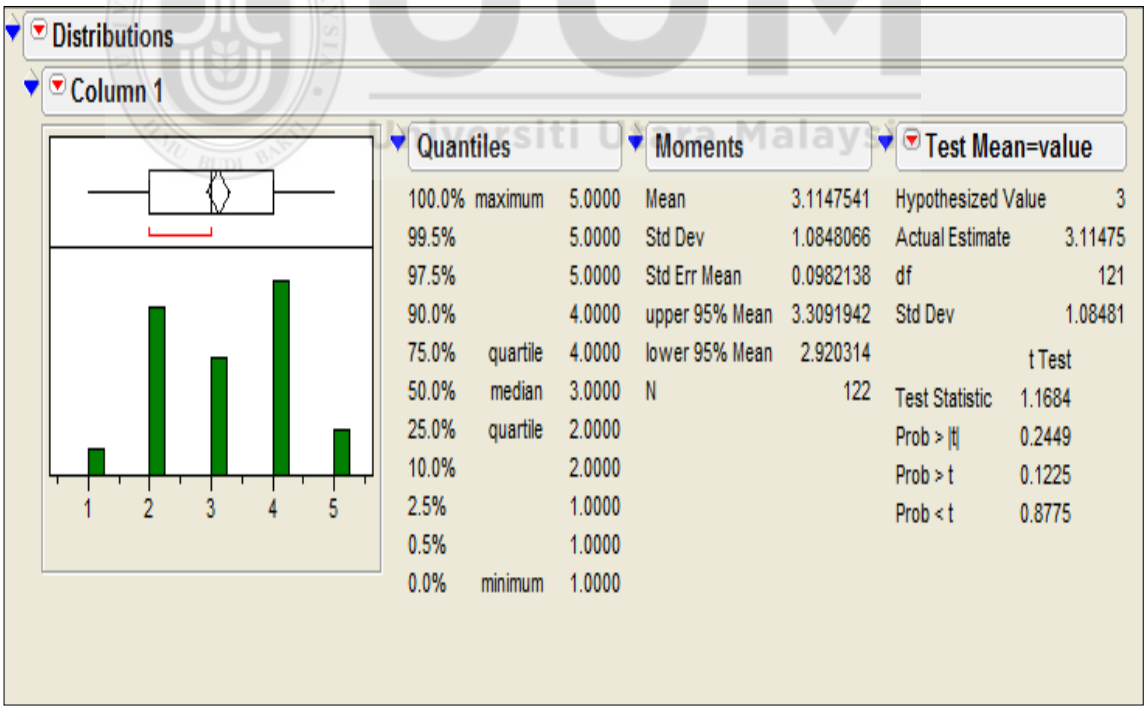


Question#3 Pie Chart by Percentage



Question#3 – Frequency Bar Chart



Question#3 by using JMP, Statistical Tool

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Finding:

Respondents believe employee who involved in human error, doesn't understand the system, process / equipment etc, well.

Question#4:

Employee who involved in human error, thought that they have followed the SOP (example: they taught they follow procedure but actually they were not)

Result:

Total of Disagreement (Strongly Disagree & Not Agree) is only 28%, where total of Agreement (Strongly Agree & Agree) is at 51%. Average score is 3.23, with a standard deviation of 1.01

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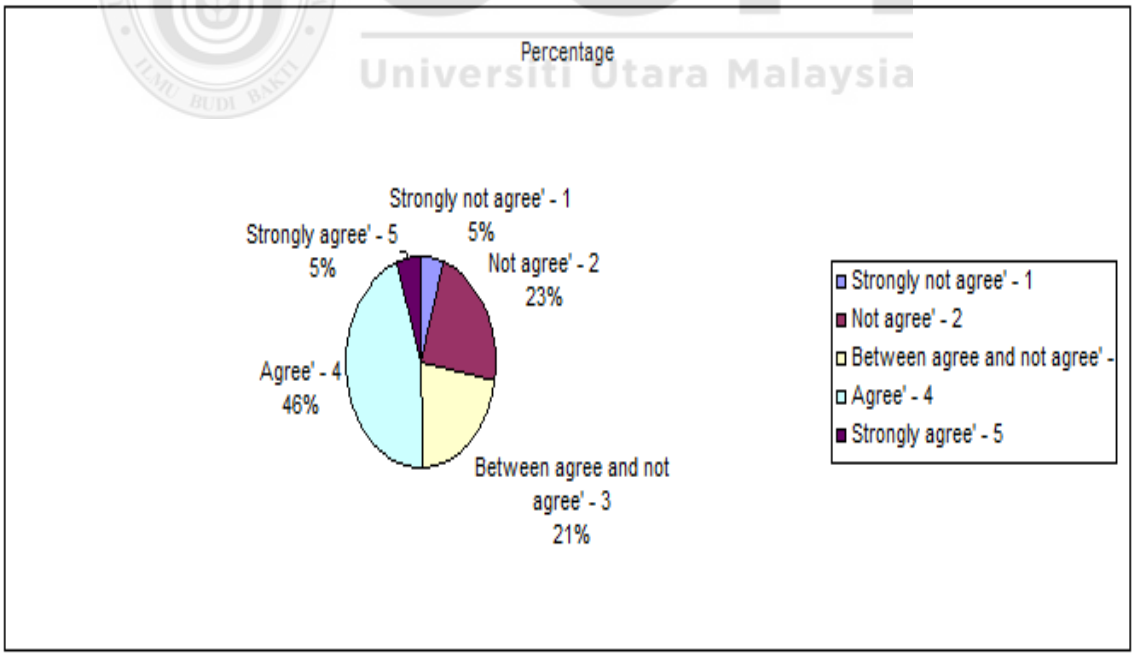
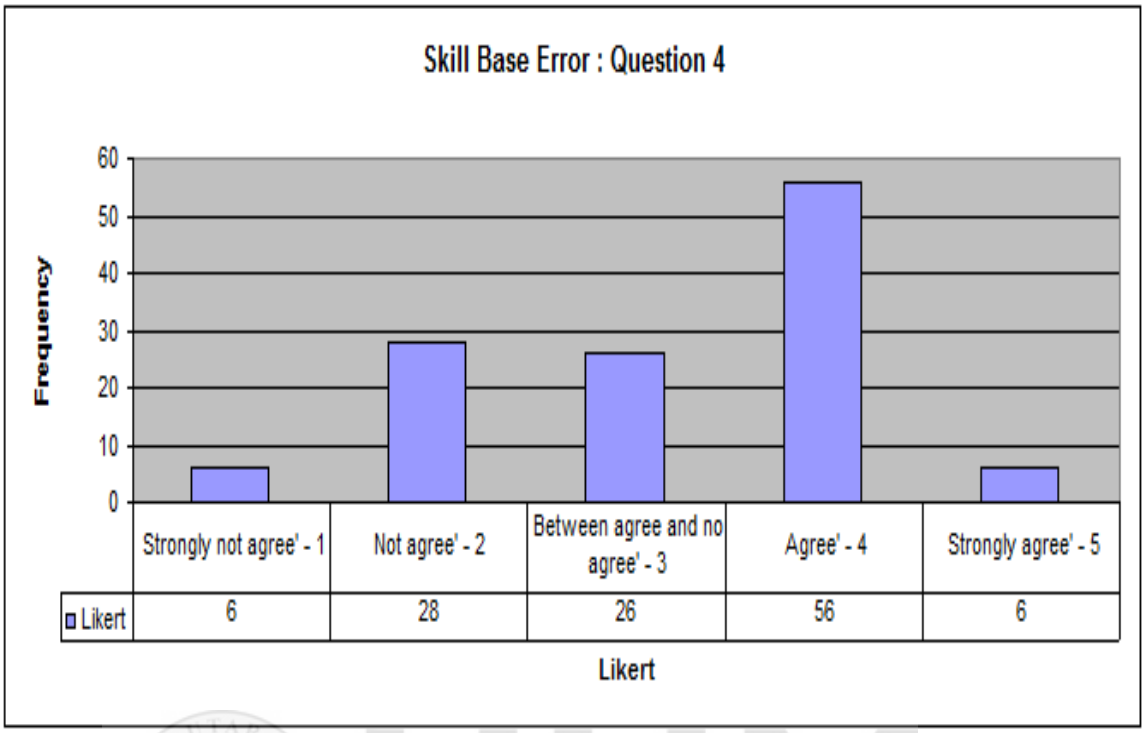
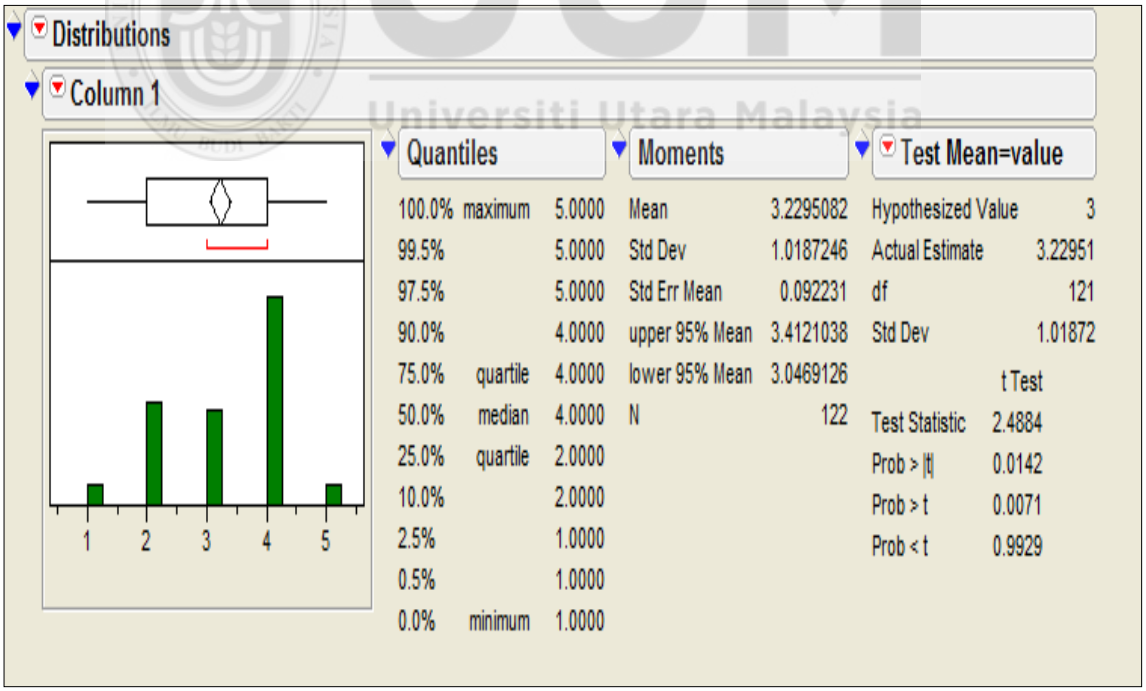


Question#4 Pie Chart by Percentage



Question#4 – Frequency Bar Chart



Question#4 by using JMP, Statistical Tool

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Finding:

Respondents believe employee who involved in human error, thought that they have followed the SOP (actualy they were not).

A.1 Decision Errors

Question#5:

Human error happened due to improper procedure.

Result:

Total of Disagreement (Strongly Disagree & Not Agree) is 28%, where total of Agreement (Strongly Agree & Agree) is 39%. Average score is 3.17, with a standard deviation of 1.01

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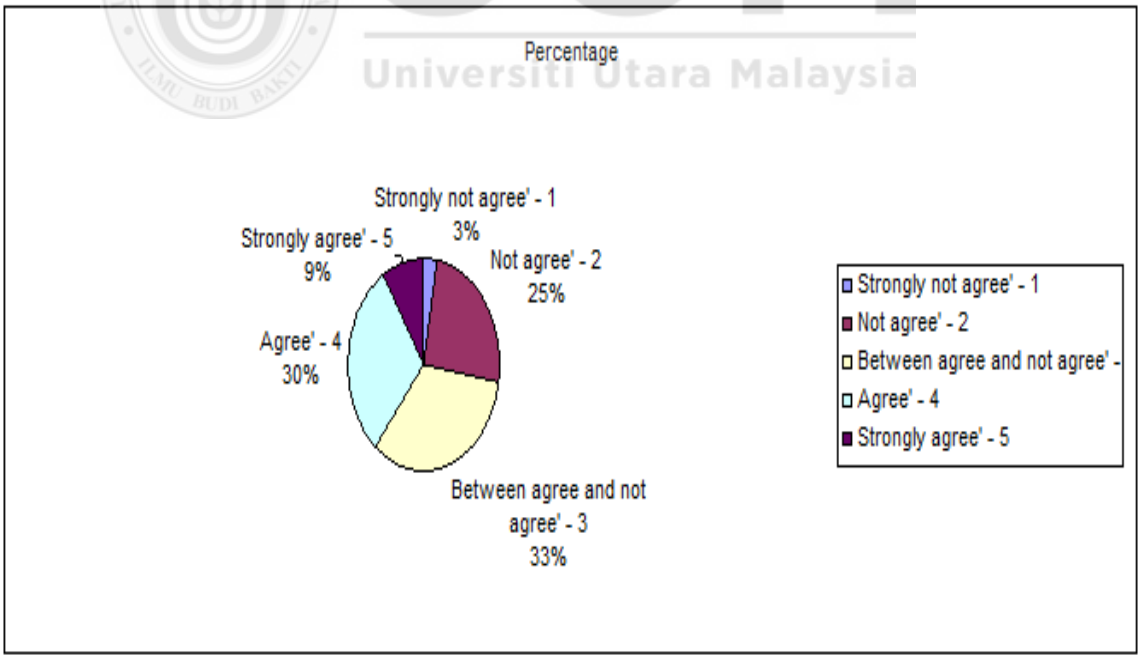
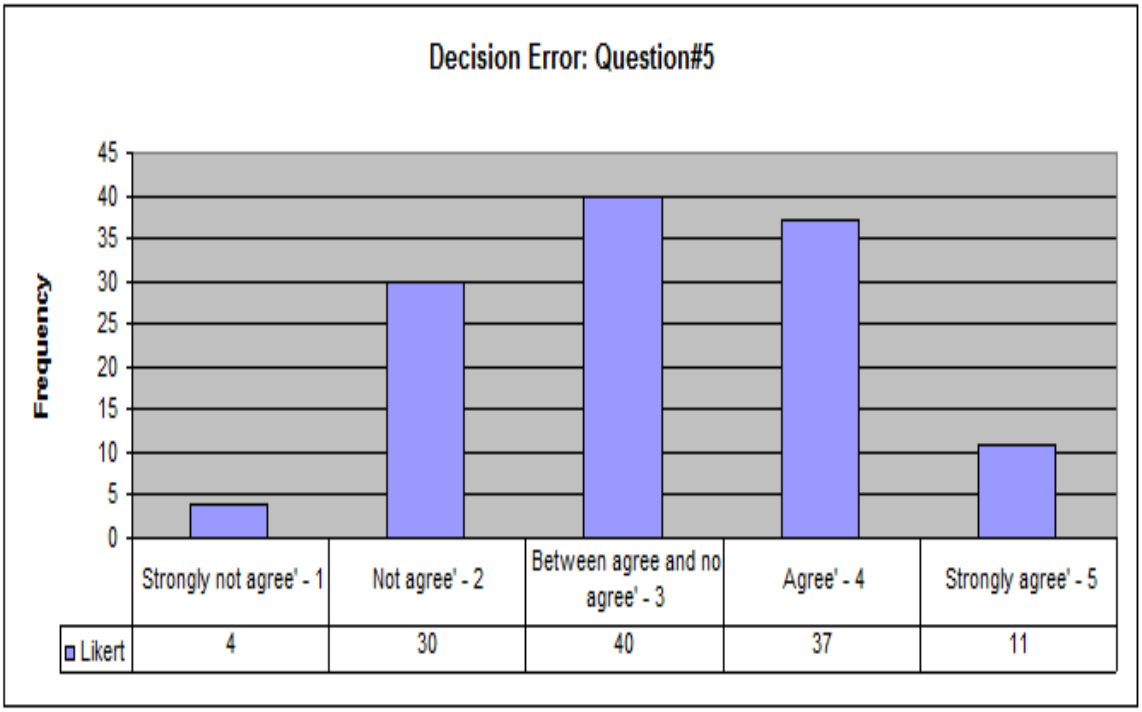
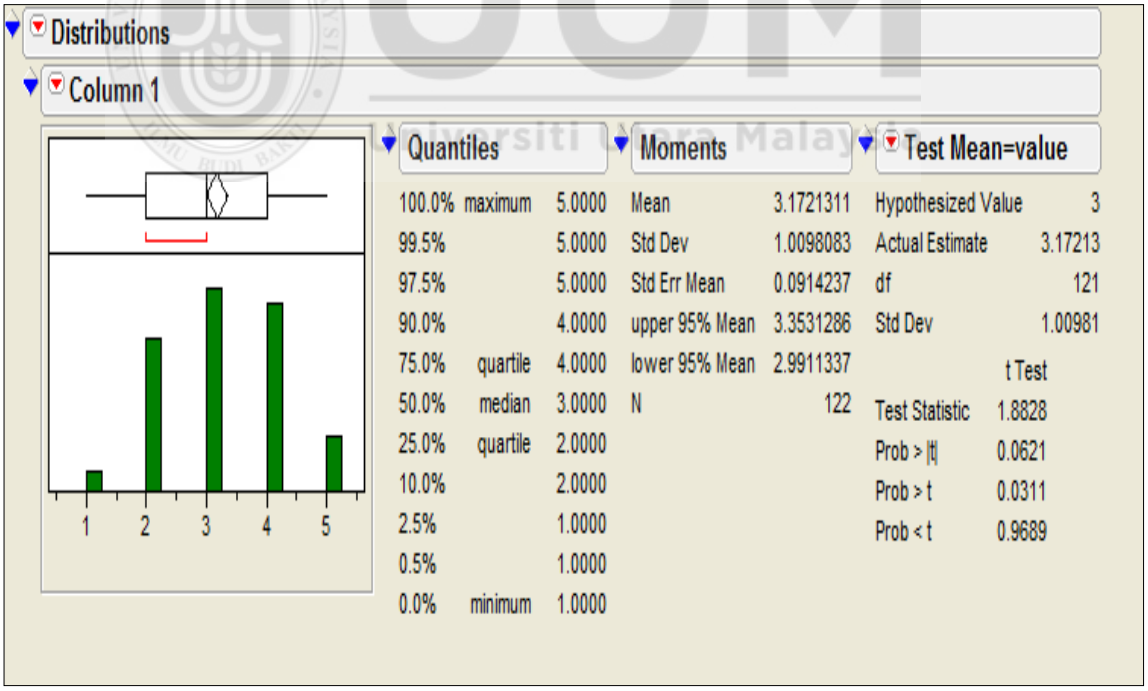


Question#5 Pie Chart by Percentage



Question#5 – Frequency Bar Chart



Question#5 by using JMP, Statistical Tool

Finding:

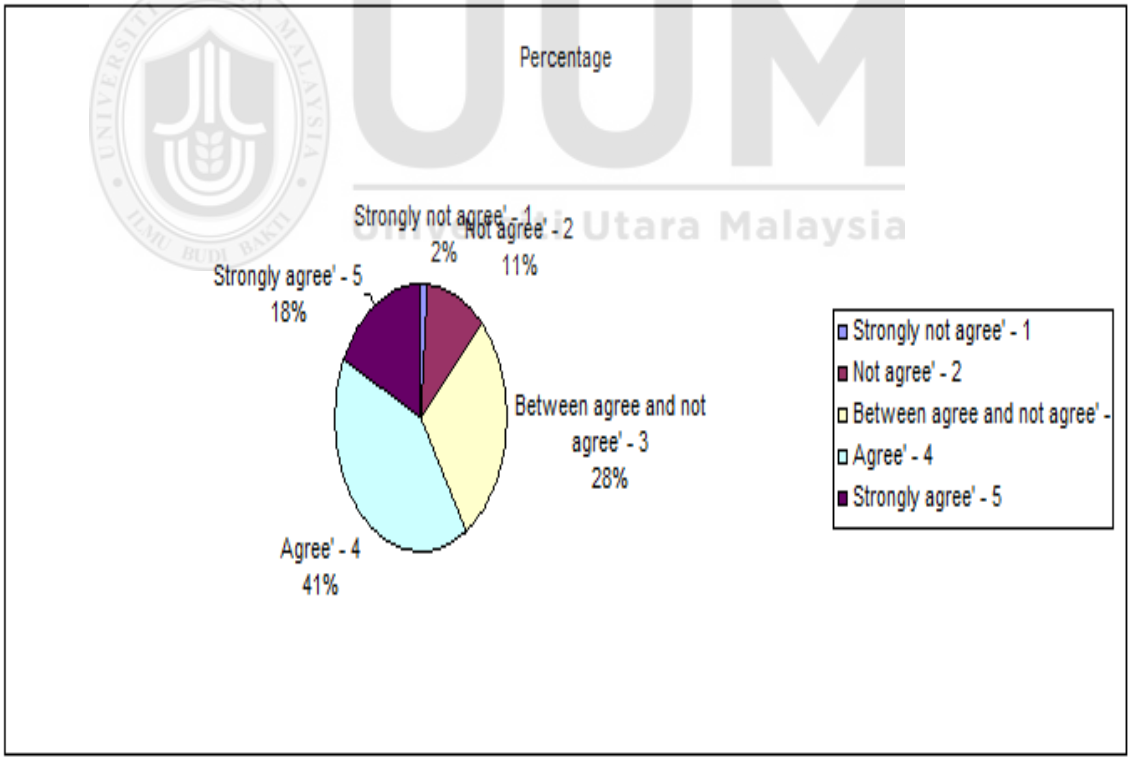
Respondents believe human error happened is due to improper procedure.

Question#6:

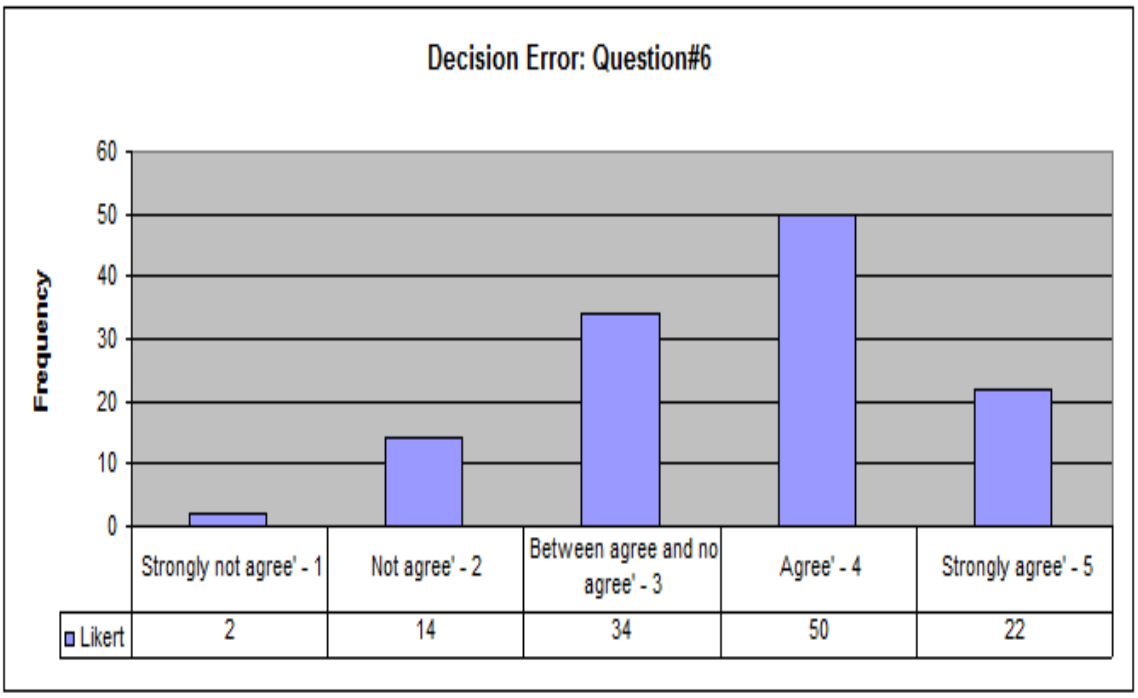
Human error will reduce if the procedure is simplified.

Result:

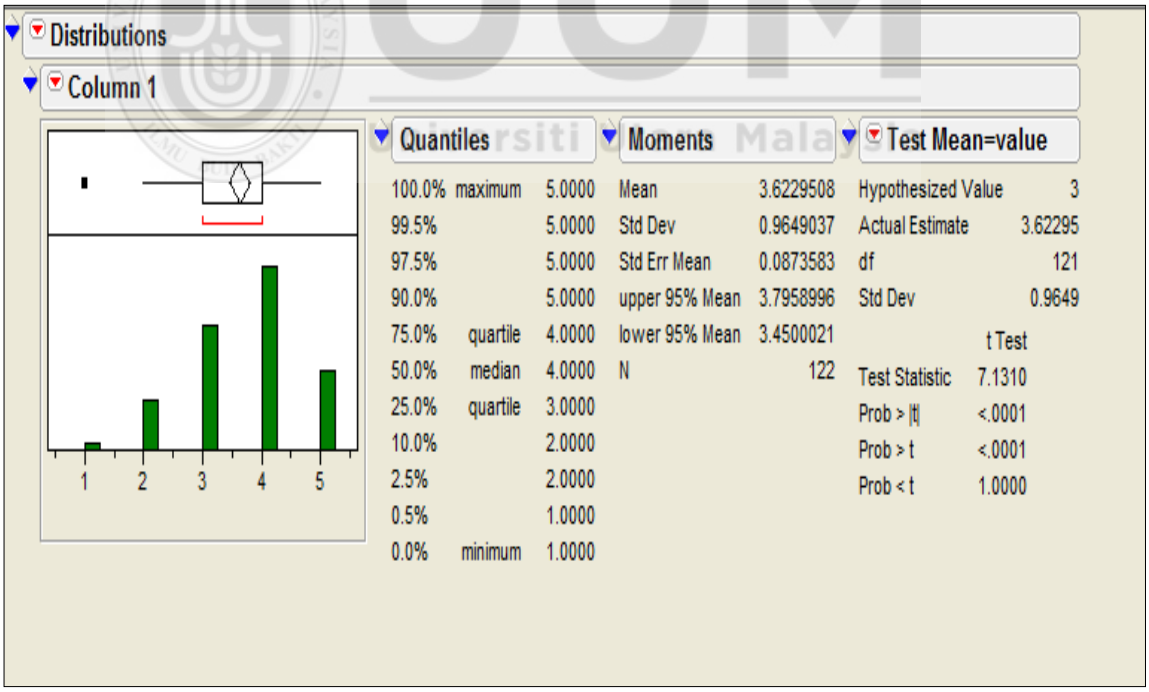
Total of Disagreement (Strongly Disagree & Not Agree) is 13%, where total of Agreement (Strongly Agree & Agree) is 59%. Average score is 3.62, with a standard deviation of 0.96



Question#6 Pie Chart by Percentage



Question#6 – Frequency Bar Chart



Question#6 by using JMP, Statistical Tool

Finding:

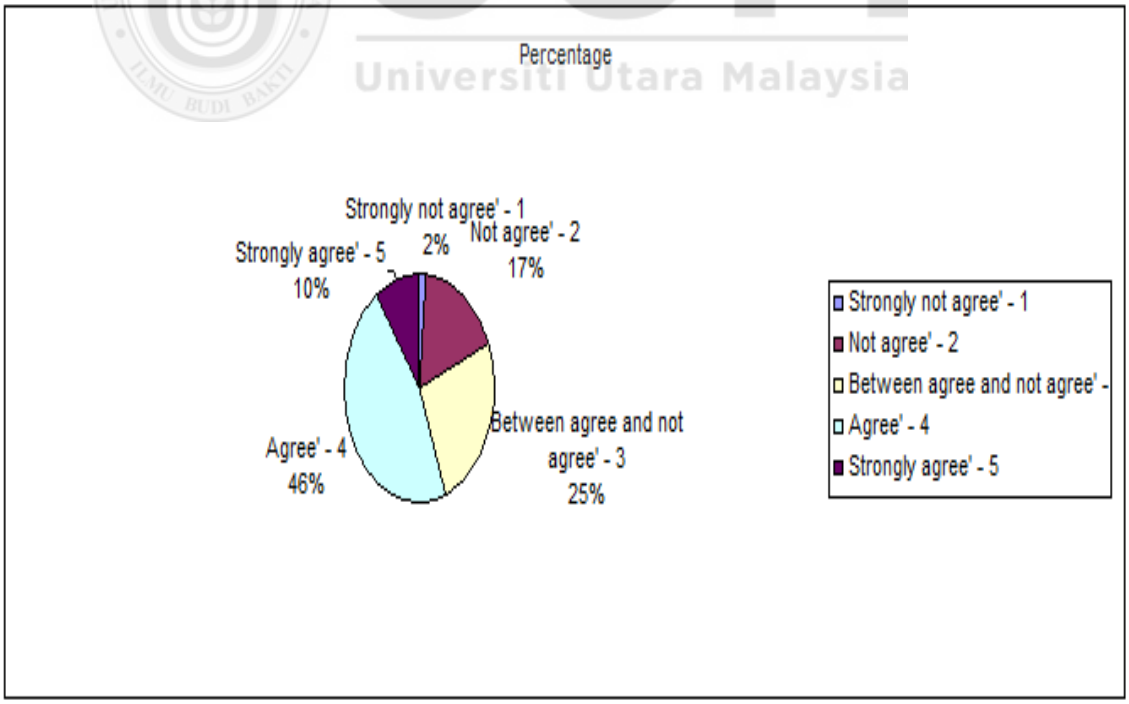
Respondents believe human error will reduce if procedure could be simplified.

Question#7:

Human error will reduce if you are given a platform by Management to simplify the procedure.

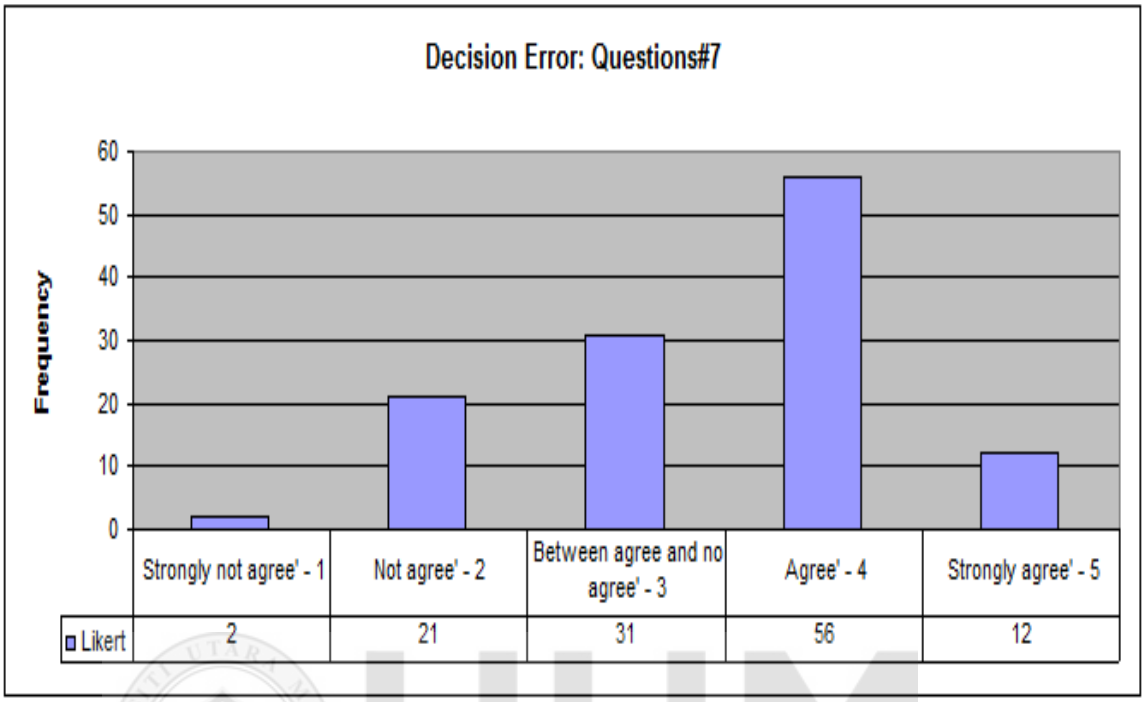
Result:

Total of Disagreement (Strongly Disagree & Not Agree) is 19%, where total of Agreement (Strongly Agree & Agree) is 56%. Average score is 3.45, with a standard deviation of 0.94

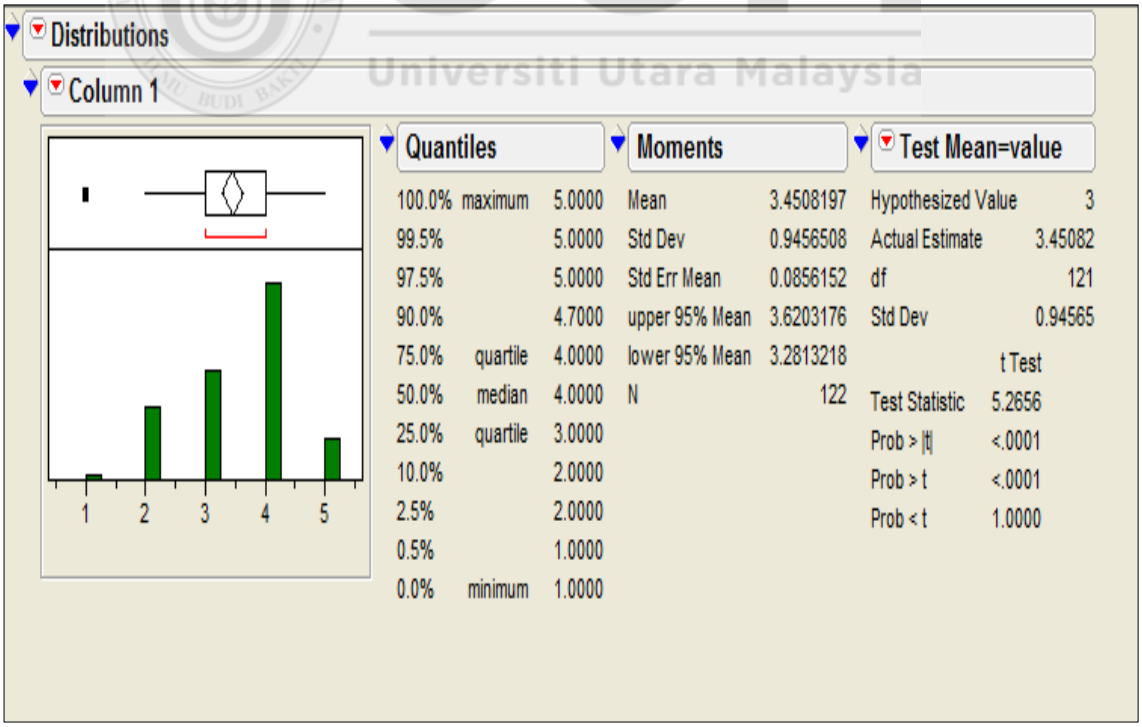


Question#7 Pie Chart by Percentage

Universiti Utara Malaysia



Question#7 – Frequency Bar Chart



Question#7 by using JMP, Statistical Tool

Universiti Utara Malaysia

Finding:

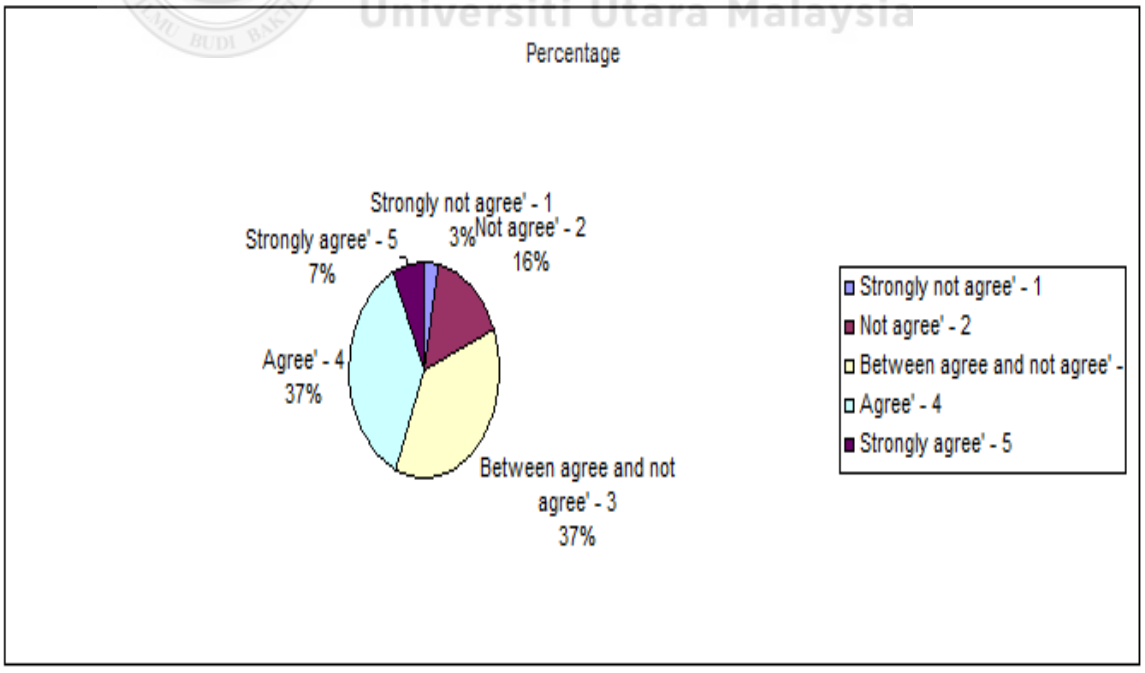
Respondents believe human error will be reduced if employee is given a platform by Management to simplify the procedure.

Question#8:

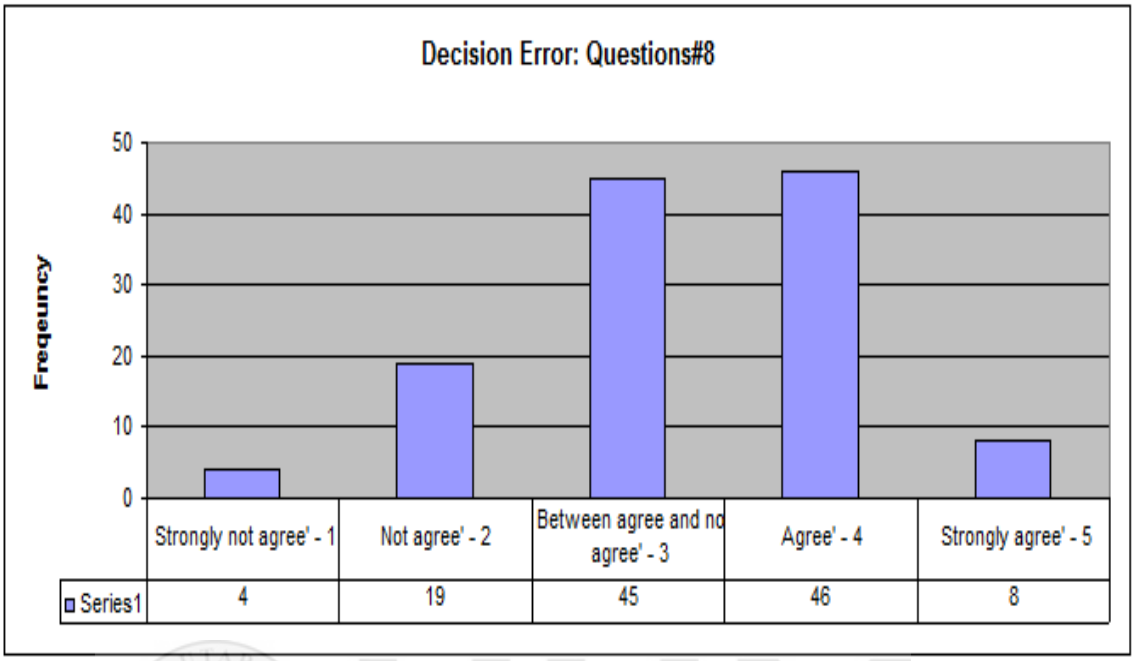
Employee who involved in human error, misdiagnosed problem, alarm, etc.

Result:

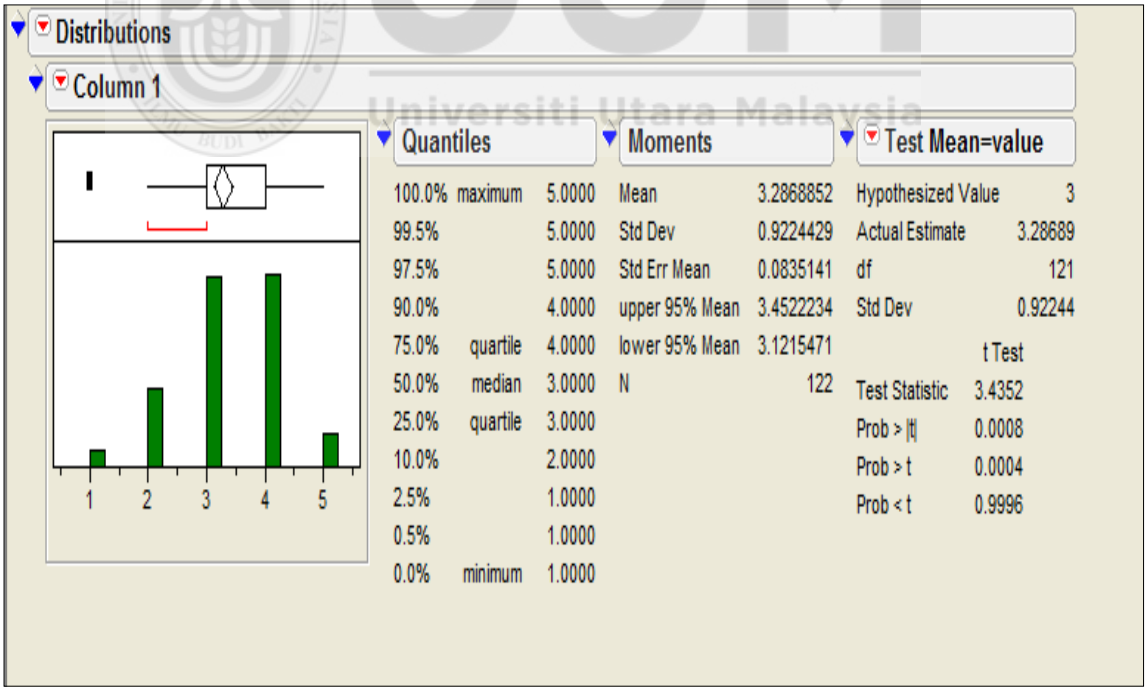
Total of Disagreement (Strongly Disagree & Not Agree) is 19%, where total of Agreement (Strongly Agree & Agree) is 44%. Average score is 3.29, with a standard deviation of 0.92



Question#8 Pie Chart by Percentage



Question#8 – Frequency Bar Chart



Question#8 by using JMP, Statistical Tool

Universiti Utara Malaysia

Finding:

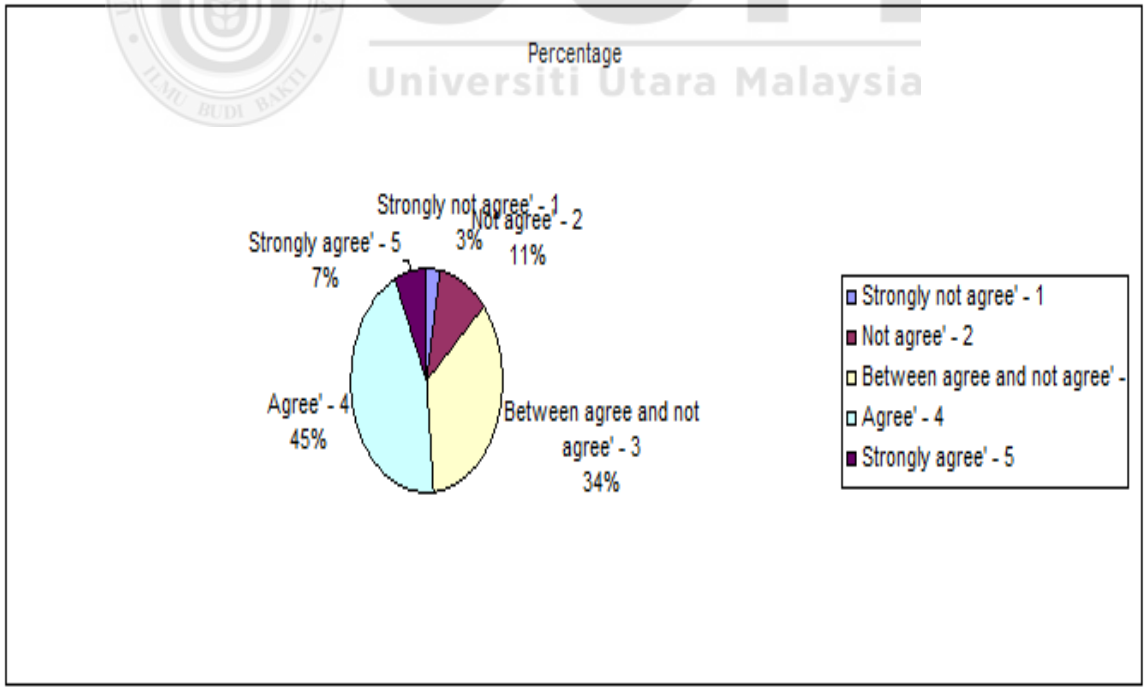
Respondents believe that employee who involved in human error, misdiagnosed problem, alarm

Question#9:

Employee who involved in human error, misjudge the lot disposition

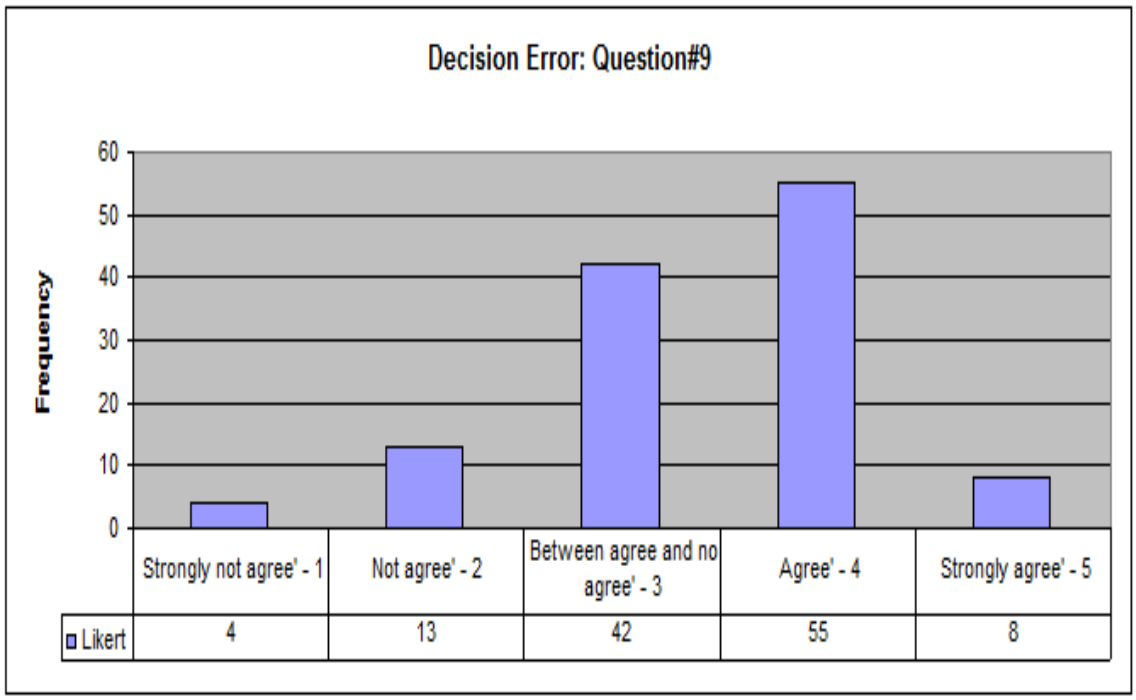
Result:

Total of Disagreement (Strongly Disagree & Not Agree) is 14%, where total of Agreement (Strongly Agree & Agree) is 52%. Average score is 3.41, with a standard deviation of 0.88

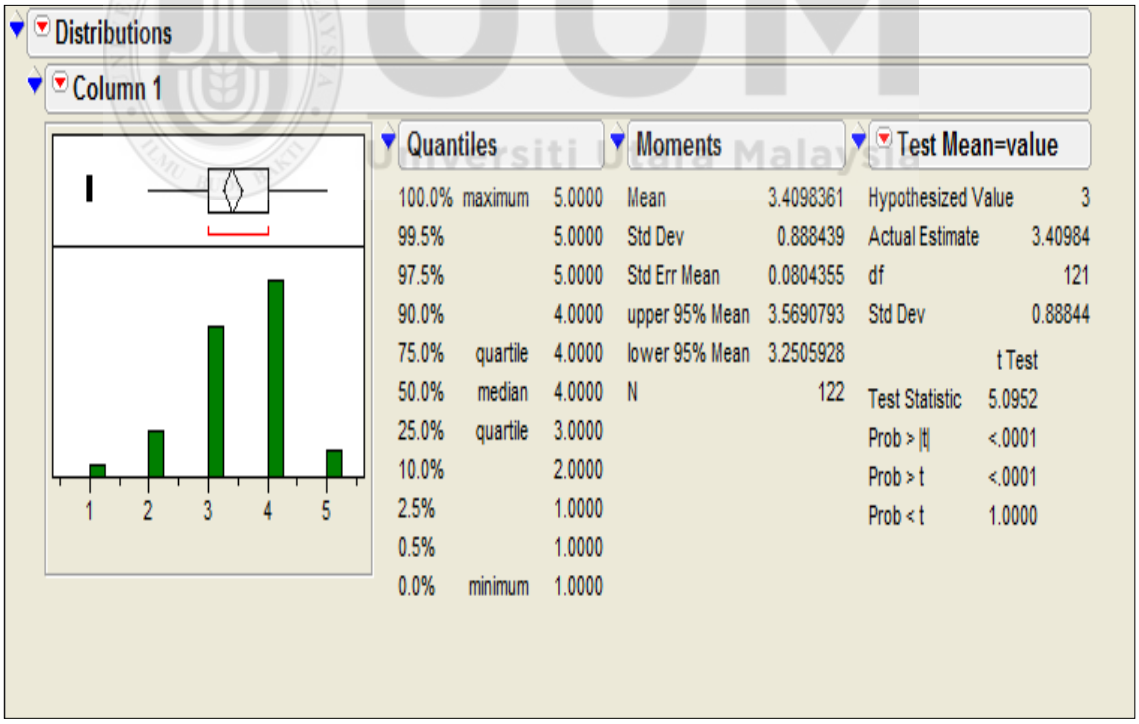


Question#9 Pie Chart by Percentage

Universiti Utara Malaysia



Question#9 – Frequency Bar Chart



Question#9 by using JMP, Statistical Tool

Finding:

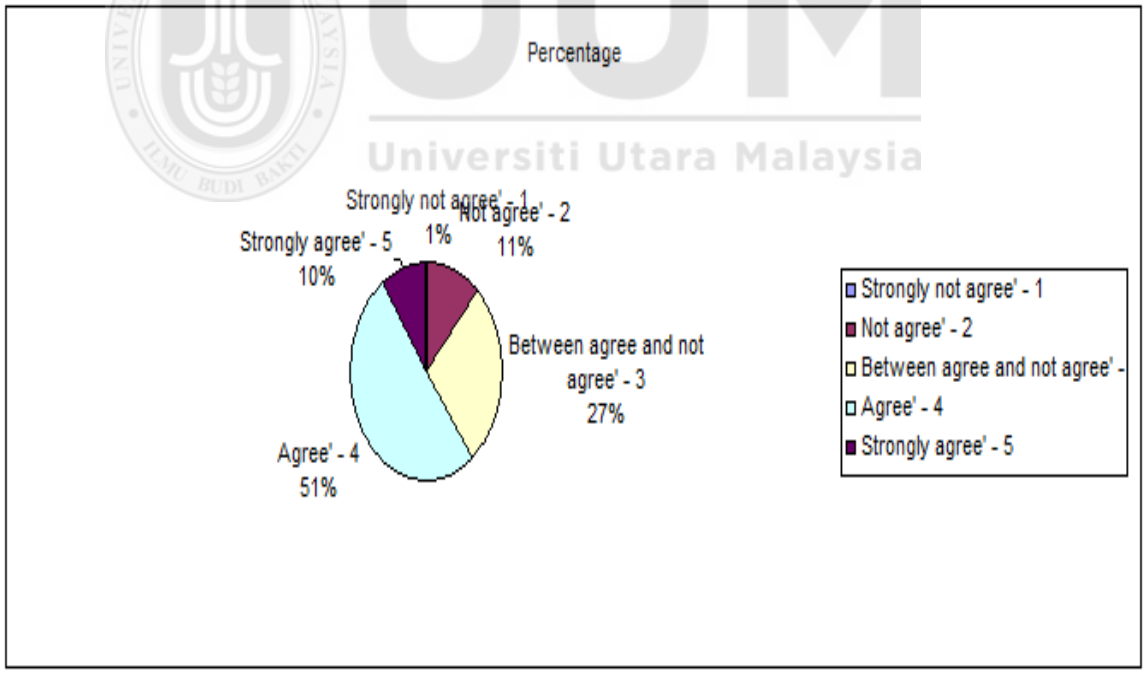
Respondents believe employee who involved in human error, misjudge lot disposition.

Question#10:

Human error happened due to lack of information (example - no pass down, no label, etc).

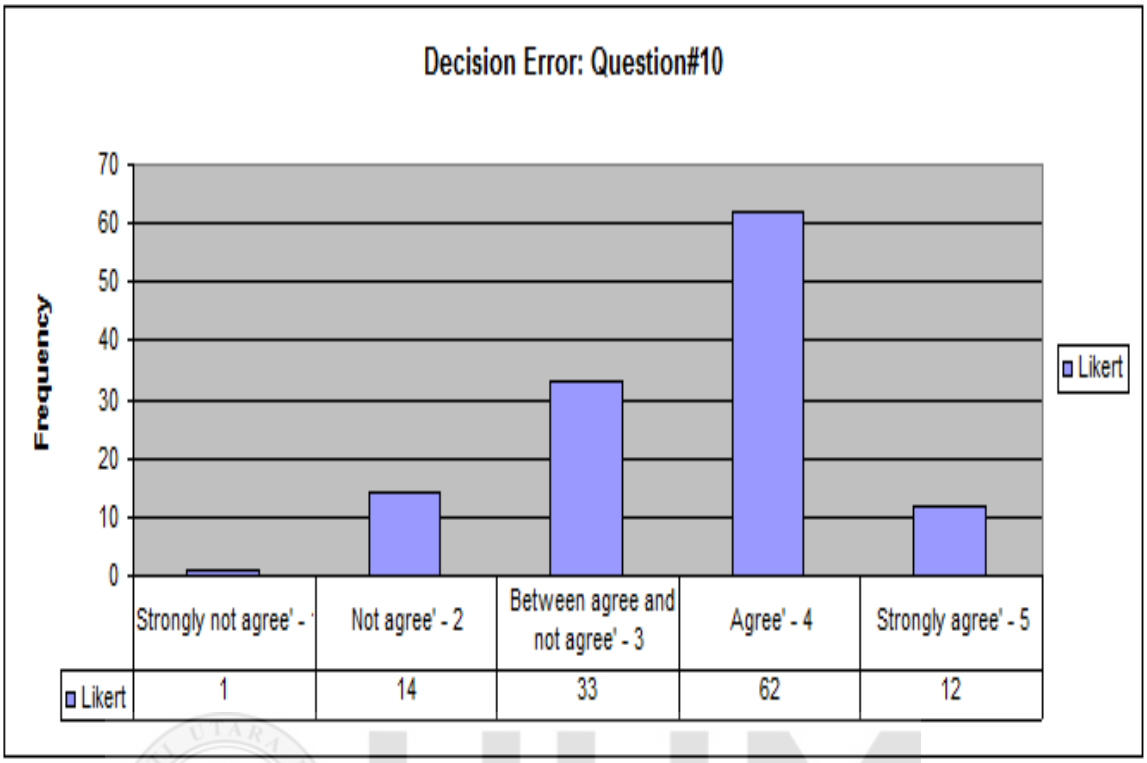
Result:

Total of Disagreement (Strongly Disagree & Not Agree) is 12%, where total of Agreement (Strongly Agree & Agree) is 61%. Average score is 3.57, with a standard deviation of 0.85.

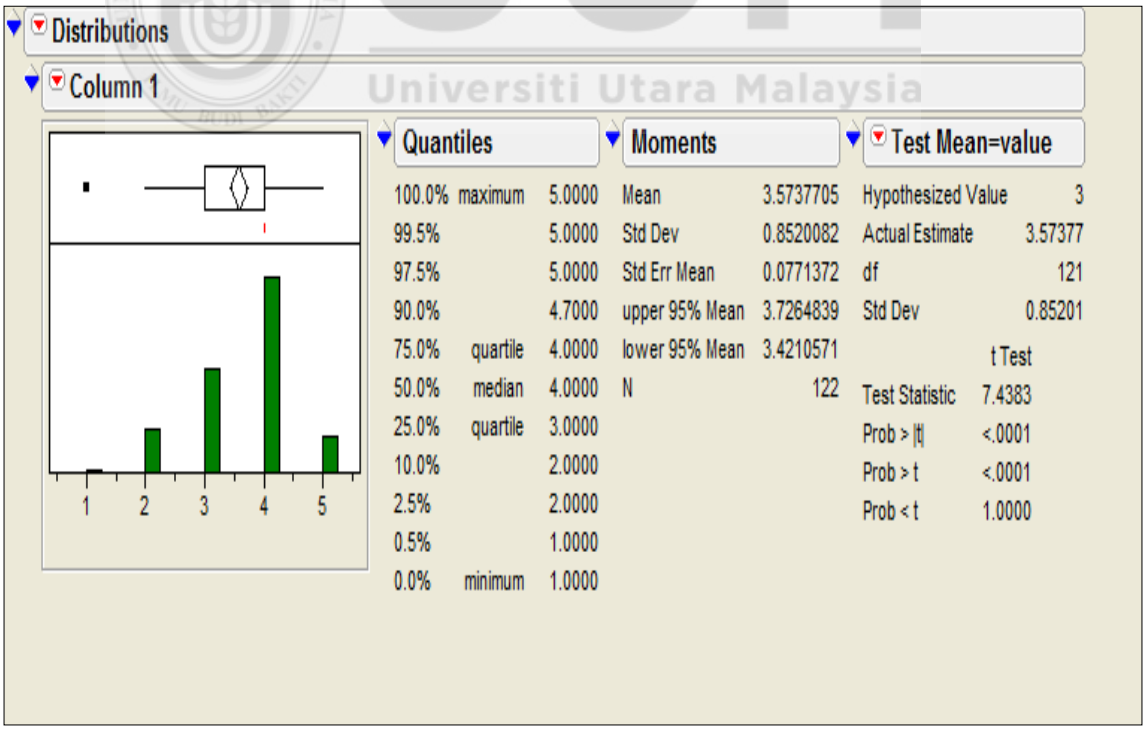


Question#10 Pie Chart by Percentage

Universiti Utara Malaysia



Question#10 – Frequency Bar Chart



Question#10 by using JMP, Statistical Tool

Universiti Utara Malaysia

Finding:

Respondents believe human error happened due to lack of information (example - no proper pass down, no label, etc)

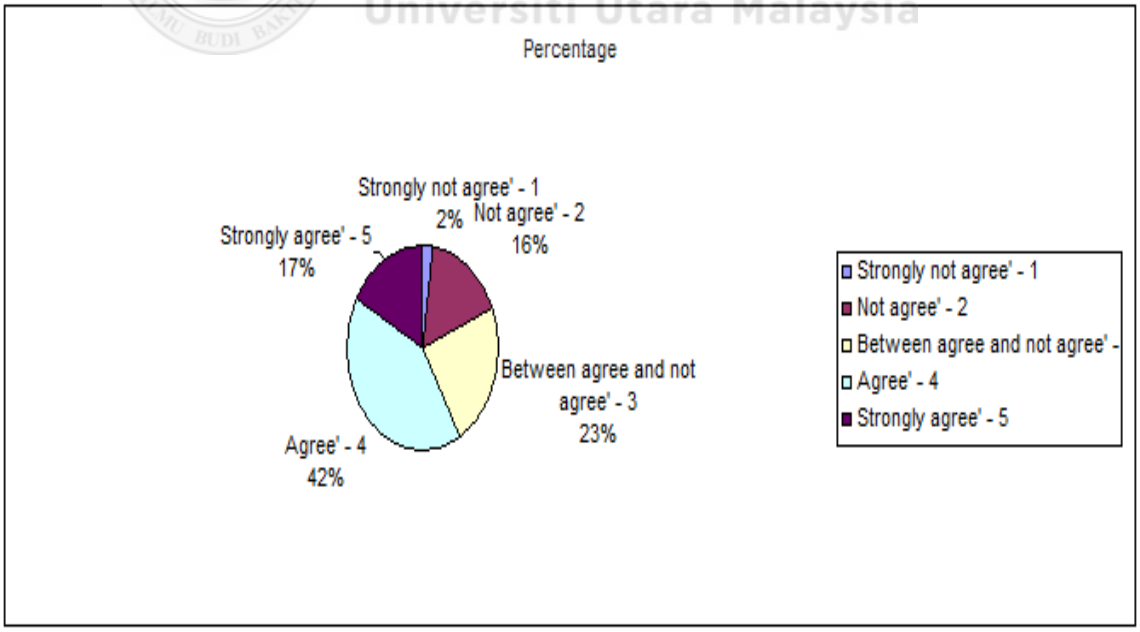
A.2 Perceptual Error

Question#11:

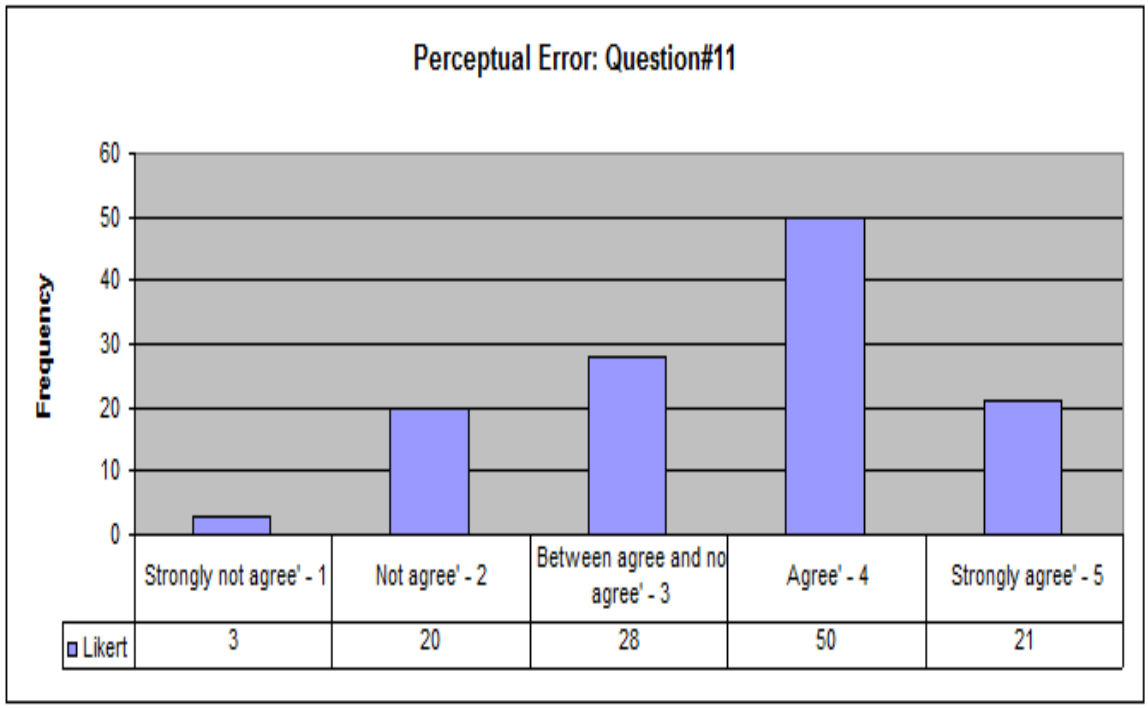
Employee, who involved in human error, was overconfidence and in hurry to expedite works.

Result:

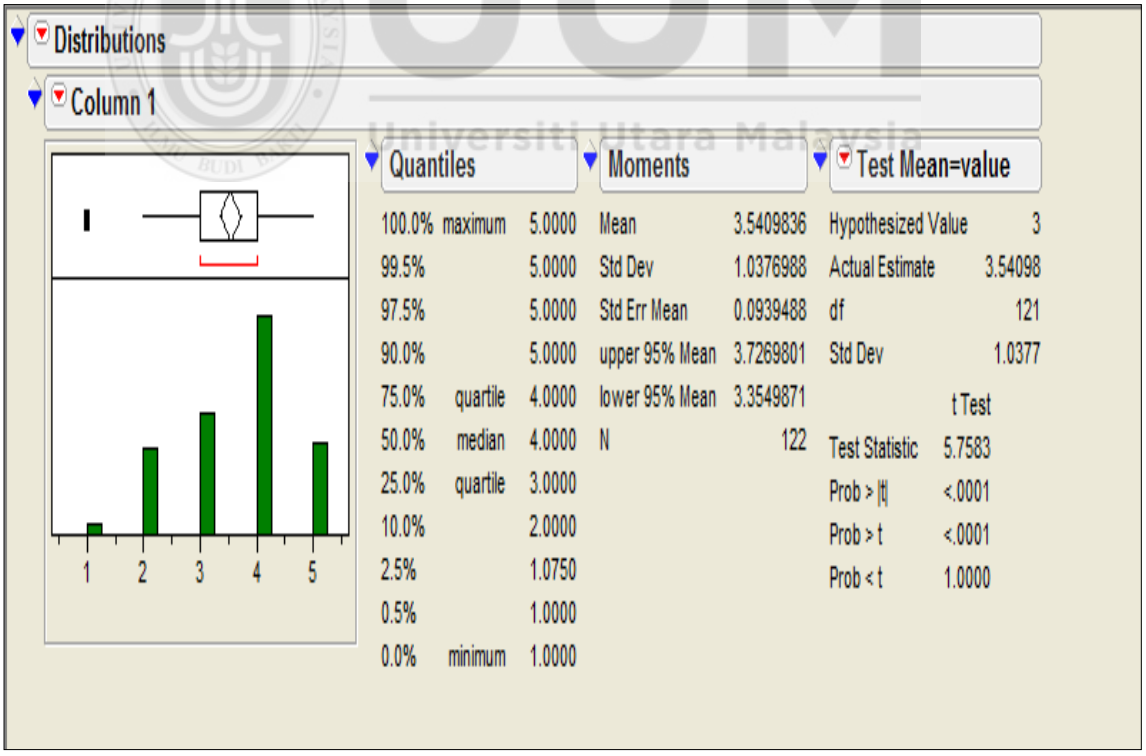
Total of Disagreement (Strongly Disagree & Not Agree) is 18%, where total of Agreement (Strongly Agree & Agree) is 59%. Average score is 3.54, with a standard deviation of 1.04



Question#11 Pie Chart by Percentage



Question#11 – Frequency Bar Chart



Question#11 by using JMP, Statistical Tool

Universiti Utara Malaysia

Finding:

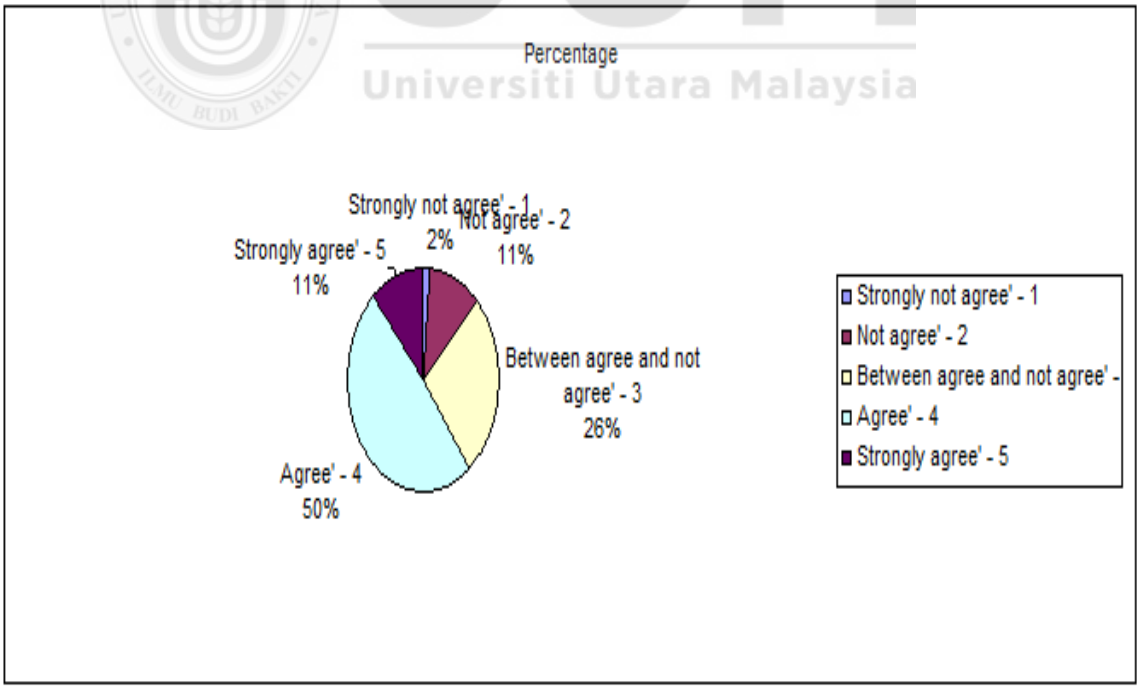
Respondents believe employee who involved in human error, was overconfidence and in hurry to expedite work

Question#12:

Human error happened, because of visual (they can't see clearly / mis intrepret / wrong judgment what they saw).

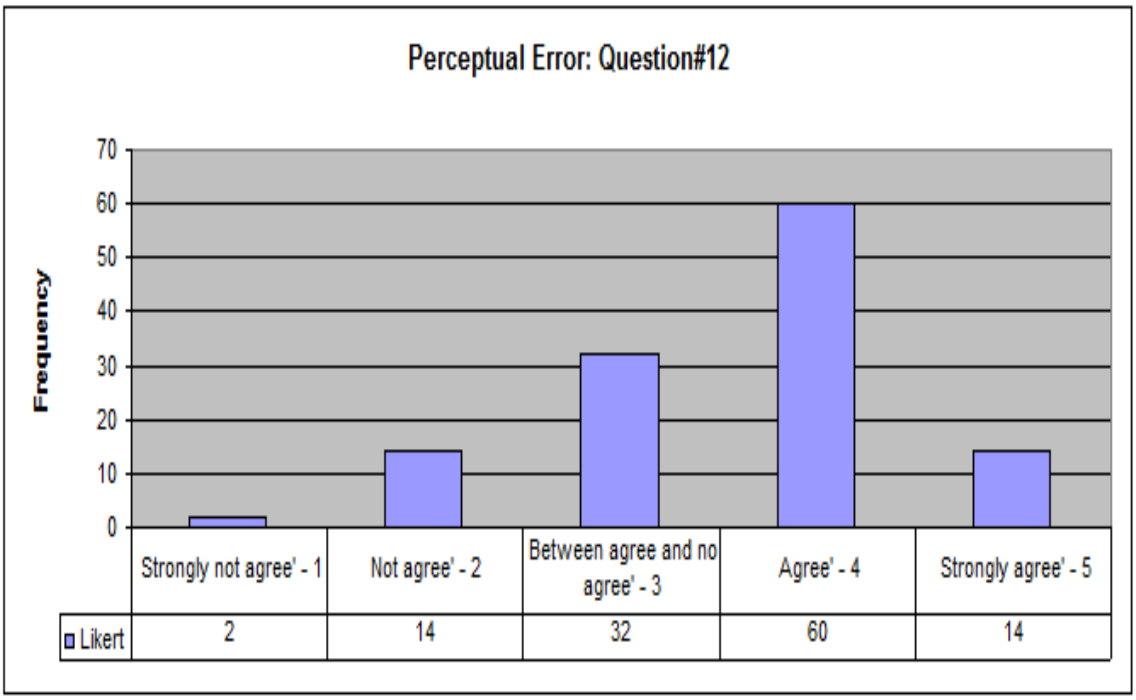
Result:

Total of Disagreement (Strongly Disagree & Not Agree) is 18%, where total of Agreement (Strongly Agree & Agree) is 61%. Average score is 3.57, with a standard deviation of 0.89.

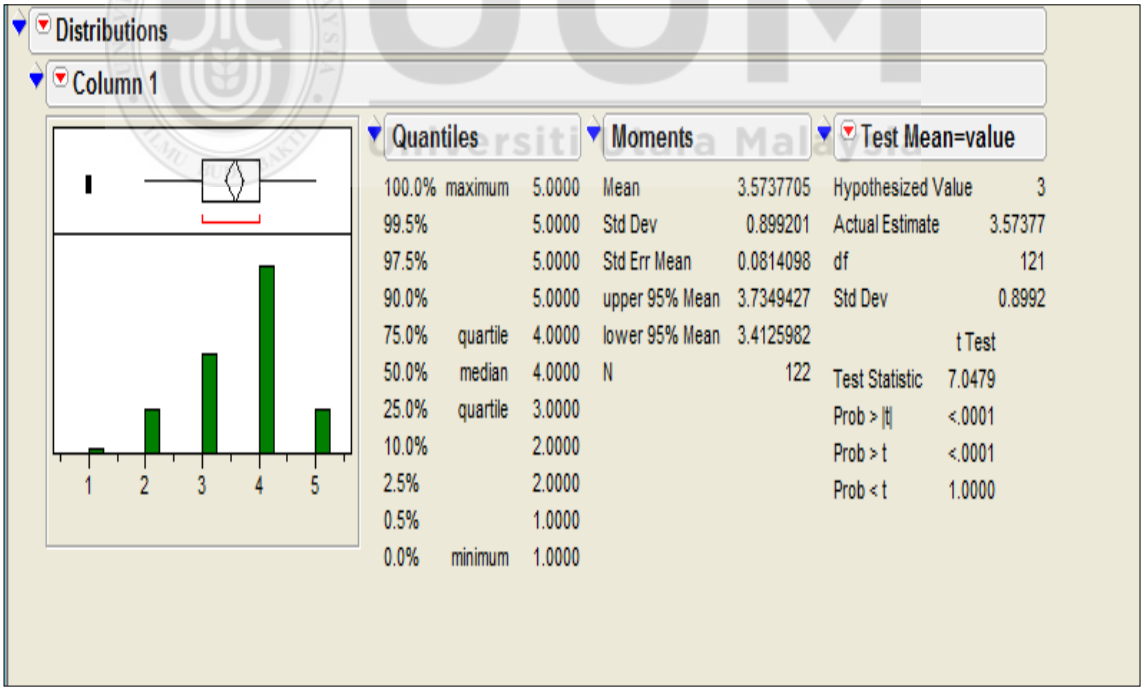


Question#12 Pie Chart by Percentage

Universiti Utara Malaysia



Question#12 – Frequency Bar Chart



Question#12 by using JMP, Statistical Tool

Finding:

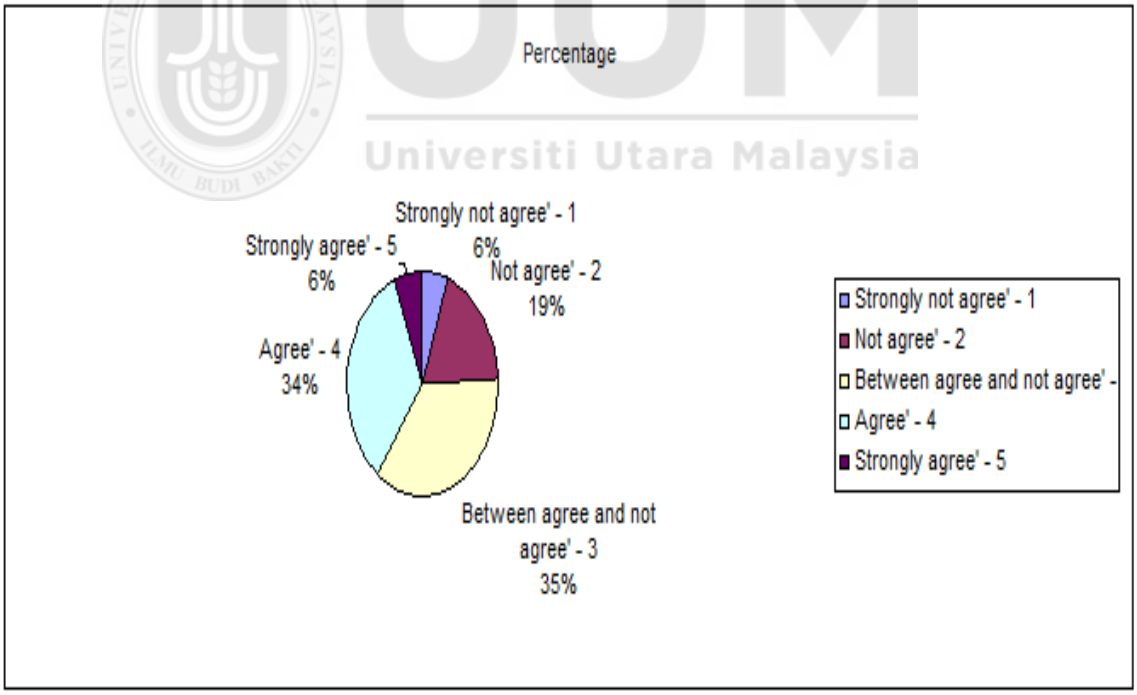
Respondents believe human error happened because of visual (they can't see clearly / misinterpret / wrong judgment what they saw).

Question#13:

Employee, who involved in human error, used poor / wrong technique.

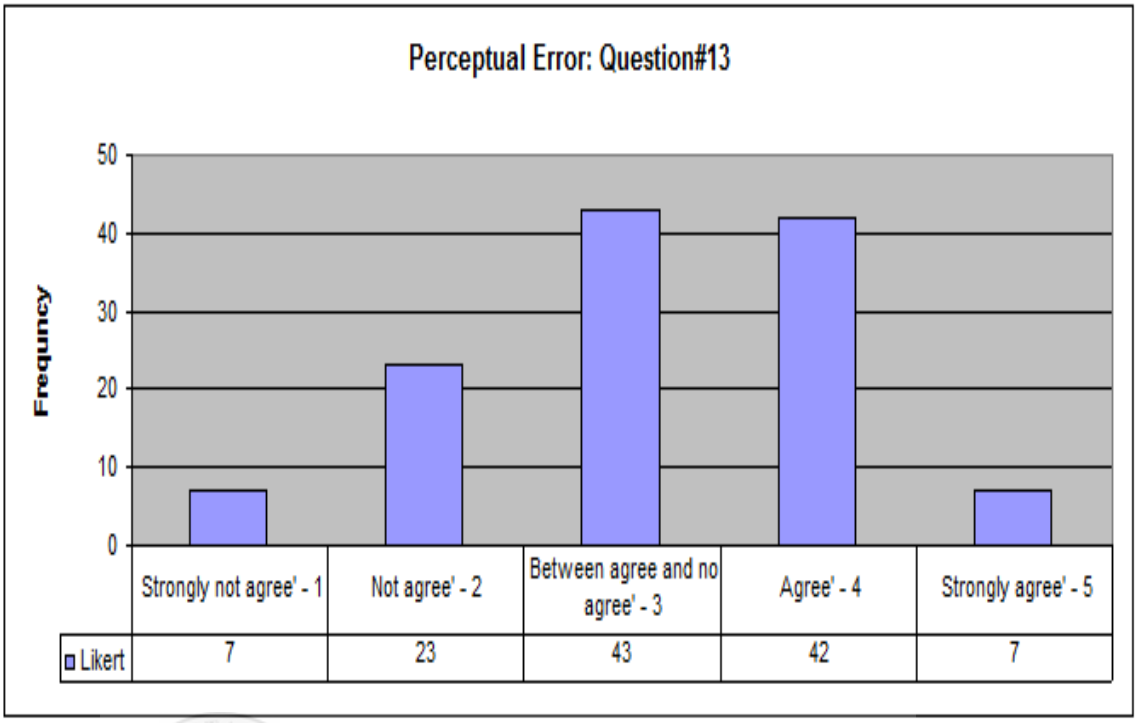
Result:

Total of Disagreement (Strongly Disagree & Not Agree) is 25%, where total of Agreement (Strongly Agree & Agree) is 40%. Average score is 3.15, with a standard deviation of 0.97.

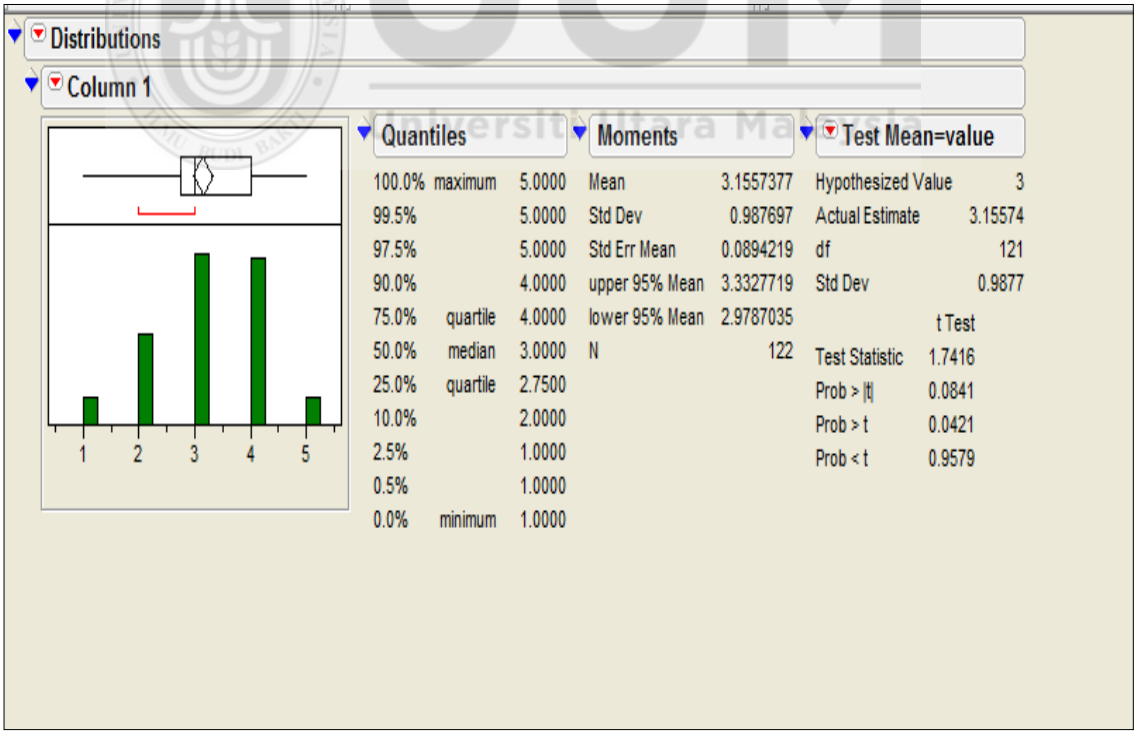


Question#13 Pie Chart by Percentage

Universiti Utara Malaysia



Question#13 – Frequency Bar Chart



Question#13 by using JMP, Statistical Tool

Finding:

Respondents believe employee who involved in human error, used poor / wrong technique.

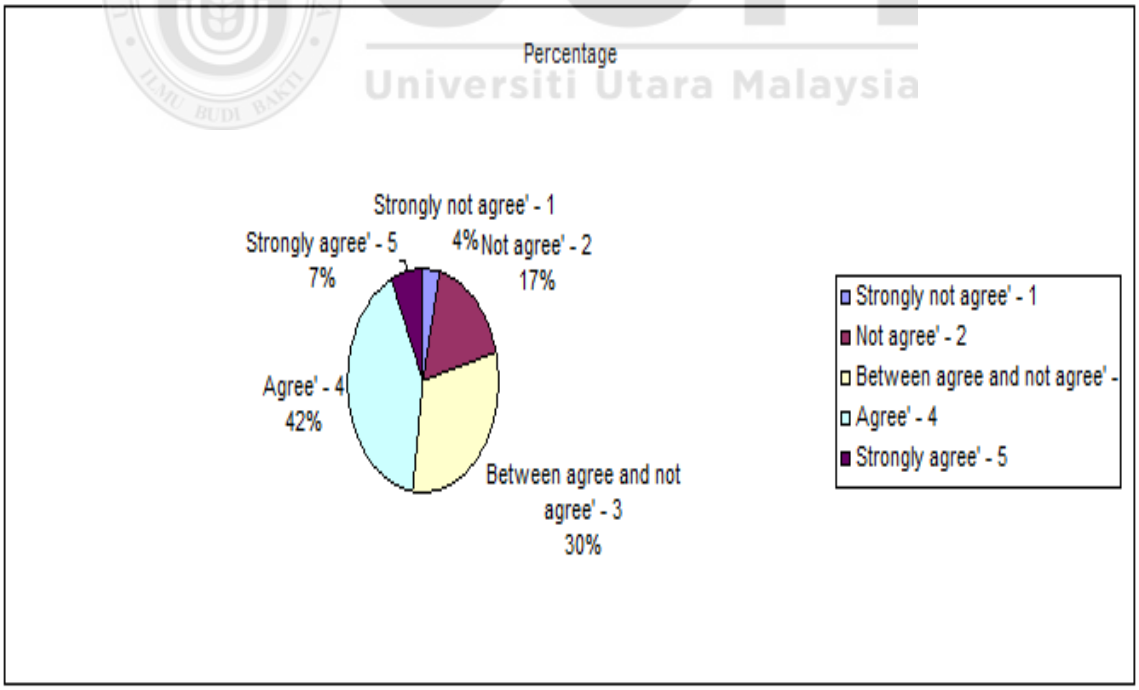
Question#14:

Employee who involved in human error, didn't not fully understand procedure / have different thought.

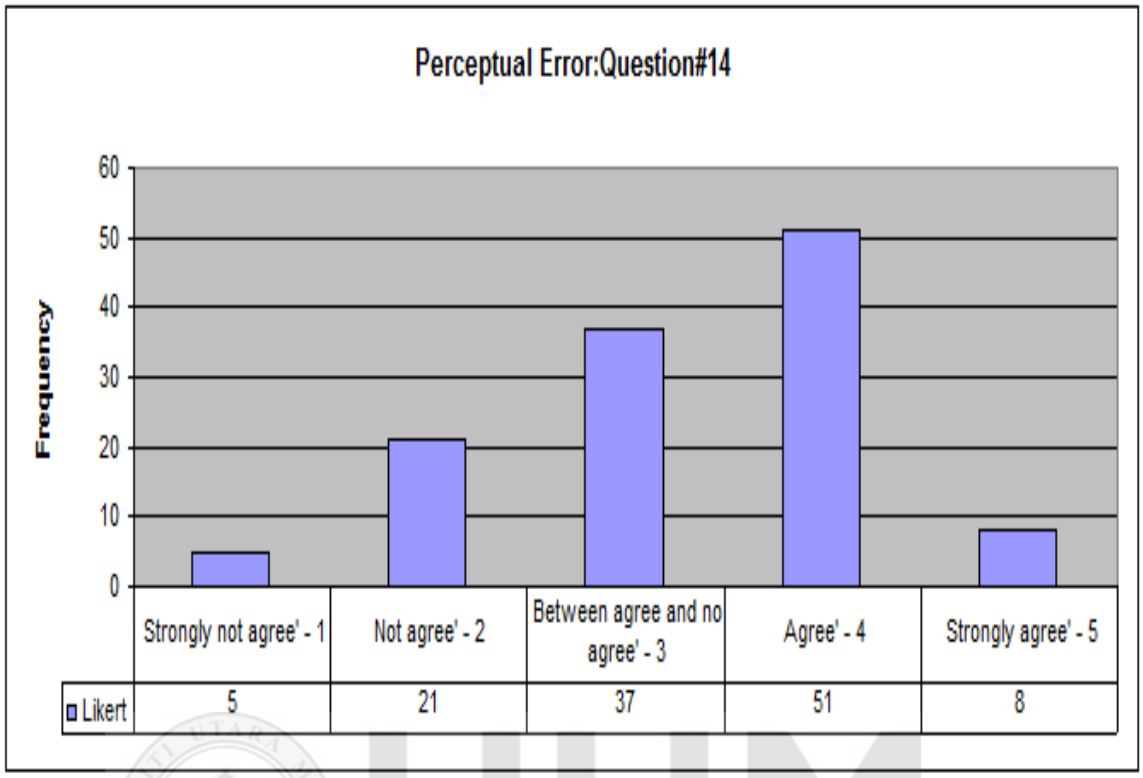
Result:

Total of Disagreement (Strongly Disagree & Not Agree) is 21%, where total of Agreement (Strongly Agree & Agree) is 49%. Average score is 3.29, with a standard deviation of 0.96.

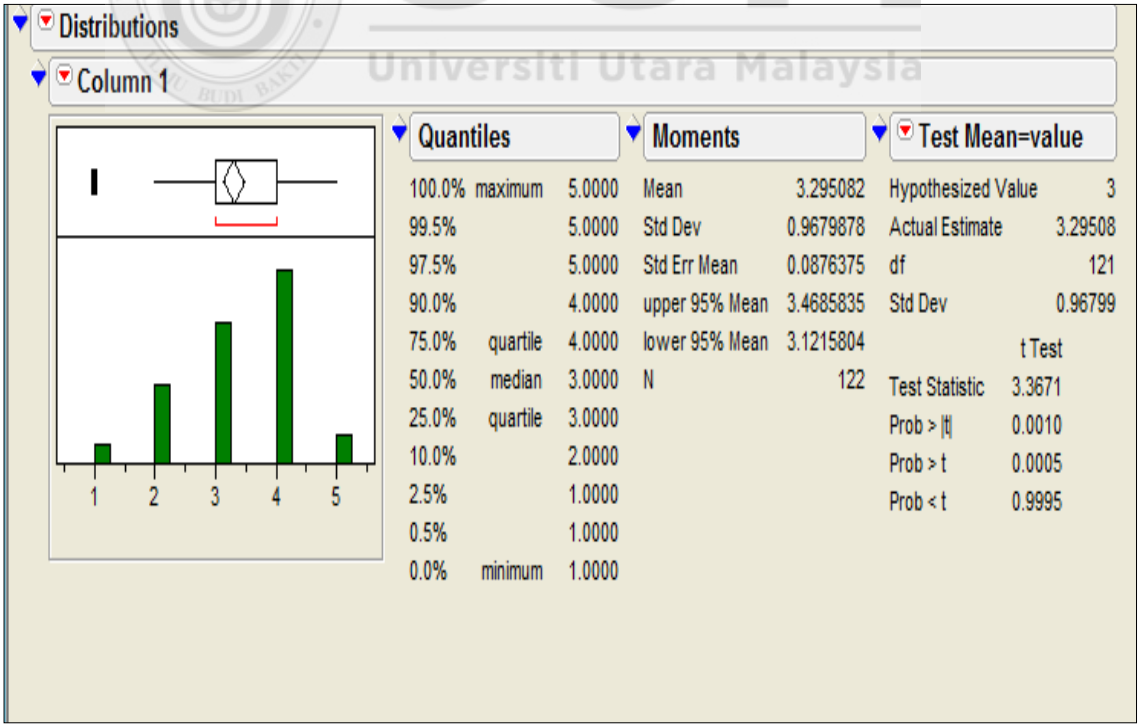
Universiti Utara Malaysia



Question#14 Pie Chart by Percentage



Question#14 – Frequency Bar Chart



Question#14 by using JMP, Statistical Tool

Universiti Utara Malaysia

Finding:

Respondents believe employee who involved in human error, didn't not fully understand procedure / have different thought.

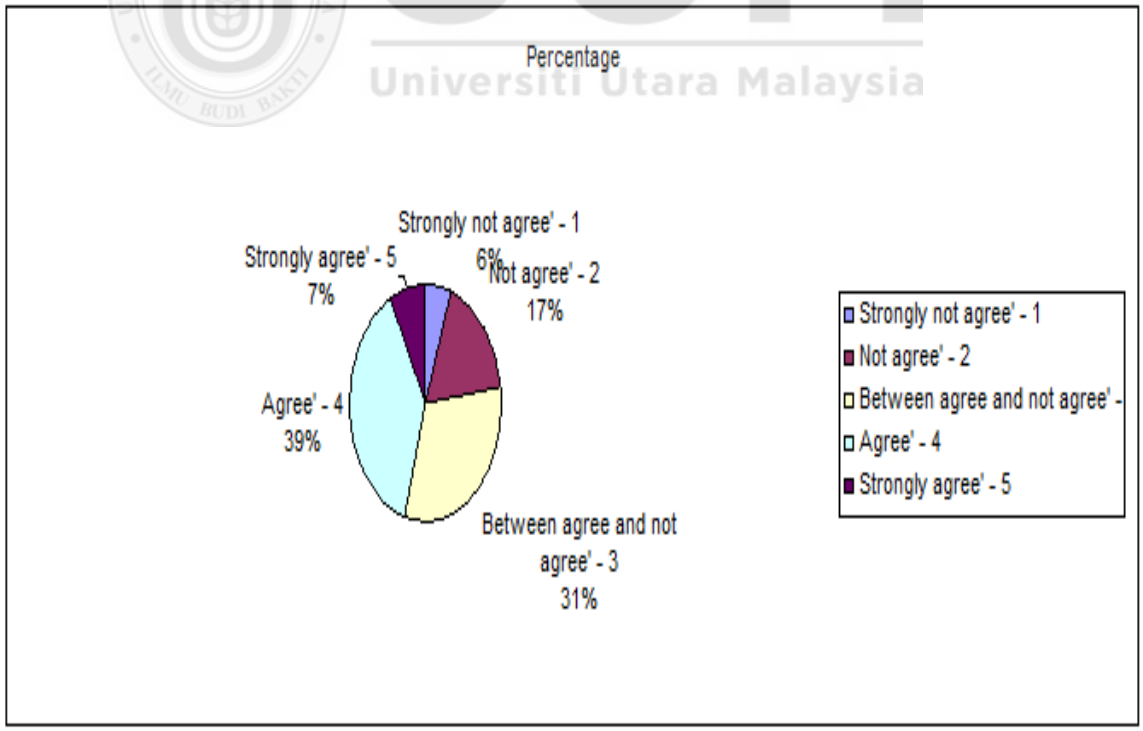
A.3 Violations

Question#15:

Employee who involved in human error, did short cuts.

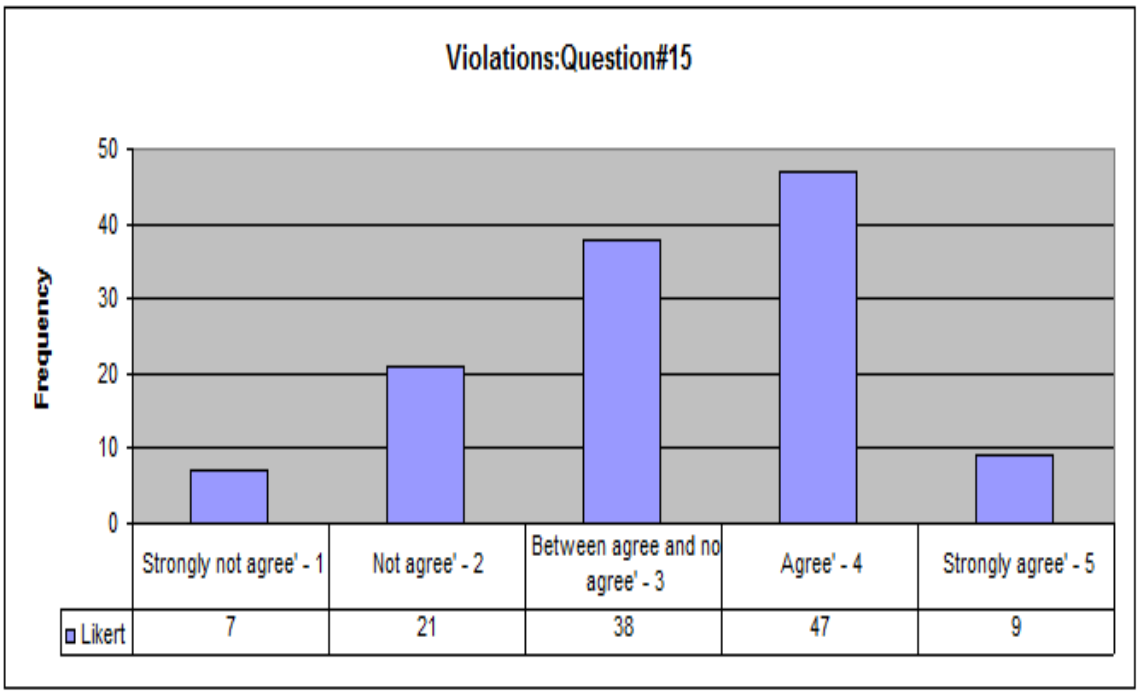
Result:

Total of Disagreement (Strongly Disagree & Not Agree) is 23%, where total of Agreement (Strongly Agree & Agree) is 46%. Average score is 3.24, with a standard deviation of 1.01.

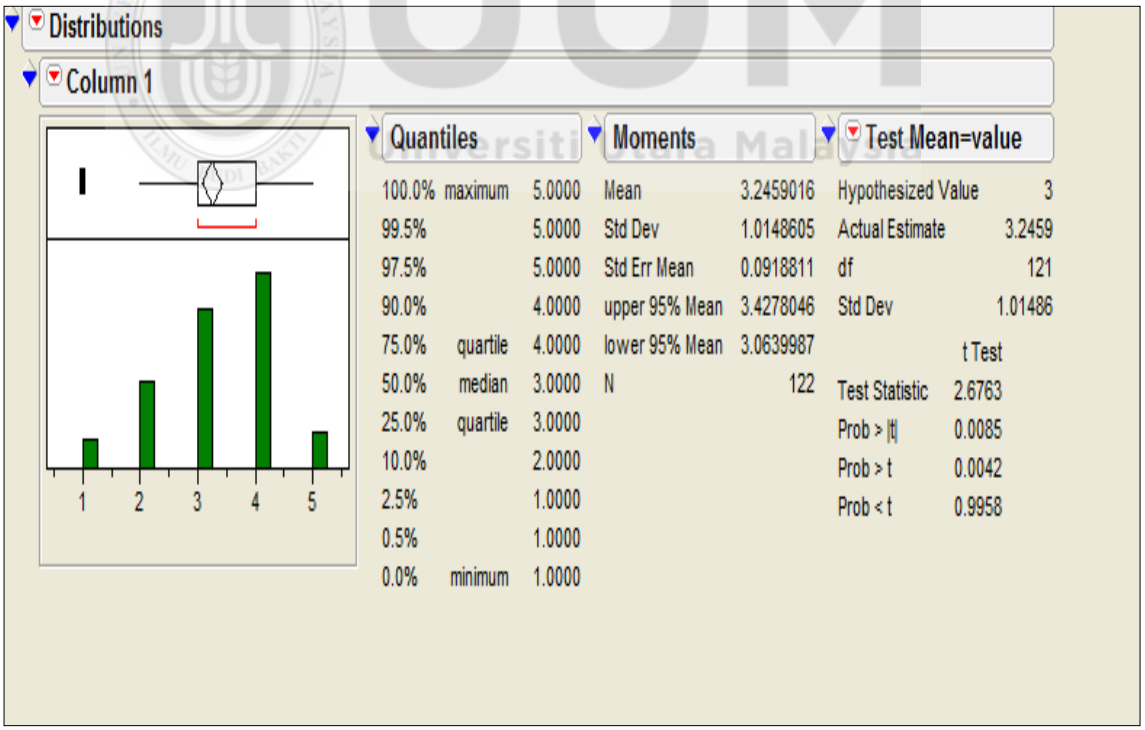


Question#15 Pie Chart by Percentage

Universiti Utara Malaysia



Question#15 – Frequency Bar Chart



Question#15 by using JMP, Statistical Tool

Finding:

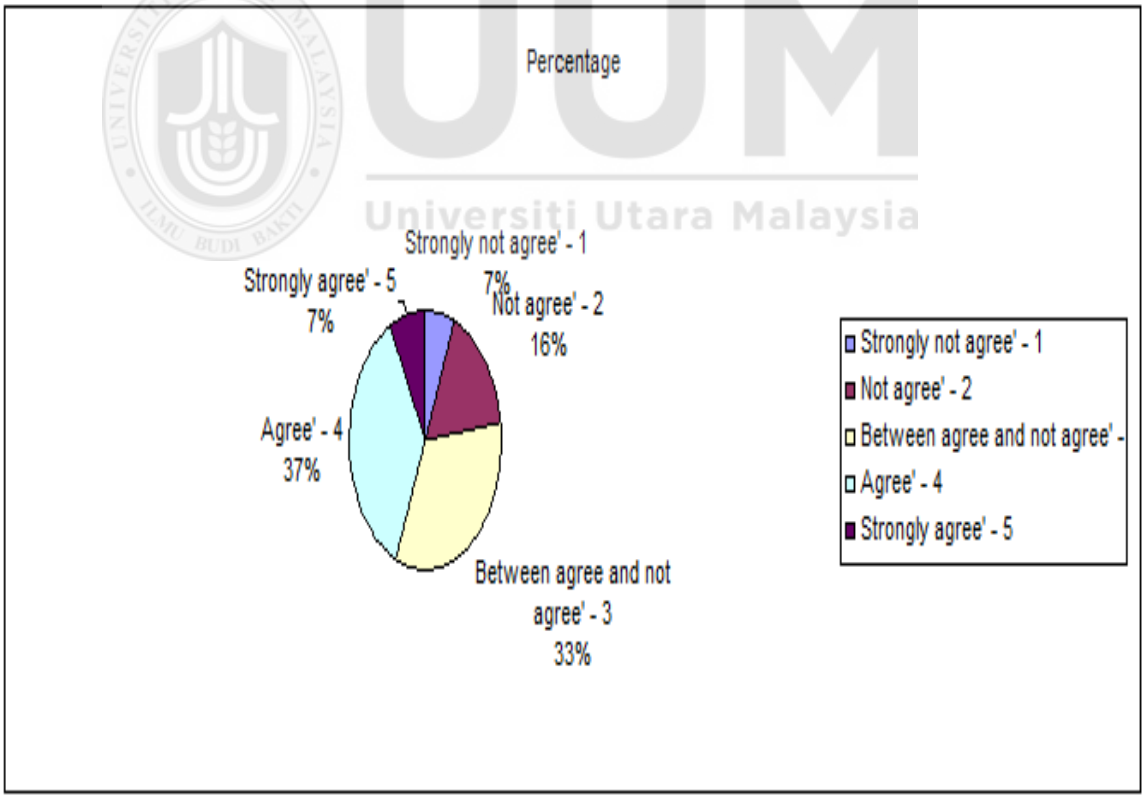
Respondents believe employee who involved in human error, did short cuts

Question#16:

Employee who involved in human error, did not follow SOP.

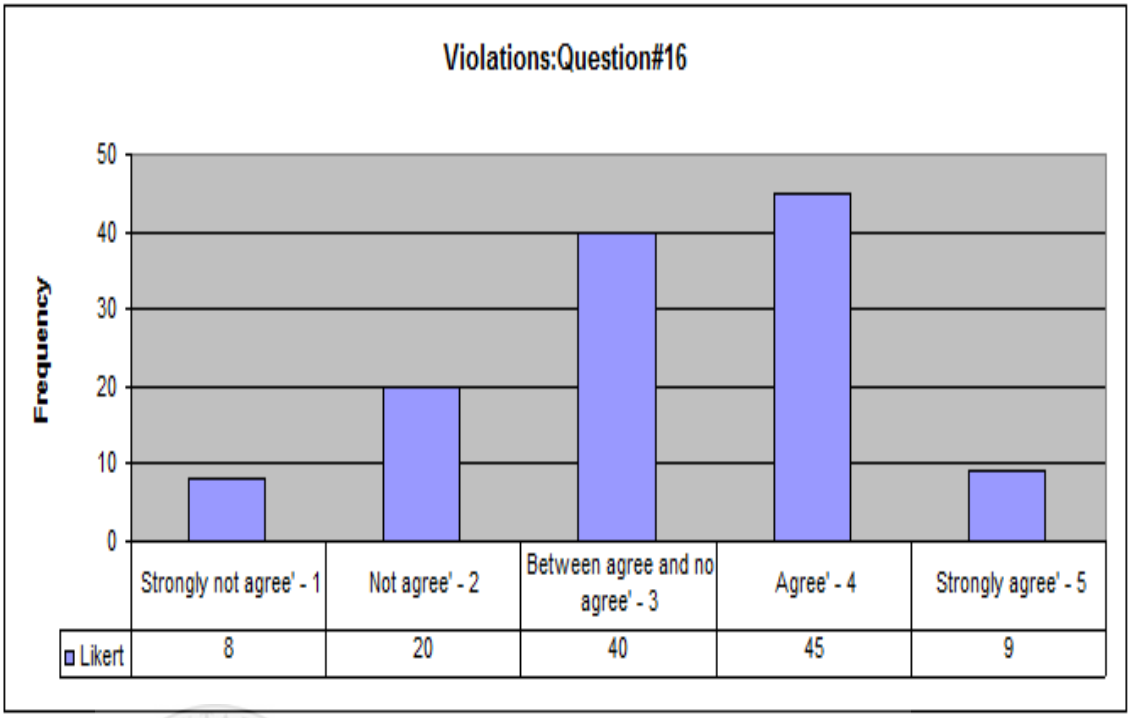
Result:

Total of Disagreement (Strongly Disagree & Not Agree) is 23%, where total of Agreement (Strongly Agree & Agree) is 44%. Average score is 3.22, with a standard deviation of 1.02

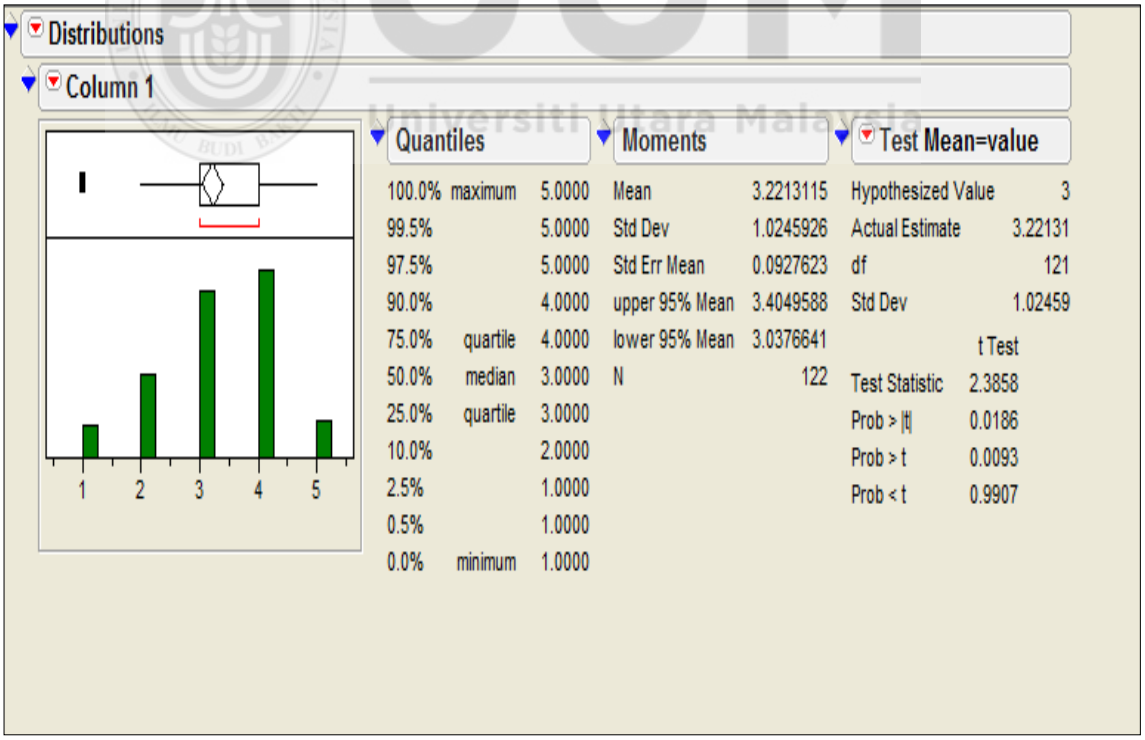


Question#16 Pie Chart by Percentage

Universiti Utara Malaysia



Question#16 – Frequency Bar Chart



Question#16 by using JMP, Statistical Tool

Universiti Utara Malaysia

Finding:

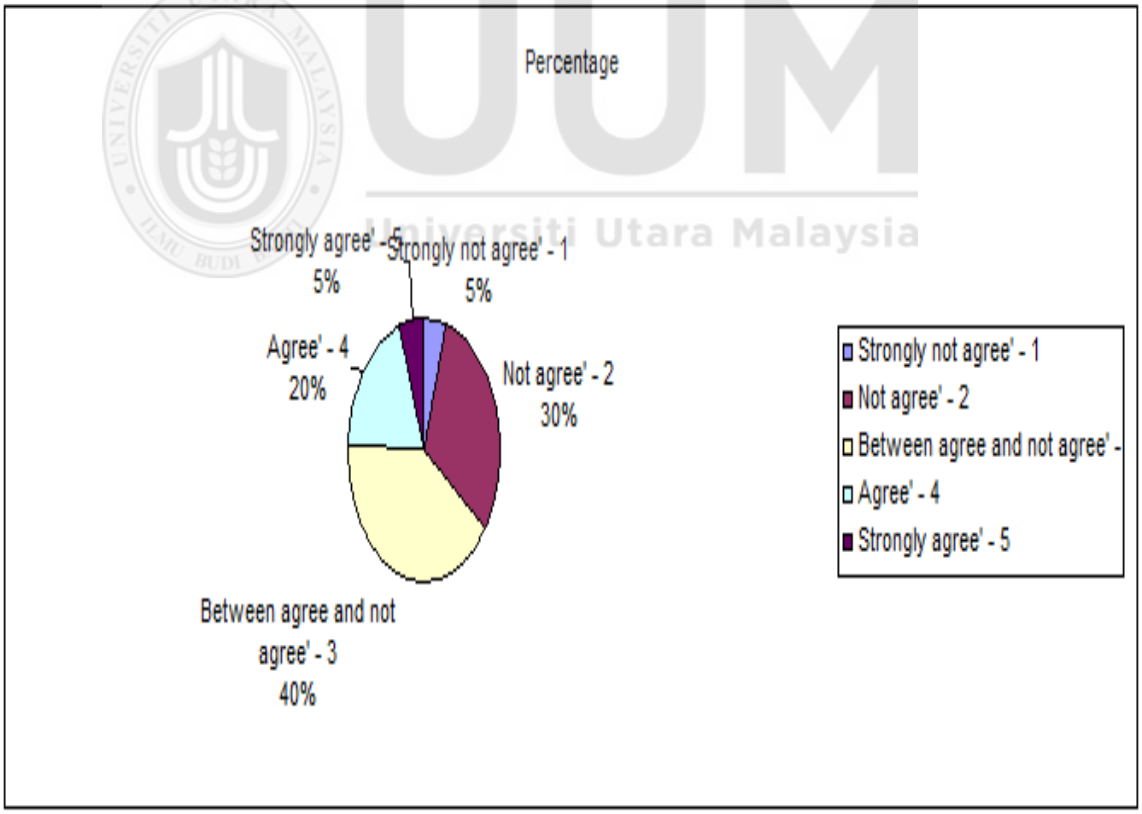
Respondents believe employee who involved in human error, did not follow SOP.

Question#17:

Employee who involved in human error did a data alteration / manipulation.

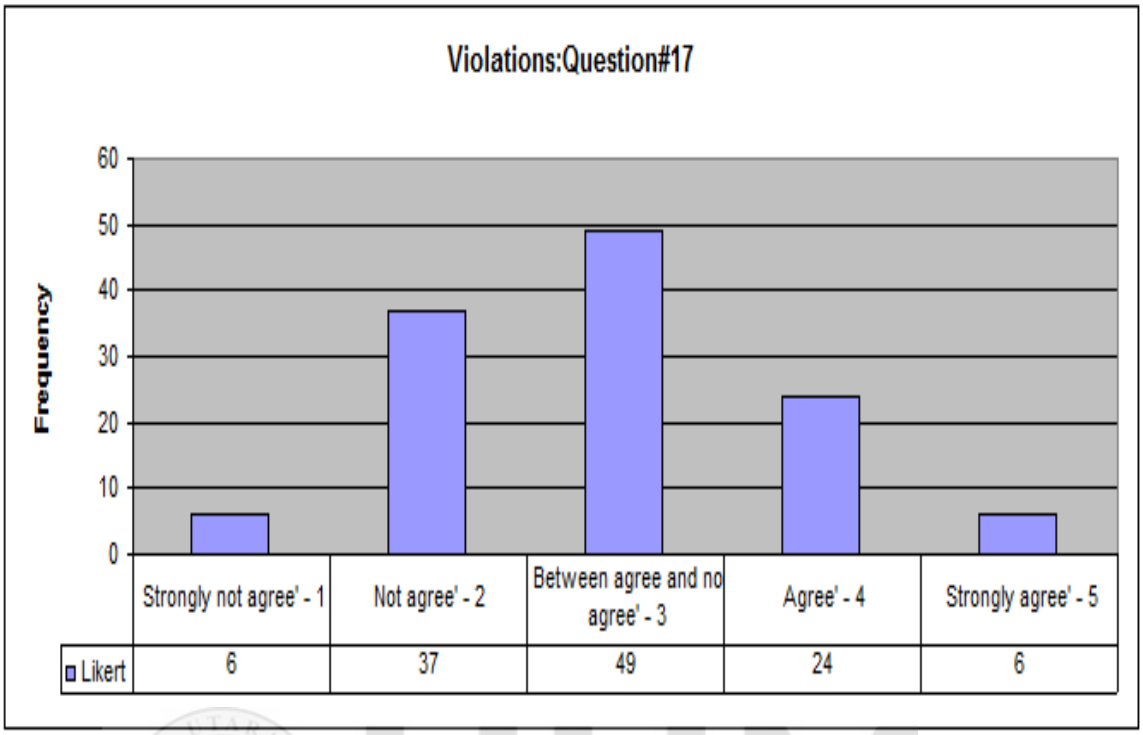
Result:

Total of Disagreement (Strongly Disagree & Not Agree) is 35%, where total of Agreement (Strongly Agree & Agree) is 25%. Average score is 2.89, with a standard deviation of 0.94.

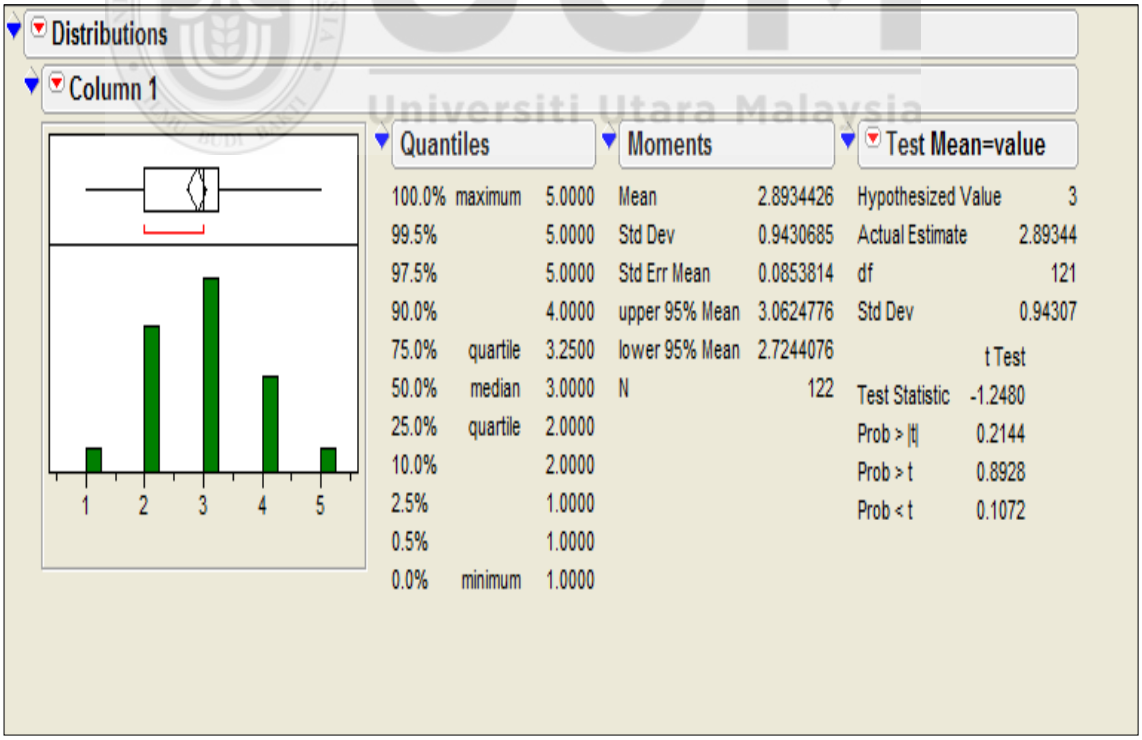


Question#17 Pie Chart by Percentage

Universiti Utara Malaysia



Question#17 – Frequency Bar Chart



Question#17 by using JMP, Statistical Tool

Universiti Utara Malaysia

Finding:

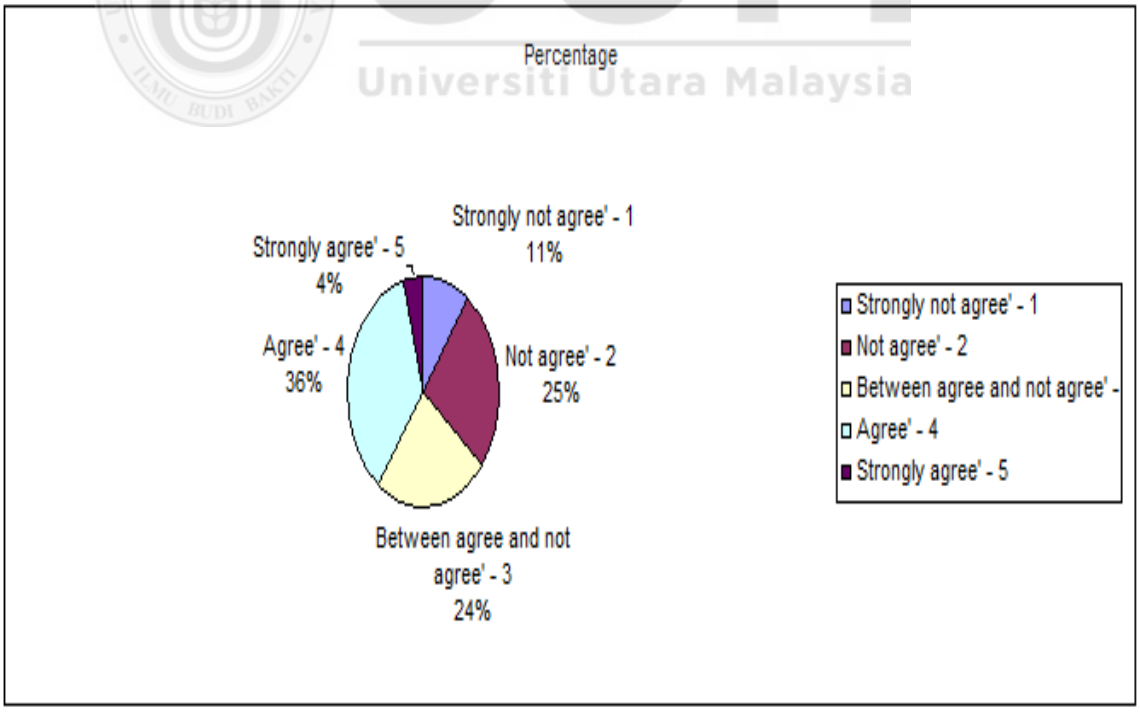
Respondents believe employee who involved in human error did not do a data alteration / manipulation.

Question#18:

Human error happened because the employee didn't respect instruction from his/her leader, superior.

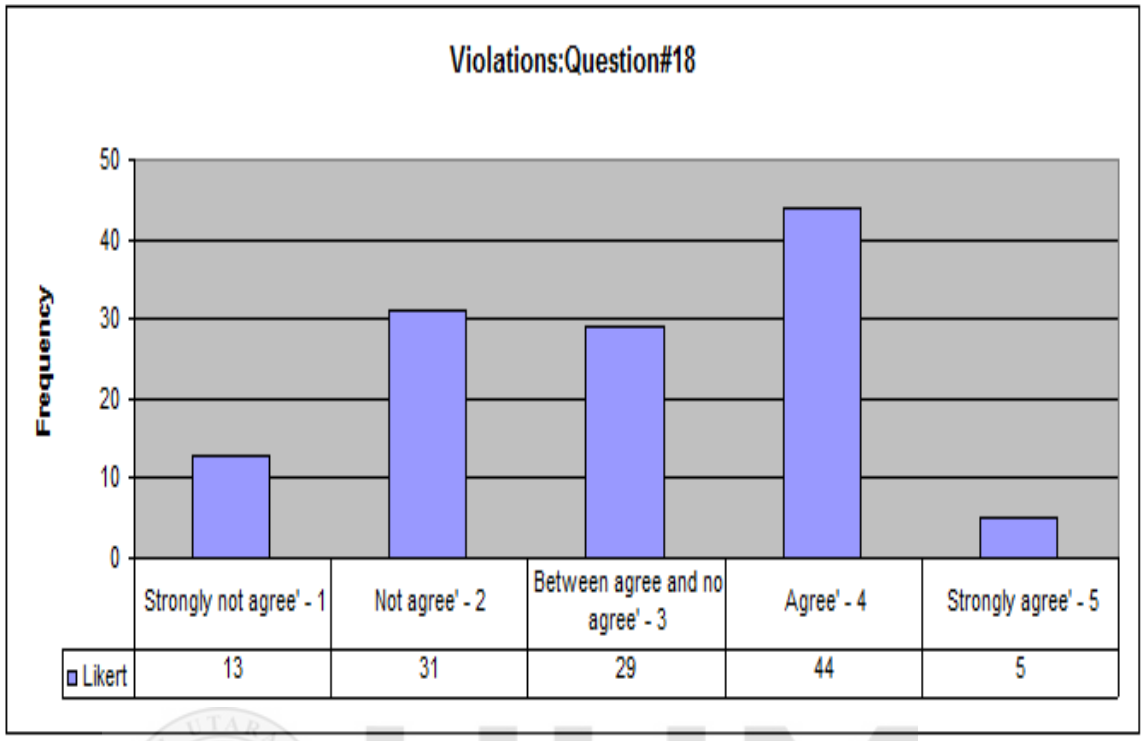
Result:

Total of Disagreement (Strongly Disagree & Not Agree) is 36%, where total of Agreement (Strongly Agree & Agree) is 40%. Average score is 2.97, with a standard deviation of 1.10.

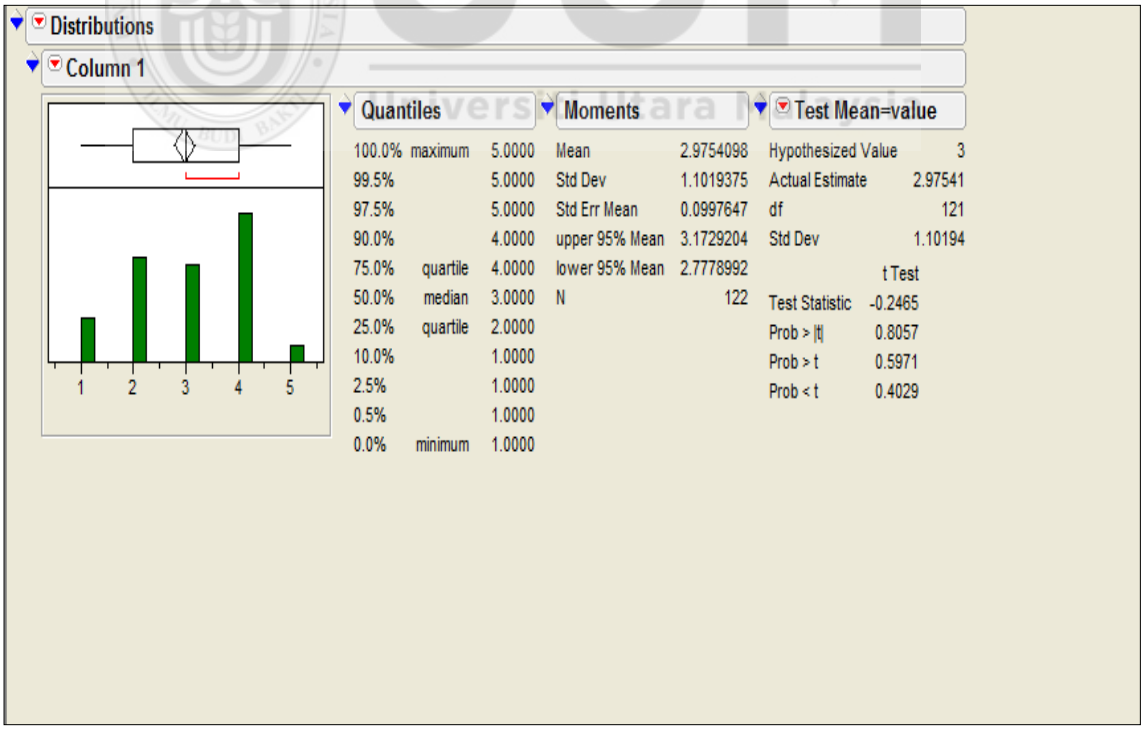


Question#18 Pie Chart by Percentage

Universiti Utara Malaysia



Question#18 – Frequency Bar Chart



Question#18 by using JMP, Statistical Tool

Finding:

Respondents believe human error happened due to the employee didn't respect instruction from his/her leader, superior.

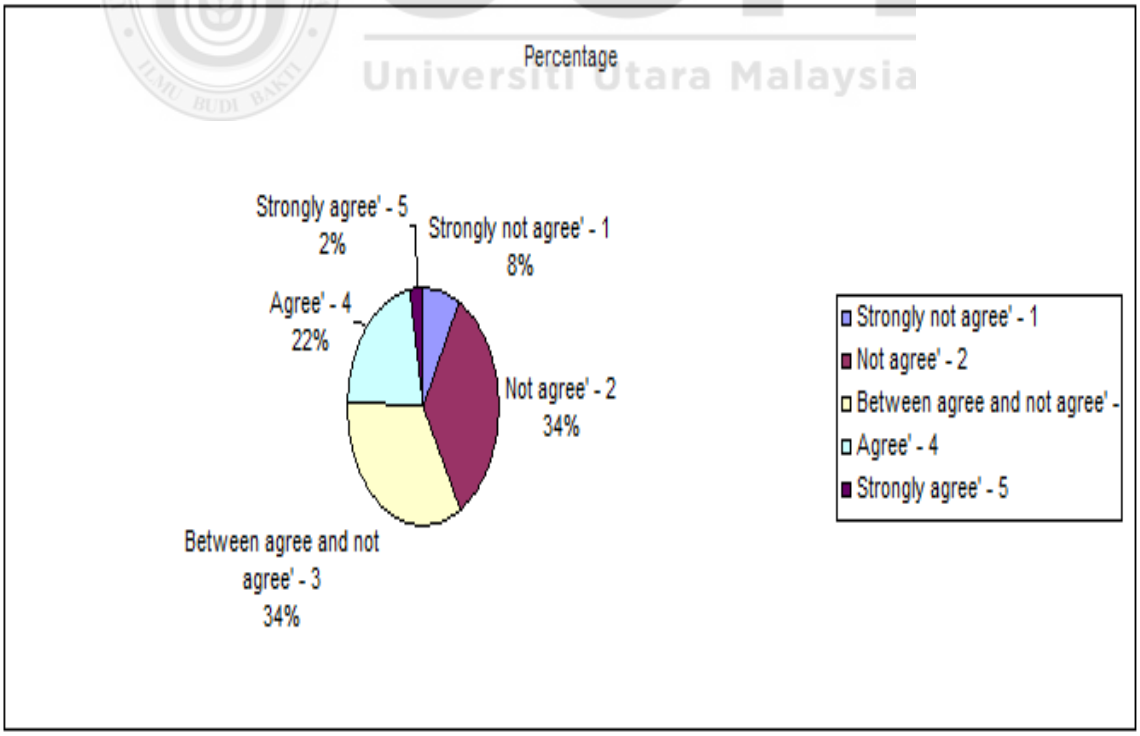
Question#19:

Employee who committed to misprocess intentionally tweak/change process, equipment parameters.

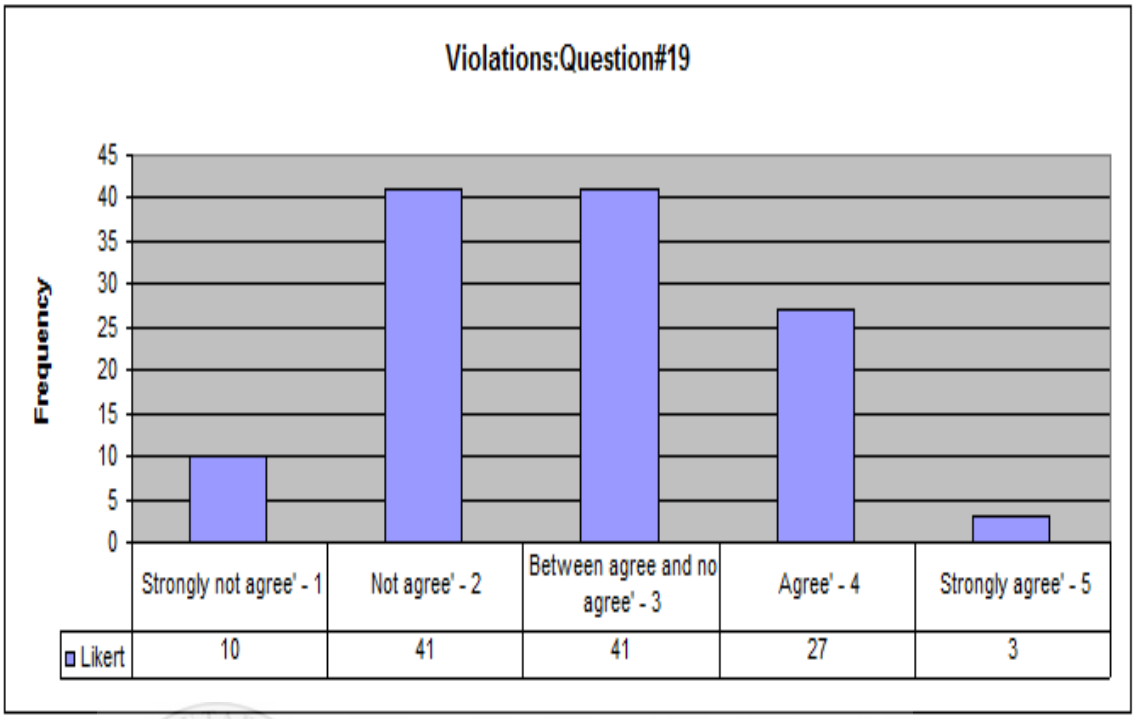
Result:

Total of Disagreement (Strongly Disagree & Not Agree) is 42%, where total of Agreement (Strongly Agree & Agree) is 24%. Average score is 2.77, with a standard deviation of 0.96.

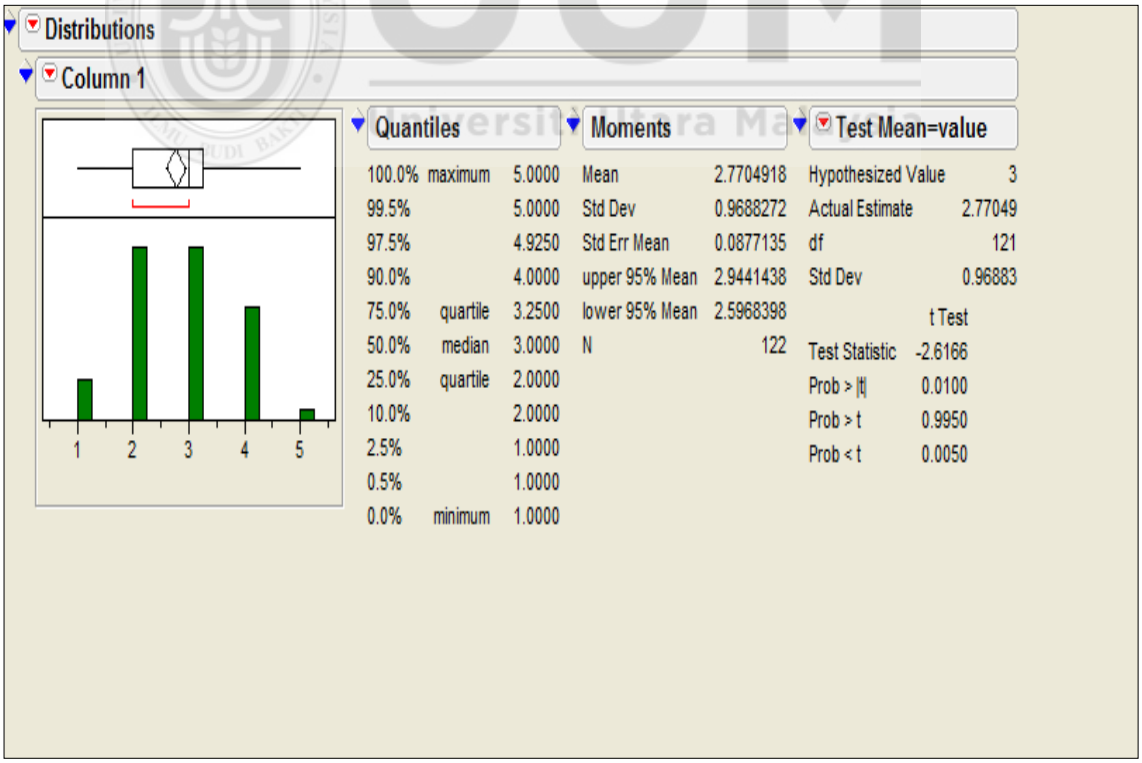
Universiti Utara Malaysia



Question#19 Pie Chart by Percentage

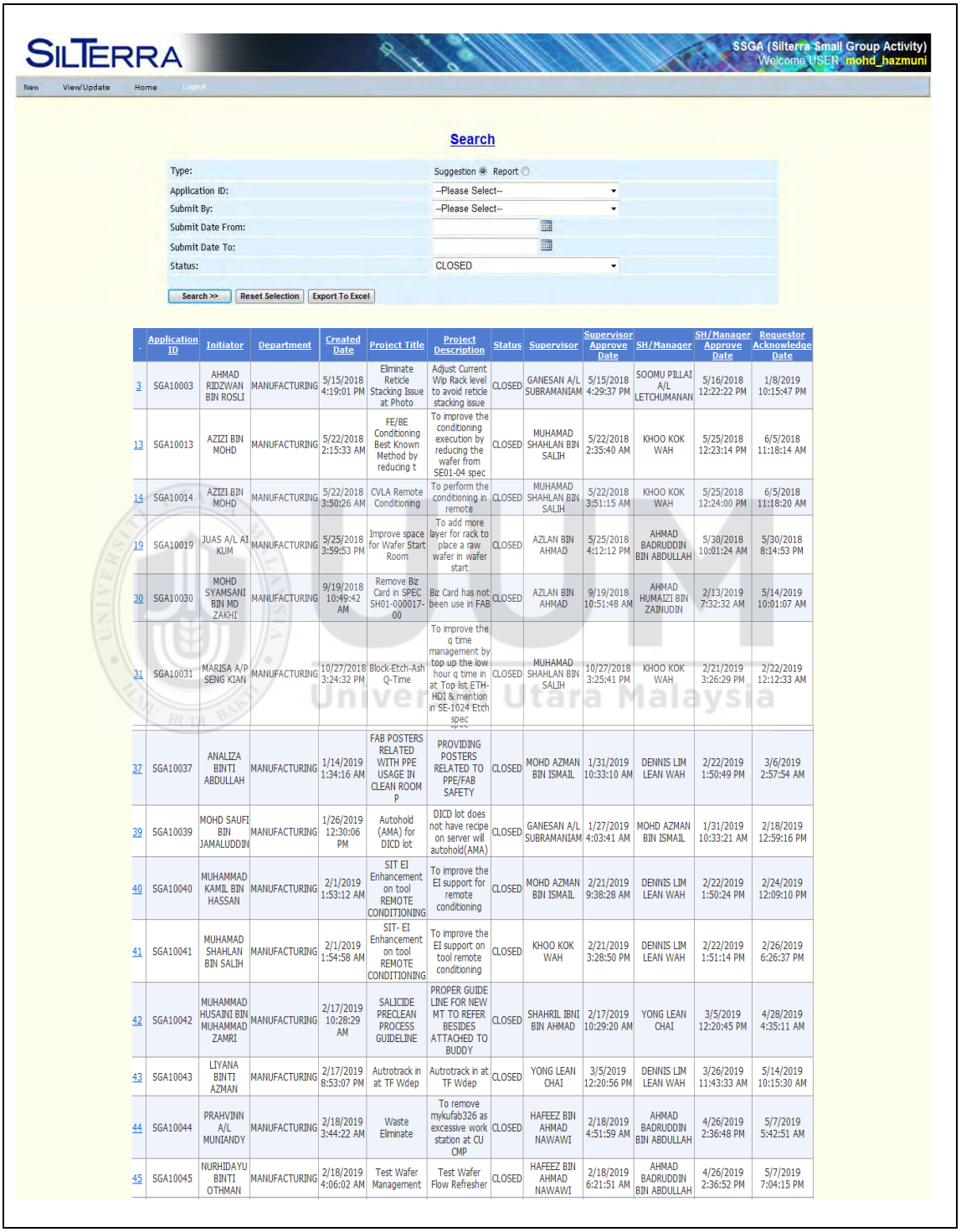


Question#19 – Frequency Bar Chart



Question#19 by using JMP, Statistical Tool

Appendix B: SilTerra Small Group Activity Program



SILTERRA

SSGA (Silterra Small Group Activity)
Welcome USER: mohd_hazmuni

New View/Update Home Logoff

Search

Type:	Suggestion ◉ Report ○
Application ID:	--Please Select--
Submit By:	--Please Select--
Submit Date From:	
Submit Date To:	
Status:	CLOSED

Search >> | Reset Selection | Export To Excel

-	Application ID	Initiator	Department	Created Date	Project Title	Project Description	Status	Supervisor	Supervisor Approve Date	SH/Manager	SH/Manager Approve Date	Requestor Acknowledge Date
3	SGA10003	AHMAD RIDZWAN BIN ROSLI	MANUFACTURING	5/15/2018 4:19:01 PM	Eliminate Reticle Stacking Issue at Photo	Adjust Current Wip Rack level to avoid reticle stacking issue	CLOSED	GANESAN A/L SUBRAMANIAM	5/15/2018 4:29:37 PM	SOOMU PILLAI A/L LETCHUMANAN	5/16/2018 12:22:22 PM	1/8/2019 10:15:47 PM
13	SGA10013	AZIZI BIN MOHD	MANUFACTURING	5/22/2018 2:15:33 AM	FE/BE Conditioning Best Known Method by reducing t	To improve the conditioning execution by reducing the wafer from SE01-04 spec	CLOSED	MUHAMAD SHAHLAN BIN SALIH	5/22/2018 2:35:40 AM	KHOO KOK WAH	5/25/2018 12:23:14 PM	6/5/2018 11:18:14 AM
14	SGA10014	AZIZI BIN MOHD	MANUFACTURING	5/22/2018 3:50:26 AM	CVLA Remote Conditioning	To perform the conditioning in remote	CLOSED	MUHAMAD SHAHLAN BIN SALIH	5/22/2018 3:51:15 AM	KHOO KOK WAH	5/25/2018 12:24:00 PM	6/5/2018 11:18:20 AM
19	SGA10019	JUAS A/L AI KUM	MANUFACTURING	5/25/2018 3:59:53 PM	Improve space for Wafer Start Room	To add more layer for rack to place a raw wafer in wafer start	CLOSED	AZLAN BIN AHMAD	5/25/2018 4:12:12 PM	AHMAD BADRUDDIN BIN ABDULLAH	5/30/2018 10:01:24 AM	5/30/2018 8:14:53 PM
30	SGA10030	MOHD SYAMSANI BIN MD ZAKHI	MANUFACTURING	9/19/2018 10:49:42 AM	Remove Biz Card in SPEC SH01-000017-00	Biz Card has not been use in FAB	CLOSED	AZLAN BIN AHMAD	9/19/2018 10:51:48 AM	AHMAD HUMAIZI BIN ZAINUDIN	2/13/2019 7:32:32 AM	5/14/2019 10:01:07 AM
31	SGA10031	MARISA A/P SENG KIAN	MANUFACTURING	10/27/2018 3:24:32 PM	Block-Etch-Ash Q-Time	To improve the q time management by top up the low hour q time in at Top list ETH-HDI & mention in SE-1024 Etch spec	CLOSED	MUHAMAD SHAHLAN BIN SALIH	10/27/2018 3:25:41 PM	KHOO KOK WAH	2/21/2019 3:26:29 PM	2/22/2019 12:12:33 AM
37	SGA10037	ANALIZA BINTI ABDULLAH	MANUFACTURING	1/14/2019 1:34:16 AM	FAB POSTERS RELATED WITH PPE USAGE IN CLEAN ROOM P	PROVIDING POSTERS RELATED TO PPE/FAB SAFETY	CLOSED	MOHD AZMAN BIN ISMAIL	1/31/2019 10:33:10 AM	DENNIS LIM LEAN WAH	2/22/2019 1:50:49 PM	3/6/2019 2:57:54 AM
39	SGA10039	MOHD SAUFI BIN JAMALUDDIN	MANUFACTURING	1/26/2019 12:30:06 PM	Autohold (AMA) for DICD lot	DICD lot does not have recipe on server will autohold(AMA)	CLOSED	GANESAN A/L SUBRAMANIAM	1/27/2019 4:03:41 AM	MOHD AZMAN BIN ISMAIL	1/31/2019 10:33:21 AM	2/18/2019 12:59:16 PM
40	SGA10040	MUHAMMAD KAMIL BIN HASSAN	MANUFACTURING	2/1/2019 1:53:12 AM	SIT EI Enhancement on tool REMOTE CONDITIONING	To improve the EI support for remote conditioning	CLOSED	MOHD AZMAN BIN ISMAIL	2/21/2019 9:38:28 AM	DENNIS LIM LEAN WAH	2/22/2019 1:50:24 PM	2/24/2019 12:09:10 PM
41	SGA10041	MUHAMAD SHAHLAN BIN SALIH	MANUFACTURING	2/1/2019 1:54:58 AM	SIT- EI Enhancement on tool REMOTE CONDITIONING	To improve the EI support on tool remote conditioning	CLOSED	KHOO KOK WAH	2/21/2019 3:28:50 PM	DENNIS LIM LEAN WAH	2/22/2019 1:51:14 PM	2/26/2019 6:26:37 PM
42	SGA10042	MUHAMMAD HUSAINI BIN MUHAMMAD ZAMRI	MANUFACTURING	2/17/2019 10:28:29 AM	SALICIDE PRECLEAN PROCESS GUIDELINE	PROPER GUIDE LINE FOR NEW MT TO REFER BESIDES ATTACHED TO BUDDY	CLOSED	SHAHRIL IBNI BIN AHMAD	2/17/2019 10:29:20 AM	YONG LEAN CHAI	3/5/2019 12:20:45 PM	4/28/2019 4:35:11 AM
43	SGA10043	LIYANA BINTI AZMAN	MANUFACTURING	2/17/2019 8:53:07 PM	Autotrack in at TF Wdep	Autotrack in at TF Wdep	CLOSED	YONG LEAN CHAI	3/5/2019 12:20:56 PM	DENNIS LIM LEAN WAH	3/26/2019 11:43:33 AM	5/14/2019 10:15:30 AM
44	SGA10044	PRAHVINN A/L MUNIANDY	MANUFACTURING	2/18/2019 3:44:22 AM	Waste Eliminate	To remove mykufab326 as excessive work station at CU CMP	CLOSED	HAFEEZ BIN AHMAD NAWAWI	2/18/2019 4:51:59 AM	AHMAD BADRUDDIN BIN ABDULLAH	4/26/2019 2:36:48 PM	5/7/2019 5:42:51 AM
45	SGA10045	NURHIDAYU BINTI OTHMAN	MANUFACTURING	2/18/2019 4:06:02 AM	Test Wafer Management	Test Wafer Flow Refresher	CLOSED	HAFEEZ BIN AHMAD NAWAWI	2/18/2019 6:21:51 AM	AHMAD BADRUDDIN BIN ABDULLAH	4/26/2019 2:36:52 PM	5/7/2019 7:04:15 PM

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New Suggestion - View Page

Initiator :	AZIZI BIN MOHD	Application ID :	SGA10013
Employee No :	A1127	Status :	CLOSED
Title :	Mfg Group Leader (7CR)	Application Date :	5/22/2018 2:15:33 AM
Department :	MANUFACTURING		
Project Title:	FE/BE Conditioning Best Known Method by reducing t		
Project Description :	To improve the conditioning execution by reducing the wafer from SE01-04 spec		
Attachment:	Suggestion form Rev0 SSGA.xls		
Remarks:			

Audit Trail :

Date	Action By	Action	Remarks
5/22/2018 2:15:33 AM	AZIZI BIN MOHD	Submit New	
5/22/2018 2:35:40 AM	MUHAMAD SHAHLAN BIN SALIH	Approved by Supervisor	FE/BE Conditioning Best Known Method by reducing the condition wafer
5/25/2018 12:23:14 PM	KHOO KOK WAH	Approved by SH/Manager	Approved
6/5/2018 11:18:14 AM	AZIZI BIN MOHD	Acknowledged by Requestor	

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SILTERRA MALAYSIA SDN BHD

SILTERRA SMALL GROUP ACTIVITY (SSGA) SUGGESTION SYSTEM

NAME	AZIZI BIN MOHD
EMP NO	A1127
DEPT	MFG -ETCH

SUGGESTION TITLE: (as verb)	FE/BE Conditioning Best Known Method by reducing the condition wafer

WHAT IS THE CURRENT PRACTISE:

(Write down what you see it as it is NOW)

Local conditioning mode with total 8wafer per chamber as per SE01-04 spec

WHAT IS THE IMPROVEMENT SUGGESTION:

(Write down what you think a better practise should be)

Local conditioning by reducing the wafer per chamber to 5 wafers from 8 wafers which current practise also continue with 5 wafer from time to time/request

WHAT IS THE BENEFIT

(Why you think the suggestion is good to be implemented)

Will have 1 lot per tool for conditioning performing rather than 2 lot require as example:

1 chamber = 8 wafer if 4 chamber for 1 tool -> 4*8=32 wafer which 1 lot only have 25w and require 2 lots

Need to change the SE01-04 spec from 8wafers to 5 wafers in order to continue run this contiditioning -> 4*5=20wafers

Validation Section (for CTQ member ONLY)

SUGGESTION RELATED TO:

X	IMPROVEMENT		SPEC OBSOLETE		BEST KNOWN METHOD		
	COST SAVING		IMPROVE SAFETY		IMPROVE EFFICIENCY		WASTE ELIMINATE

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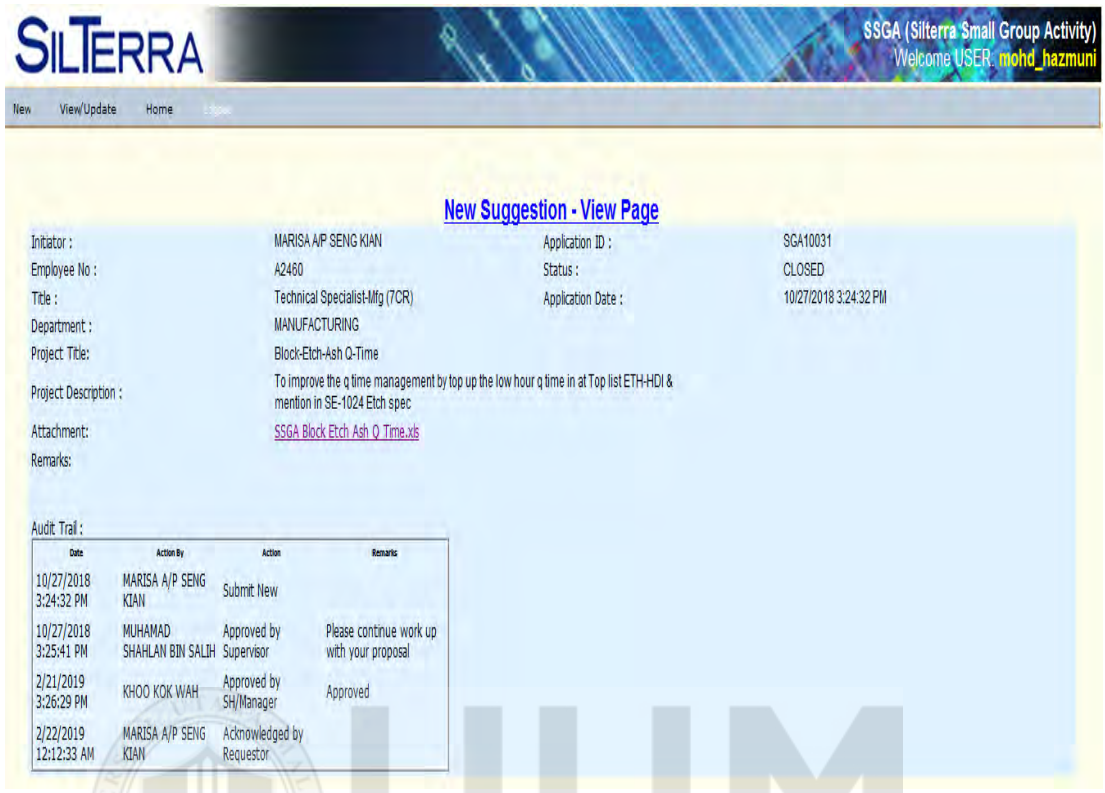

SILTERRA MALAYSIA SDN BHD

SILTERRA SMALL GROUP ACTIVITY (SSGA) SUGGESTION SYSTEM

NAME	MARISA A/P SENG KIAN
EMP NO	A2460
DEPT	MFG-ETCH

SUGGESTION TITLE: (as verb)	Block-Etch-Ash Miss Q - Time OCAP justification

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WHAT IS THE CURRENT PRACTISE:

(Write down what you see it as it is NOW)

Only continue search and keep expedite with OCAP spec not mention the Q-Time hour

WHAT IS THE IMPROVEMENT SUGGESTION:

(Write down what you think a better practise should be)

1.To improve the cycle time from lot missing and prevent from miss q time by mention in OCAP spec for Q-Time hour

2. Top up on Top list in ETH-HDI screen for all the Q-Time lot.

WHAT IS THE BENEFIT

(Why you think the suggestion is good to be implemented)

Manage the cycle time from lot missing experience which has been scrap 1 lot

Validation Section (for CTQ member ONLY)

SUGGESTION RELATED TO:

X	IMPROVEMENT		SPEC OBSOLETE	X	BEST KNOWN METHOD		
	COST SAVING		IMPROVE SAFETY	X	IMPROVE EFFICIENCY		WASTE ELIMINATE

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SILTERRA MALAYSIA SDN BHD

SILTERRA SMALL GROUP ACTIVITY (SSGA) SUGGESTION SYSTEM

NAME	AZIZI BIN MOHD
EMP NO	A1127
DEPT	MFG -ETCH

SUGGESTION TITLE: (as verb)	CVLA Remote Conditioning

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WHAT IS THE CURRENT PRACTISE:

(Write down what you see it as it is NOW)

Currently all conditioning under local activities

WHAT IS THE IMPROVEMENT SUGGESTION:

(Write down what you think a better practise should be)

Need to improve by performing in remote mode in order to prevent from any wrongly execution as remote can cover by EI.

WHAT IS THE BENEFIT

(Why you think the suggestion is good to be implemented)

1.To improve the conditionning tool by performing in remote mode 2.To prevent from any miss process from local activity. 3.To improve the cycle time by peforming the conditoning together with production lot running.

Validation Section (for CTQ member ONLY)

SUGGESTION RELATED TO:

X	IMPROVEMENT		SPEC OBSOLETE		BEST KNOWN METHOD		
	COST SAVING		IMPROVE SAFETY		IMPROVE EFFICIENCY		WASTE ELIMINATE

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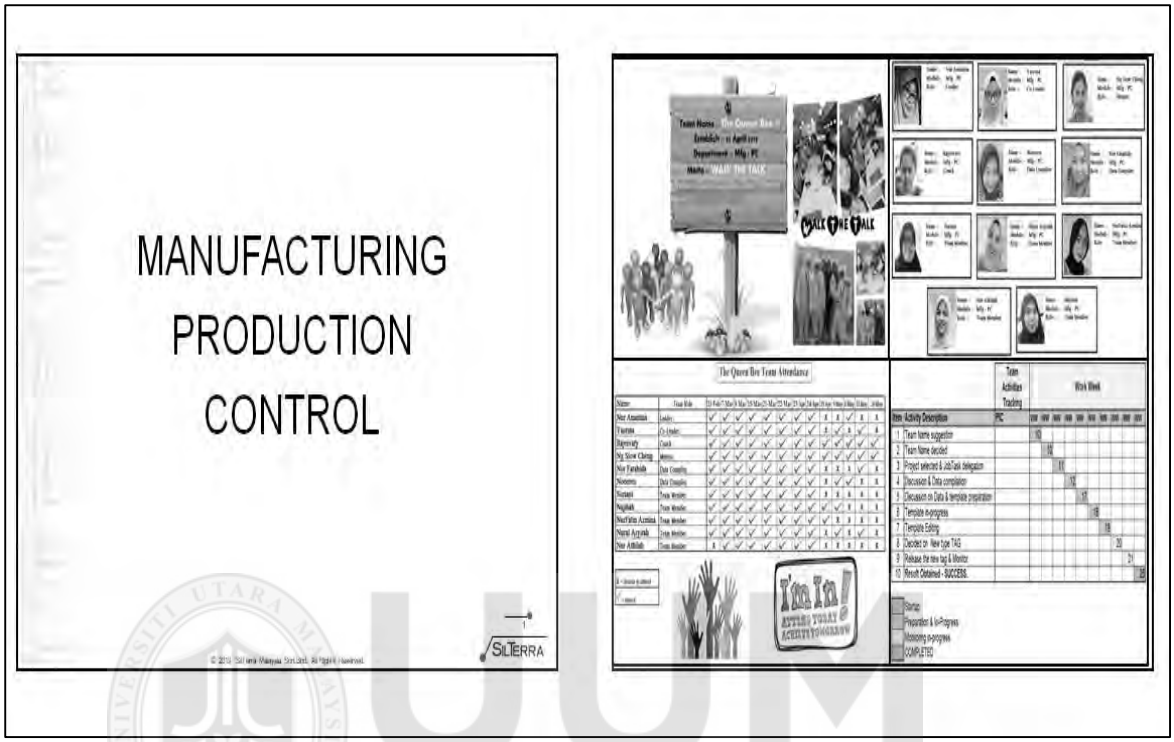
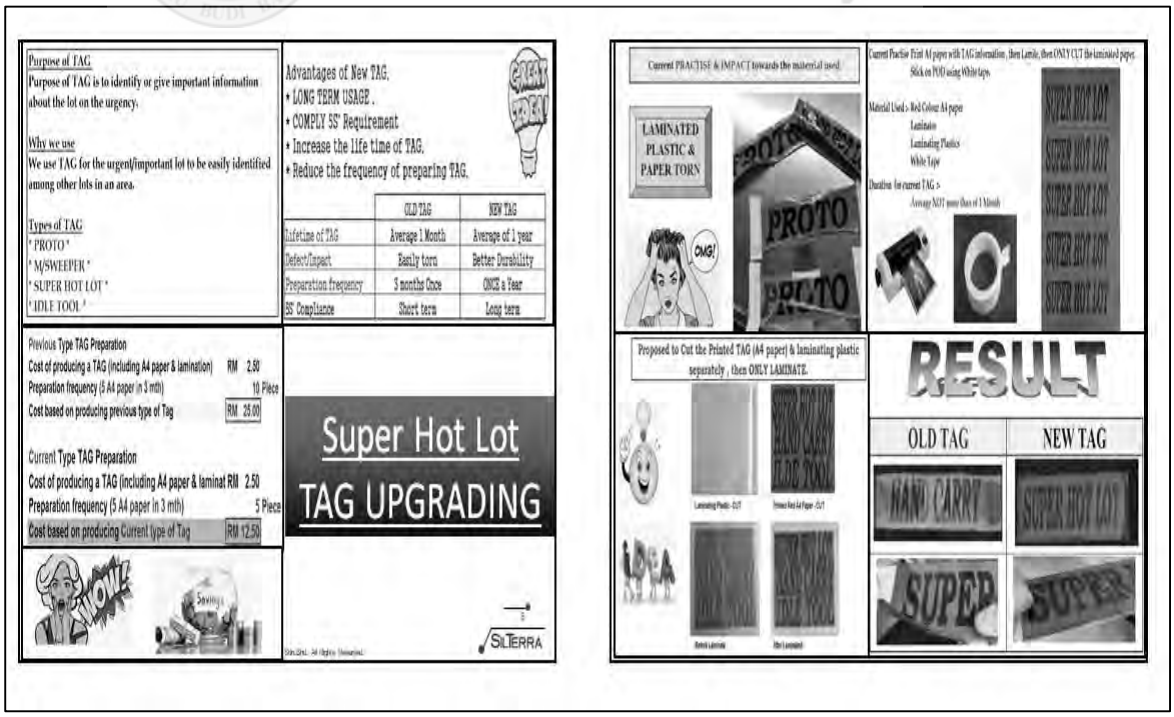
Appendix C: Before-and-After Flow Guideline Example





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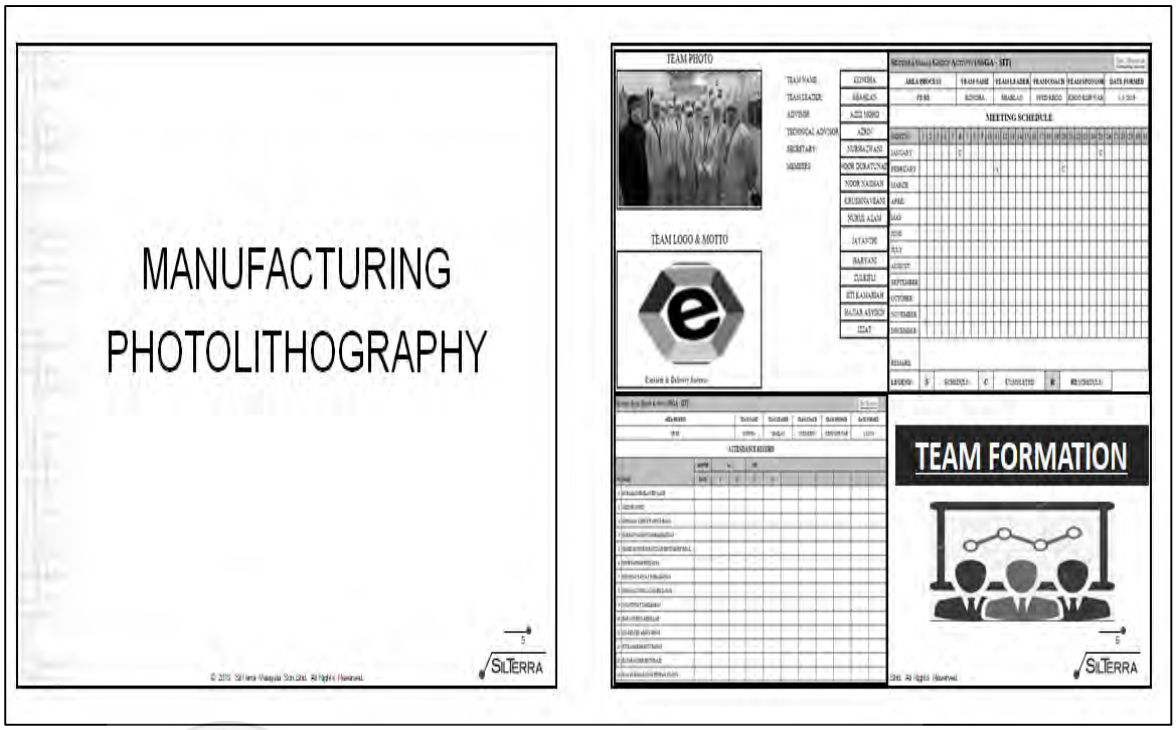

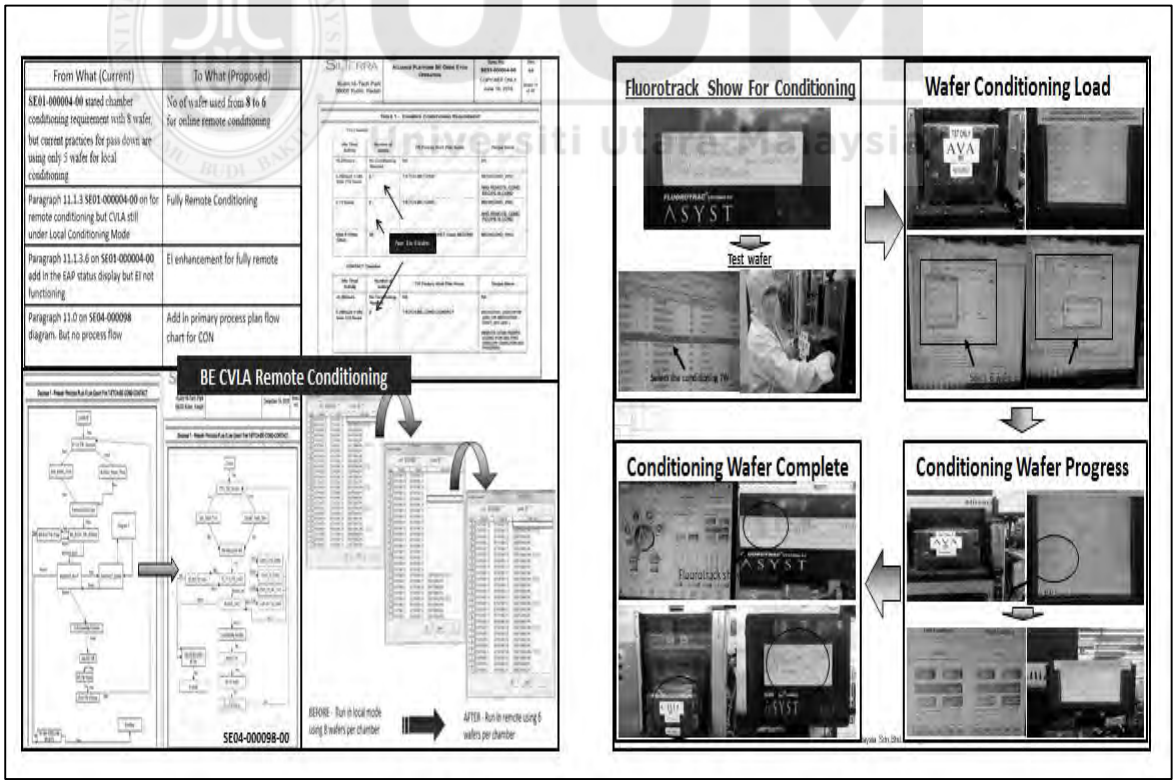

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E-TEST

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BUSINESS CASE

In E-Test, ET require to perform routine task Weekly Preventive Maintenance for Probers.
Total probers we have 10 unit (7 EG Prober + 3 TEL Prober)
Every Week, each prober required Schedule Downtime for 30mins and this also have to combined with Tester Weekly PM for 1 Hour.

There are many task initially written for Weekly PM does not relevant with current industrial standard under TPM approach.
Some of the task even introduce particle exposure and even risk part for defect.

OPPORTUNITY / ROI STATEMENT

This project will contribute following expected impact

1) Eliminate Weekly Preventive Downtime
2) Reduction of Weekly Maintenance cost average of USD32/prober which will gain total USD10.9k per year for total of 7 Probers
3) Removal of Arm bent risk which will save cost of USD680/unit or any unschedule downtime for arm adjustment.
4) Yearly Reduction of minimum 8736 clean wipes used in performing Weekly PM which return saving of USD481.10 (RM2009.78)
5) Yearly Reduction of 11 Liters of IPA Chemical for cleaning purpose which return saving of USD119.952 (RM500.97)
6) **TOTAL Saving Projected: USD12,001.062 (RM50,110.39)**

GOAL STATEMENT

1. To reduce Non-Value Added activity from current Weekly PM
2. To remove task which does not fall into Clean-Inspect-Lubricate. Replace category (TPM Approach)
3. MFG to gain additional 1560mins/year for Tool Production Time
4. Reduce waste generated by performing cleaning activity (Wipes + IPA)

PROGRAM / PROJECT SCOPE

The propose improvement cover

- EG4090u Probet Weekly Preventive Maintenance
- E-Test Area

MAJOR MILESTONES

	Ending Dates
1- Finalize team charter	Feb'19
2- Review Weekly Preventive Maintenance Task	Feb - Mar '19
3- Study Current Weekly PM vs OEM Recommended vs TPM Practice	Mar - Apr '19
4- Identify Risk comparison between having Weekly PM vs Skip Weekly PM	Apr'19
5- Propose for changes through SSGA submission	May'19
6- Pilot Run 2 Probers for 1 Month as skip Weekly PM	Aug'19
7- Fan Out all Prober remove Weekly Maintenance	Sep'19

TEAM FORMATION

Equipment Owner : Wajid Bin Salamat
SSGA Mentor : Mohd Nizam Bin Taslim Khan
Team Members : Ahmad Fachrol Ikhwan Bin Ahmad Shuhaimee (Leader)

From What (Current)	To What (Proposed)
From spec and checklist from X-Site :- 1. Need to verify SMIF Pod configuration for Cu-Free and Cu-Shared. 	➢ Smif pod pin configuration is not applicable at current state. It is applied when there is tool conversion request. Suggest to remove from weekly PM. ➢ All Probers in E-Test are configured to run Cleo/Green Pod without conversion. ➢ If need to run Amber pod - conversion request covers the task to verify the pin configurations.
2. Inspect system supply CDA and PVAC 	➢ Inspect system supply CDA and PVAC can be perform anytime without down the tool. Suggest to remove from weekly PM. ➢ Historical Downtime Data (Oct 2018- Oct 2019) shows Zero Downtime of Probet due to incoming CDA/PVAC issue.

From What (Current)	To What (Proposed)
3. Confuse instruction "Remove probe card, open tester head and then shutdown the prober" refer to Appendix A, Step7. *Misleading instruction - Even Tester Head not open 	➢ This is confusing and can made to misleading instruction. Confusing instruction may cause PIC to skip the task. Actual instruction set should be Open the Tester Head -> Remove Probe Card -> Shutdown Probet ➢ Suggest to remove this task since we do not intend to perform cleaning under the tester head weekly.
4. Weekly wiper scan qual to check scratch occurance.	➢ Wiper scan qual normally made during part change. If there are part change then it is not applicable for wiper qual since no changes made on tool hardware and software. Suggest to remove from weekly PM.

From What (Current)	To What (Proposed)
5. Open the prober cover beside Optic bridge. Gently clean the quick loader arm with 90% IPA cloth. Please make sure not to bend the arm. 	➢ Clean quick loader on Weekly PM can cause potential risk of arm bent. In a control environment, there is no need frequent cleaning for quick loader, chuck and material handler. Besides, frequently open prober cover can expose to air drop particle inside tool. Suggest to remove from weekly PM.
6. Inspect probecard guide pin. Make sure it is pin no loose. 	➢ Inspect probecard guide pin is no need for weekly PM since the best time to inspect is during probecard change. Probecard change done by MT. Suggest to remove from weekly PM. ➢ This Pin is permanently fix and do not have moving mechanism which can cause any deterioration. Detection of guide pin damage would be more efficient during setup change probe card.

What was changed?

Why have to changed?

- At present we use to perform Weekly PM as weekly basis to maintain tool maintenance. In order to perform this task, we are taking risk on several parts inside the tool and also tool downtime from manufacturing.
- In order to solve this we found new alternative which is more practical that can increase availability time for manufacturing process to get their fab out target. We are suggesting to eliminate extra PM downtime activity from spec and to reduce non-value added task from the PM activity.
- Weekly PM activity can increase potential risk arm bent on quick loader and other parts. Thus in future, there will be more UM (unschedule maintenance) down from this task and it will be opposite from our target cost reduction plan due to broken parts.

Impact of Change Or Benefit

- It reduce non-value added task. Non value task can waste time for tool downtime.
- Eliminate extra PM downtime activity.
- Remove potential risk arm bent on quick loader and other parts.
- Reduce air drop particle entering tool during open and close prober cover.
- Reduce usage of consummable such as dry wipe and IPA.
- Increase availability time for manufacturing process.
- ET PIC can focus on other issue.

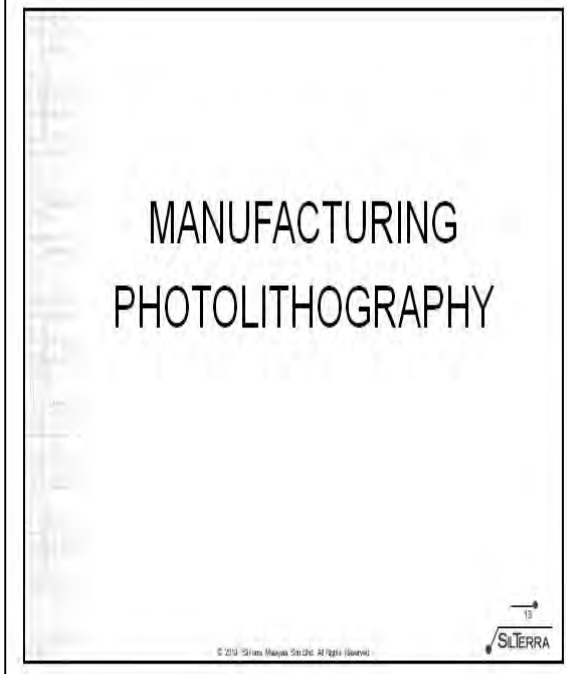
Consummables saving

- During PM, it require to use wipe and IPA to eliminate dust, particle and contamination element inside and outside the tool.
- This item is consummables and need to restock when finished.
- When Weekly PM is reductacte, it will reduce the use of IPA and wips.
- In a cleanroom protocol, one wipe only use for one part of tool. For example one wipe only use for transfer arm and cannot be use at pre-aligner. This two parts are example of critical parts and cannot be exposed to dust because it use vacuum to hold the wafer. Otherwise, particle will stick to the wafer and need to be clean or the tool will trigger alarm cause by mishandling wafer that will lead to wafer drop and so on.
- Cleanroom protocol states that when cleaning only use one direction and starts from top to bottom.
- Total wipe use for Weekly PM on prober to wipe inside and outside the tool around 24 wipes use and with 200ml IPA.
- If 24 wipes and 200ml IPA use for weekly PM times by a month will cause:

24wipes x 52weeks = 1248 wipes/year for 1 Prober
200ml x 52weeks = 10.2liter/year for 1 Prober

Total Annual Saving: 7 Probers x 1248wipes
= 8736 wipes ~USD481.10

Total Annual Saving: 7 Probers x 10.2liters
= 71.4liters x USD1.68~ USD119.952


MANUFACTURING
PHOTOLITHOGRAPHY
13
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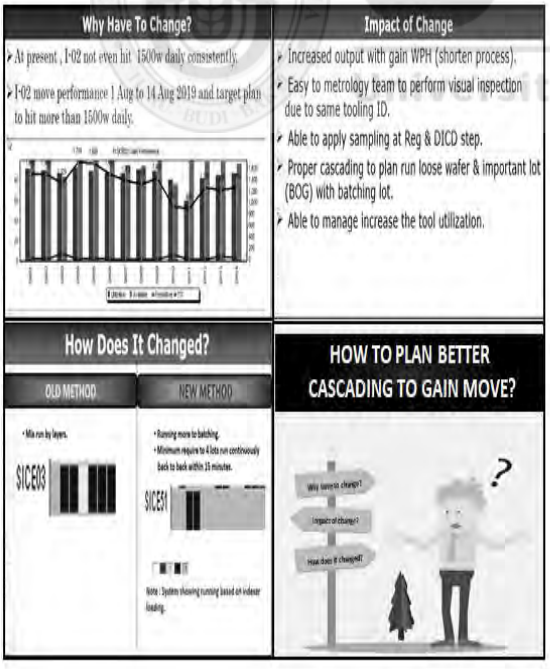
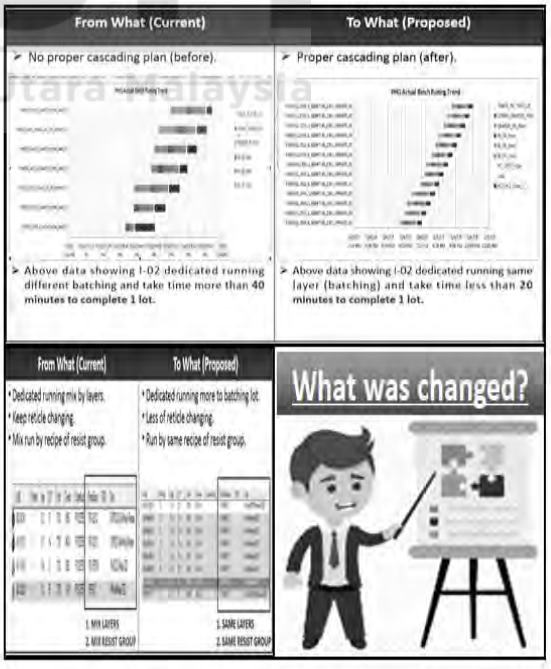
TEAM FORMATION
PHOTO SILTERRA


Why Have To Change?
At present , I-02 not even hit 1500w daily consistently.
I-02 move performance 1 Aug to 14 Aug 2019 and target plan to hit more than 1500w daily.
Impact of Change
Increased output with gain WPH (shorten process).
Easy to metrology team to perform visual inspection due to same tooling ID.
Able to apply sampling at Reg & DICD step.
Proper cascading to plan run loose wafer & important lot (BOG) with batching lot.
Able to manage increase the tool utilization.
How Does It Changed?
OLD METHOD
NEW METHOD
HOW TO PLAN BETTER CASCADING TO GAIN MOVE?


From What (Current)
To What (Proposed)
No proper cascading plan (before).
Proper cascading plan (after).
Above data showing I-02 dedicated running different batching and take time more than 40 minutes to complete 1 lot.
Above data showing I-02 dedicated running same layer (batching) and take time less than 20 minutes to complete 1 lot.
From What (Current)
To What (Proposed)
Dedicated running mix by layers.
Keep reticle changing.
Mix run by recipe of resist group.
Dedicated running more to batching lot.
Less of reticle changing.
Run by same recipe of resist group.
What was changed?

MANUFACTURING

DIFFUSION

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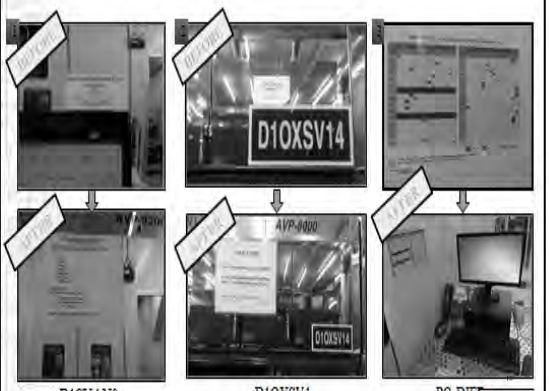
2.1 PROJECT AT DIFFUSION AREA WW'24, 2019

1. Provide the proper template for tool requirement before load and unloading lot as per Spec -Diffusion Copper Sintering Process Specification SD02-0000020- The impact can caused recipe aborted during lot processing at tool D1CUAN01.
2. Provide the proper template for tool requirement at D1OXSV14. Do not unload dummy at L2 - S7S30413.1. The reason is the tool will error and need to reboot and blank run.
3. Prepared the VISUAL AIDS for Diffusion MEs about SPV Qual for WW18 and WW19,2019. The purpose is to remind AME/ME for qual scheduling so that can remind their subordinate to expedite qual on time without delay (PC DIFF ME). Based in my observation, ME/AME/MT still delay qual without acceptable reason. Also aggreed and verified by SH Humaizi.



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