

Six Sigma Project-Story-Book

for the project: **Public Garbage Littering in Trung Hung village harvest area**

Green-Belt Candidate:

Luong Van Tim

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Phase	Content	Page
Define	Introduction	3 - 6
	Project-Topic	8 - 11
	Project-Definition	13 - 16
	SIPOC	18
	Voice to Critical	19
	Chart: Y CtQs Bar-Chart & Y CTQ Kano	20
	Project-Charter	21
	Stakeholder-Communication	22
	Results of the DEFINE-Steering	23
Measure	Input-Analysis & Influence of xl Chart	25
	Process-Mapping and Analysis	26
	Chart: Influence of xP	27
	1st Reference data	28
	C&E Matrix xY	29
	C&E Heatmap	30
	Data-Collection-Plan	31-34
	Hypothesis	35-36
	Hypothesis (Template)	37
	Data-Collection-Results	38-39
	2nd Reference data	40
	Results of the MEASURE-Steering	41
Analyse	Graphical Evaluation of collected data	43-50
	Control chart	51-52
	Process Capability	53-54
	Test of Hypothesis	55-62
	Root Cause Analysis	63-67
	Reference data	68
	Summary	69
	Results of the ANALYSE-Steering	70
Improve	Solution-Ideas	72
	Chart: Solution-Selection	73
	Action-Plan	74-75
	FMEA	76-78
	Summary and Benefit	79
	Reference data	80-90
Control	Results of the IMPROVE-Steering	91
	Graphical Evaluation of new collected data	93-98
	Control chart	99
	Before and after data evaluation	100-102
	Beefore and after Process-Capability	103
	Test of Hypothesis	104-107
	Process-Management-Plan	108
	Reaction-Plan (Reference data)	109
	Summary and Benefit (With confirmed number)	110
	Lessons Learned	111
	Reference data (Certificate to recognize, issued by local government)	112
	Reference data (Video of sponsor sharing)	113
	Results of the CONTROL-Steering	114

Introduction

My introduction as a Green-Belt candidate and my Project Sponsor



Green Belt

Name: Luong Van Tim

Education: Hanoi University of science and technology

Position: Innovation Leader at Hanesbrands company



Sponsor

Name: Pham Van Quang

Position: Secretary of the Communist Party of Trung Hung Village

Location: Trung Hung village, Bac Hung commune, Tien Lang district, Hai Phong city, Vietnam

Scan of the signed confirmation eMail of my project sponsor

CONFIRMATION MAIL

My name is Pham Van Quang from Bac Hung commune committee (Secretary of the Communist Party of Trung Hung Village). I am responsible for managing all activities of Trung Hung village.

I confirm, that Luong Van Tim (luongvantim.hust@gmail.com) will implement the Six Sigma project in my area of responsibility and will support Luong Van Tim along the DMAIC phases (DEFINE, MEASURE, ANALYSE, IMPROVE, CONTROL).

For the Lean Six Sigma Green Belt certificate he/ she will measurable solve:

- a Quality-Problem (e.g. defects of the output),
- an Availability-Problem (e.g. reduce cycle time or increase volume) and
- a Consumption-Problem (e.g. better utilization of inputs/ resources; elimination of waste).

I allow Luong Van Tim to conduct interviews with internal customer, to involve experts of the topic and to conduct workshops

a) in the MEASURE phase to analyse the inputs and the process and

b) in the transition of the ANALYSIS to the IMPROVE phase to determine the root causes of the problems and to develop solution ideas to eliminate the root causes.

At the end of each DMAIC phase, Luong Van Tim will present the most important results of this phase in his/ her Project-Story-Book. Based on these results, I will decide on the success of the project so far, either to require adjustments in the current phase or to recommend the transition to the next DMAIC phase.

The decision about the implementation of solutions in the IMPROVE-Phase is up to me. I note, however, that a project in which no solutions are implemented, and which does not lead to measurable improvements cannot be certified.

Therefore, I will check the calculated financial and other benefits for plausibility after the approved solutions are implemented.

I accept that the application and registration at the TUM School of Management begins with the sending of this eMail, and that the course fee must be transferred if the Project-Topic and Project-Definition have passed the suitability check.

Scan of my TUM Lean Six Sigma Yellow Belt Certificate



Certificate
Executive Education Program

We hereby confirm that

Luong Van Tim

has successfully completed the certification requirements for the

TUM Lean Six Sigma Yellow Belt

through the successful completion of the 22-week Professional Series of courses on the edX platform,
including 30 hours of lecture, weekly quizzes, and guided on-line case studies and projects,

Six Sigma and Lean: Quantitative Tools for Quality and Productivity

LEAN

- History of Lean
- Continuous Improvement (Kaizen)
- 8D Problem Solving
- Value Stream Mapping
- Fishbone, 5 Whys, Cause & Effect
- 3Ms: Mura, Muri, Muda

Covering the topics

SIX SIGMA

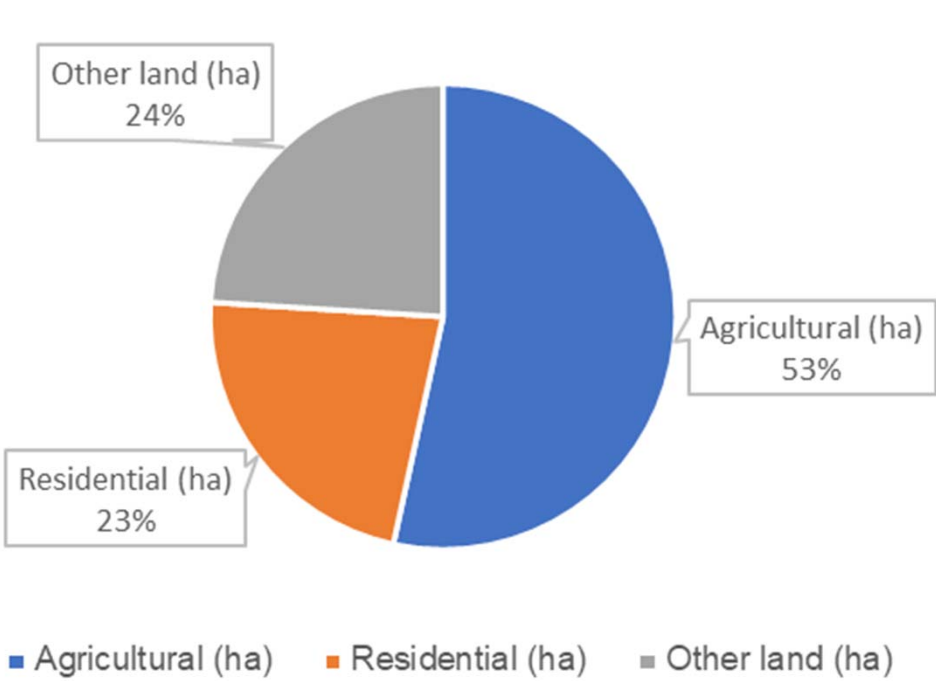
- Project Identification and Definition
- SIPOC
- Customer Expectations, VOC, Kano
- Critical-to-Quality Parameters
- Process Mapping/ Flow Diagram

DEFINE

Identification and Definition of a Six Sigma Project

Show littering Landscape of Trung Hung village

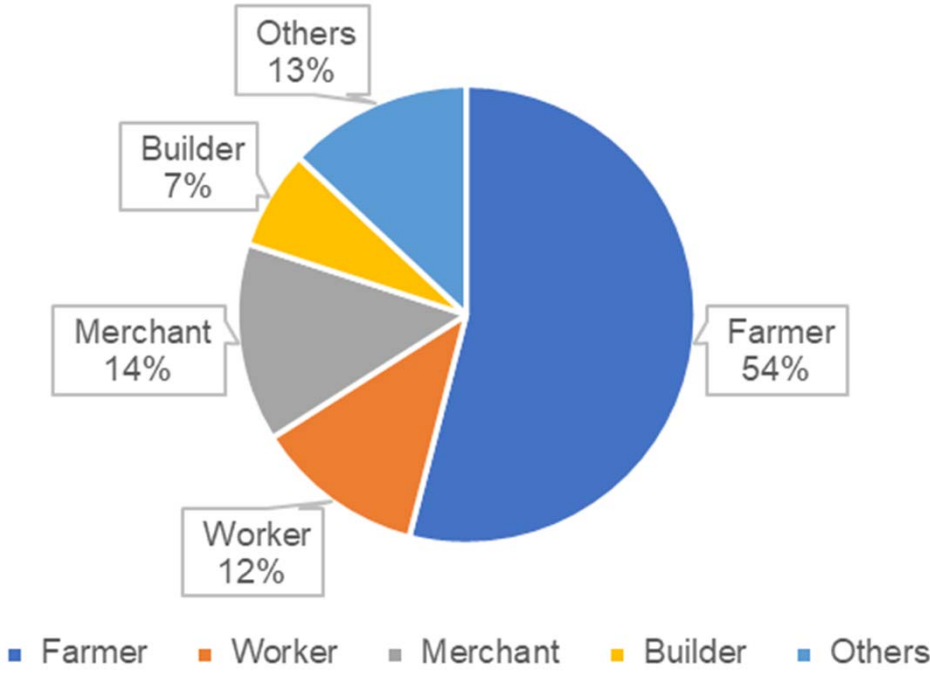
Land allocation rate



Result and Interpretation

- In Trung Hung village, most of the area is agricultural land (harvest area)
- To protect the rural environment, focus on cleaning harvest area is the most important part

Occupation distribution rate



Result and Interpretation

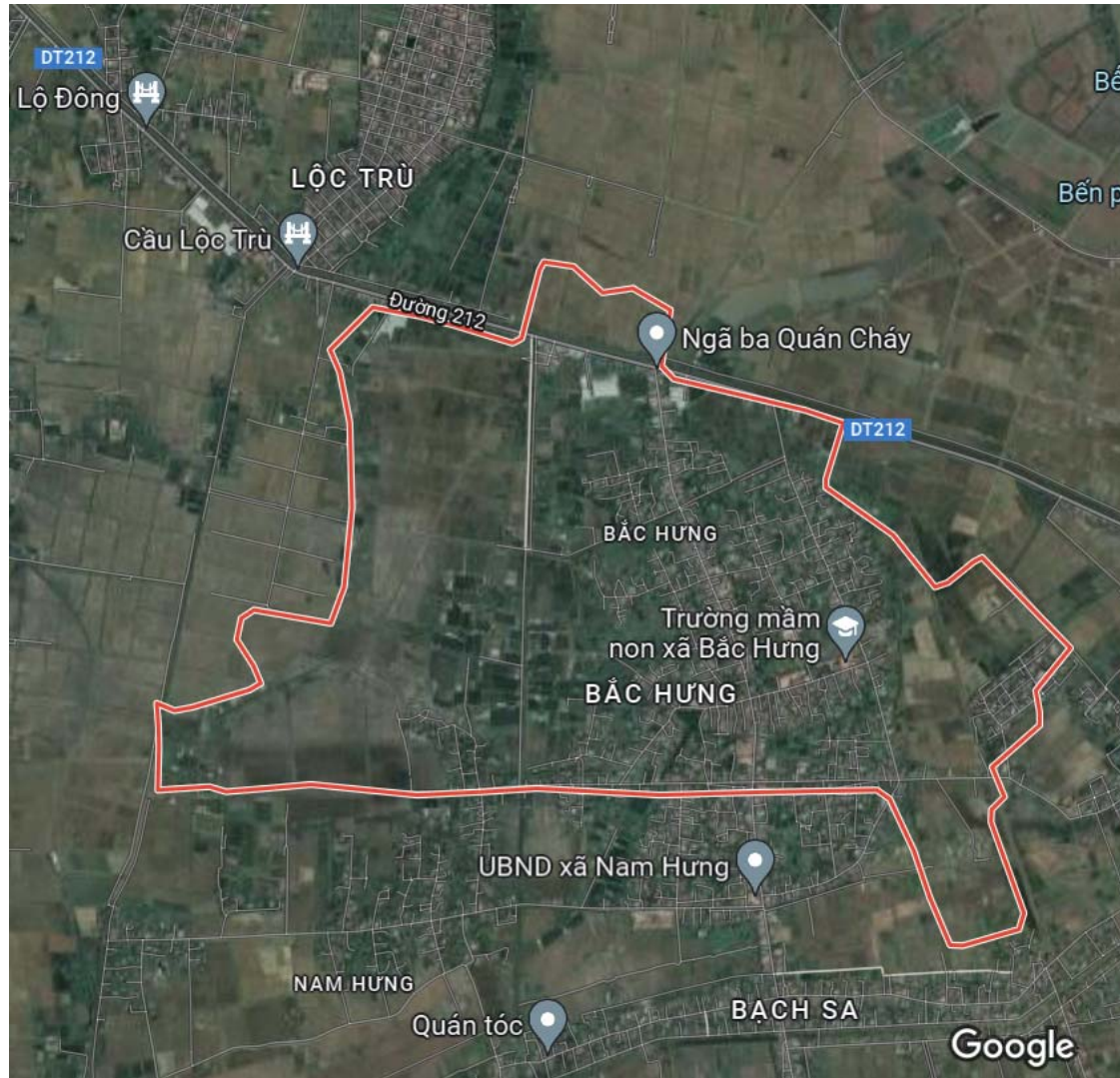
- Most of the people are engaged in farming
- Waste in rural areas is mainly generated from the activities of farmers

Trung Hung village additional information:

- The total number of households is 214
- The total area is 50,925 ha (hectare)
- Has 720 villagers
- Waste weight estimated about 350 tons of garbage/day
- Domestic waste accounts for 85%
- Other common waste accounts for 15%
- Trung Hung village is being polluted day by day and needs to be protected

... general key figure information

General information of Bac Hung commune ...



1. Geographic information

- Trung Hung is a village of Bac Hung commune, Tien Lang district, Hai Phong city, Vietnam;
- Bac Hung commune is in the East - South area of Tien Lang district, the North borders Tien Thang and Hung Thang communes. The East borders on Hung Thang commune; The South borders on Nam Hung commune; The West borders on Tien Thang and Tien Minh communes;

2. Environment information

- Bac Hung commune has a temporary landfill in Dong Tien village, with an area of 3,500m², according to the approved commune plan in 2011.
- Currently, the amount of daily-life waste generated throughout the commune is very high (estimated at 3.5 tons/day)
- The usable area of the temporary landfill has run out and is no longer capable of treating waste by burying
- Bac Hung commune has some pollution rivers, due to the discharge of domestic wastewater from the villagers, which has not been dredged in time for many years due to limited funding

... *Trung Hung village in Bac Hung* ✓

Impressive part of your introduction to your topic

Littering landscape in Trung Hung village – My hometown

Sample of typically littering wastes in Trung Hung village

- Animal carcasses;
- Pesticide shells;
- Bags (plastic and paper);
- Cans (Beer and Soda) ;
- Glass and plastic bottles ;
- Domestic waste ;
- Leftovers;
- Construction waste ;
- Cigarrets butts ;
- Animal wast ;
- Desposable masks;
- Garment waste;
- Etc.

Taking into account the moment we live this is the type of littered represents the greatest danger to the environment and people health.

Garbage on village river
(animal carcasses, plastic bags, plastic bottles paper, construction waste, domestic waste, untreated wastewater)

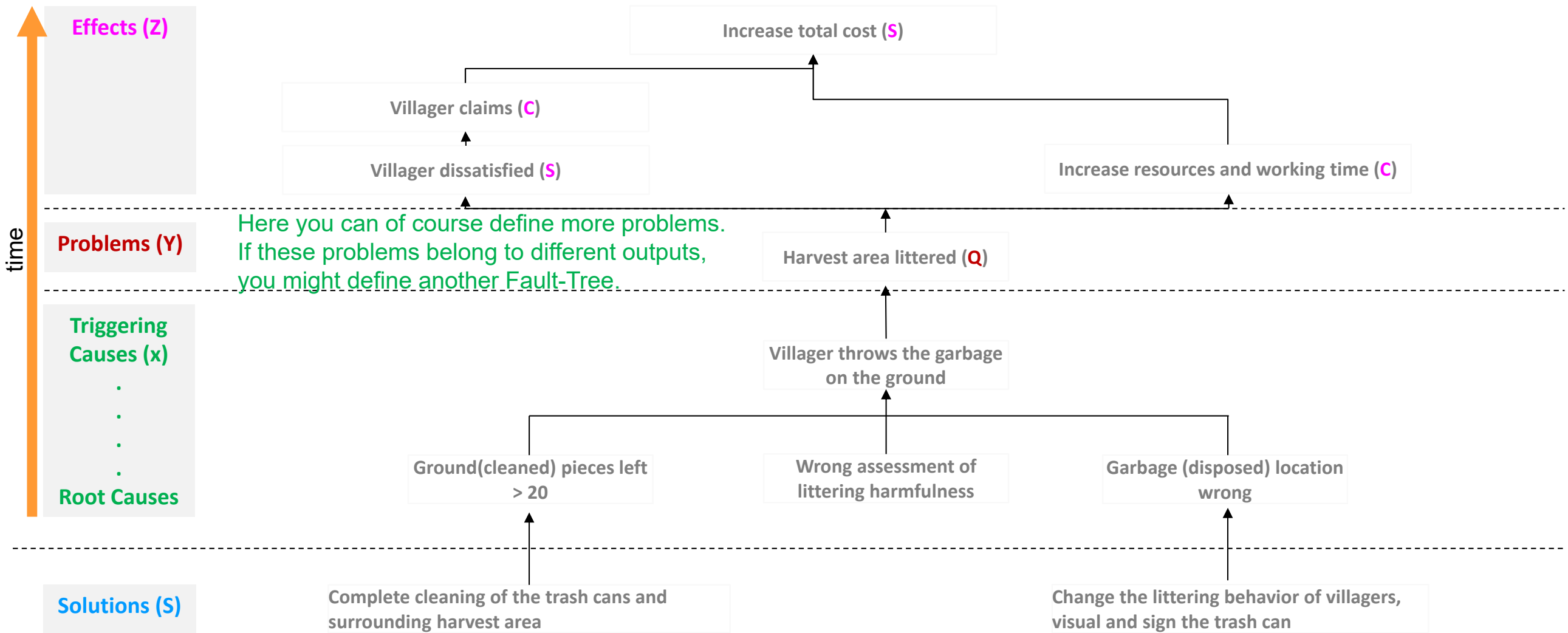


Garbage in the village harvest areas
(leftovers, animal carcasses, pesticide shells, plastic bags, domestic waste)



Nowadays, pollution has become worse and more serious in almost all villages in Vietnam. Pollution harms not only human's health but also the existence of animals, it leads to decrease the economic growth in the countryside. The authorities have been setting up some activities to protect the environment, but this hasn't completely solved the pollution problems. As the result, analyzing the pollution and taking actions to reduce the cause of pollution is one of the biggest demands in the Vietnam countryside.

My first observations, assumptions, effects and solutions ideas ...



... illustrated in the fault-tree

DEFINE

Identification and Definition of a Six Sigma Project

Project-Definition (1/4)

Project-Definition

Littering is one of the biggest problem in our planet at present. Especially in Viet Nam, we can see its presence in every corner of street, rivers, ponds, ... nearby the place where we stay. In my hometown, the wastage is compulsorily collected in some concentration areas, however, some public areas such as harvest areas, nearby local market areas, small rivers are littered by irresponsible villagers. Having the thought that all villagers are deserved to live in a fresh, clean environment, we want to improve the polluted situation in Trung Hung village. As the result, our plan is to clean the harvest area, minimize rubbish.

Activities we perform (disposal of waste), reduce the quality of products / services (ground-cleaning). This quality defect occurs very often and has a strong impact on the internal/ external customer. The problem can be solved halfway by the own department.

Relevance of the topic: 35%

Suitability for method: Six Sigma

Solvable by own department up to: 60%

Project-Definition (2/4)

Section 1: Process and Output

Summary:

The Service GROUND-CLEANING is an intangible final Output for external Customers and is in the Creation Process CLEAN THE HARVEST AREA within a year 13 - 52 times generated. Important Input of the Process to generate the Product GROUND-CLEANING is: BOTTLES, BOXES, PLASTIC BAGS, ANIMAL CARCASSES, LEFTOVERS, PESTICIDE SHELLS.

Section 2: Problem

Summary:

- 1. Problem: GROUND-CLEANING INCOMPLETE. GROUND-CLEANING fulfills the requirement on Quality (is error-free) in 30%.
- 2. Problem: GROUND-CLEANING DELAYED. GROUND-CLEANING fulfills the requirement on Availability (just in time) in 40%.
- 3. Problem: GROUND-CLEANING GARBAGE (DISPOSED) LOCATION WRONG. GROUND-CLEANING fulfills the requirement on Quality (is error-free) in 40%.

Project-Definition (3/4)

Section 3: Effect

Summary: Voice of Business

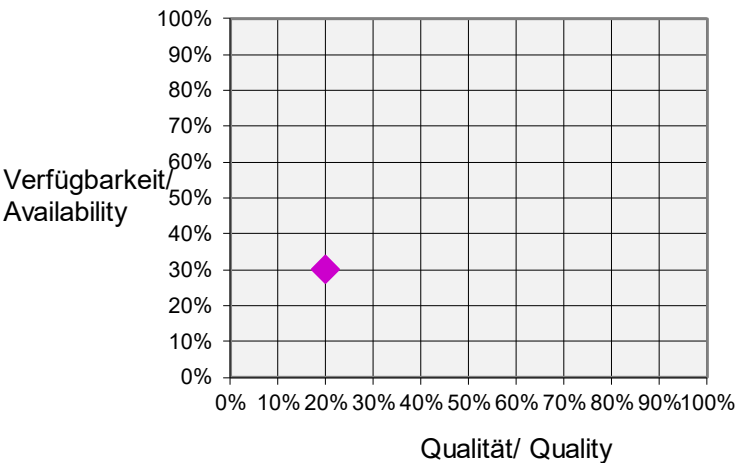
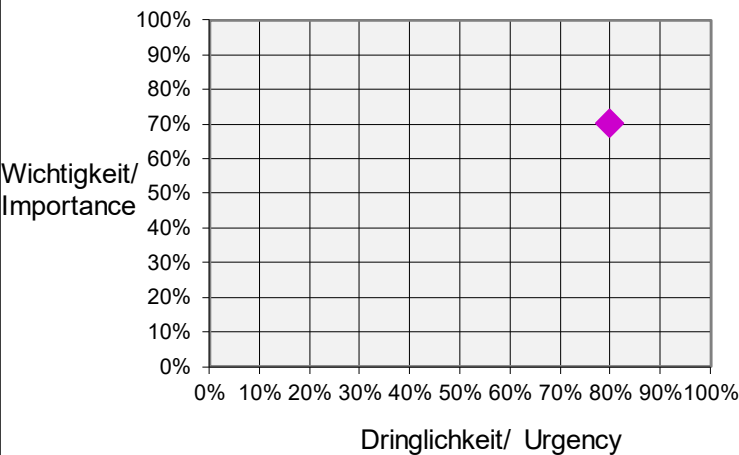
The satisfaction of the process-owners with the Consumption in the Creation Process of the GROUND-CLEANING is: 50%.

The total costs of the specified 3 problems are estimated by 1500\$ / year.

They are primarily the result of consumption costs due to waste of input and resources.

The solution of the problems is rated as:

- major URGENT (80%-Level)
- medium IMPORTANT (70%-Level)



Summary: Voice of Customer

The satisfaction of the external customers with the:

- Quality of GROUND-CLEANING is: 20%.
- Availability of GROUND-CLEANING is: 30%.

Project-Definition (4/4)

Section 4: Solution

Solution Idea to 1. Problem

Complete cleaning of the trash cans and surrounding harvest area

Solution Idea to 2. Problem

Make a specific plan for ground cleaning

Solution Idea to 3. Problem

Change the littering behavior of villagers, visual and sign the trash can

additional Information

Your additional comments, advices, feedback ... are very appreciated.

This project is very good. Because nowadays, pollution has become worse and more serious in almost all villages in Viet Nam, all environmental protection actions are encouraged in Trung Hung village.



DEFINE

SIPOC, Voice to Criticals, Project-Charter, Stakeholder Communication

You clearly understood!

SIPOC with the core process steps included in the project

SIPOC					
Process-Step	Supplier	Input (xI)	Process (xMR)	Output (Y)	Customer
1	Villager	food (packaged)	consume food	garbage (domestic waste)	
2		pesticide (packaged)	consume pesticide	garbage (pesticide shells)	
3		animal (dead)	organic decomposition	garbage (animal carcasses)	
4		garbage	decide on harmfulness	decision(garbage harmfulness)	
5		decision(garbage harmfulness)	select disposal option	decision(disposal option)	
6		decision(disposal option)	select disposal location	decision(disposal location)	
7		decision(disposal location)	dispose garbage	garbage(disposed)	Garbage Removal service
8	Garbage Removal service	gargabge removal target	develop garbage removal plan	removal(plan)	
9		removal(plan)	schedule garbage removal	removal(schedule)	
10			assign garbage removal resources	removal(team)	Garbage Collector
11				removal(equipment)	Garbage Collector
12	Garbage Collector	trash-can(full)	empty the trash-can	trash-can(empty)	Villager
13		ground(littered)	clean the ground	ground(cleaned)	Villager

- Results
- 1. The process steps 1-3 represent the villager's independent sources of creating garbage.
 - 2. The process steps 4-7 represent the decision process of disposed garbage.
 - 3. The process steps 8-11 represent garbage removal plan. It includes schedule, equipment and manpower.
 - 4. The process steps 12-13 represent cleaning activity.

Interpretation and implication

- 1. Multiple daily activities lead to many sources of garbage
- 2. The cleaning activities are critical because they are value added to fulfill customer expectations
- 3. Villager play a major role in improving environmental pollution because they are the main cause of littering

Voice of Customer & Business, Customer & Management Requirements and Problems

Summary: Voice of Customer (VoC), Voice of Business (VoB), Critical Requirements (CCR/ CBR), Problems, Severity, KANO and CtQ-Rank							
Y	Voice	of ...	Critical Business Requirement (CBR) or Critical Customer Requirement (CCR)	Problem	Kano-Category	Severity	Critical to Quality (CtQ) Rank
Y_03	ground(cleaned) ground not completely cleaned	Management	CBR: ground(cleaned) pieces left 0	ground(cleaned) pieces left > 20	Must-Be	96%	1
Y_06	decision(garbage) garbage mixture harmful	Customer	CCR: decision(garbage) harmfulness < 1	decision(garbage) harmfulness > 1	More/Less-Is-Better	90%	2
Y_04	garbage(disposed) thrown on the ground	Management	CBR: garbage(disposed) location correct	garbage(disposed) location wrong	Must-Be	83%	3
Y_02	trash-can(empty) out of sight	Customer	CCR: trash-can(empty) visibility/ attraction high	trash-can(empty) visibility/ attraction too low	More/Less-Is-Better	70%	4
Y_05	removal(schedule) trash-can fullness	Customer	CCR: removal(schedule) garbage in trash-can empty	removal(schedule) garbage in trash-can full	More/Less-Is-Better	60%	5
Y_01	ground(cleaned) removal requires a great deal of effort	Management	CBR: ground(cleaned) cleaning-effort < 8 working hours per week	ground(cleaned) cleaning-effort > 8 working hours per week	More/Less-Is-Better	40%	6
Y_07	ground(cleaned) hear the flying insect noise	Customer	CCR: ground(cleaned) flying insect sound moderate	ground(cleaned) flying insect sound noise	Delighter	25%	7

Decison(garbage) harmfulness wrong

Results

- Seven critical problems are identified under three domains.
- Four problems are based on the customer and three problems are based on management.

Interpretation and implication

1.

The result shows customer expectation is they want to have a clean area with less attention and the management (sponsor) expectation is saving effort

2.

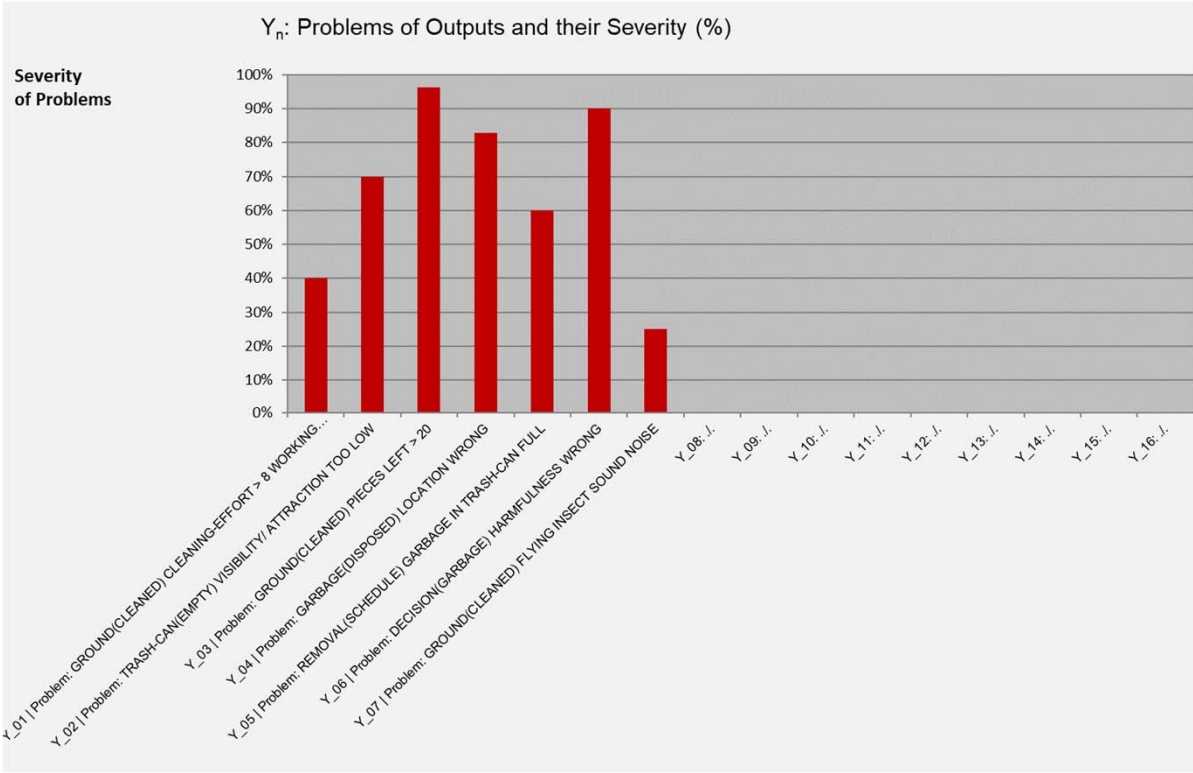
The quality problem is critical, needs to be effectively addressed and the availability problems can improve the villager’s life a lot

3.

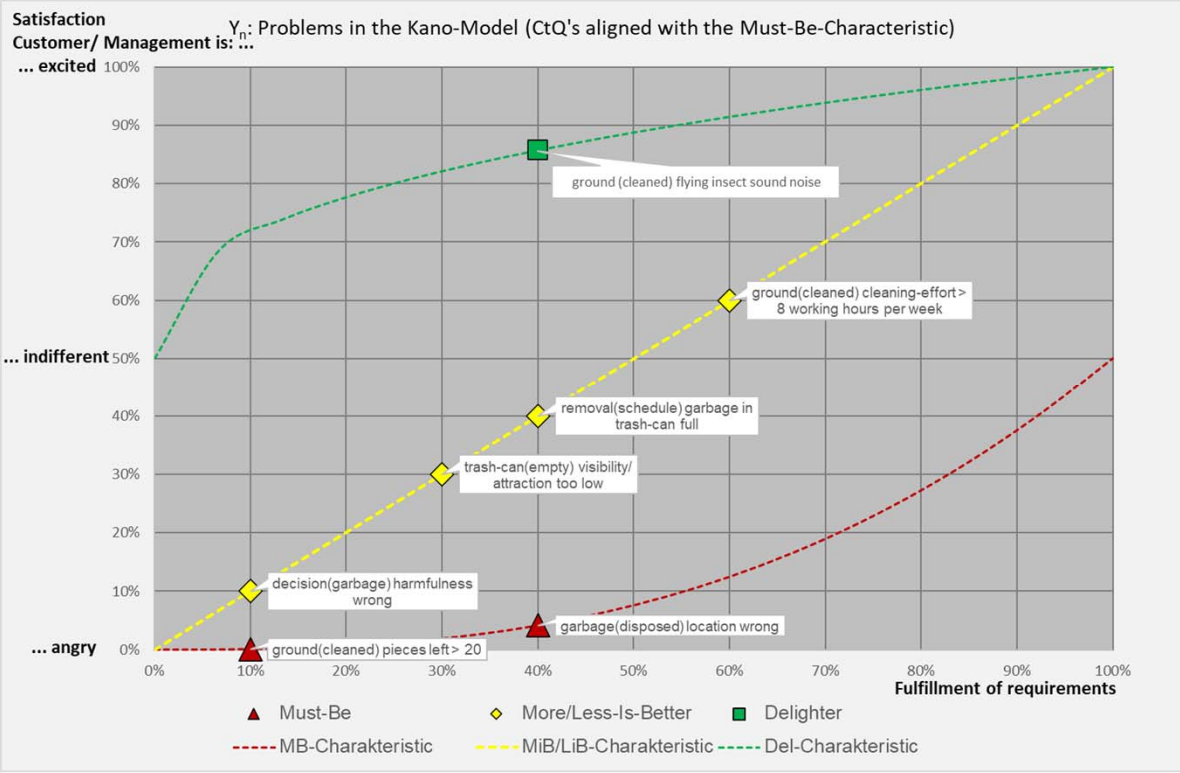
Customer can give the unobvious problem and it will become difficult to operationalize for measurement, for example Y_07

The important problems are: Y_03 & Y_06 & Y_04

CTQ Bar Chart for the Problems and their evaluation by the KANO Model



Y CTQ Bar Chart



KANO Model

Interpretation and implication

1. The main problem is the Must-Be problems (CtQ's) Y_03: Ground (cleaned) left > 20 pieces
2. Must-Be problems and More/Less-Is-Better are equal in number of the most four severe problems
3. Only one More/Less-Is-Better (Y_06) shows a high severity because of high uncertainty
4. Awareness of the dangers of environmental pollution in the village needs to be disseminated, it can help a lot in environment improvement

PROJECT CHARTER

Project-Charter				Project-Name			
				Public Garbage Littering in Trung Hung harvest area			
Business-Case				Process & Output			
The Service GROUND-CLEANING is an intangible final Output for external Customers and is in the Creation Process CLEAN THE HARVEST AREA within a year 13 - 52 times generated. Important Input of the Process to generate the Product GROUND-CLEANING is: BOTTLES, BOXES, PLASTIC BAGS, ANIMAL CARCASSES, LEFTOVERS, PESTICIDE SHELLS.				Product/ Service:		ground-cleaning	
				Process:		clean the harvest area	
Voice of Customer (VoC)				Problems			
The satisfaction of the external customers with the: - Quality of GROUND-CLEANING is: 20%. - Availability of GROUND-CLEANING is: 30%.				Y_03 ground(cleaned) pieces left > 20			
				Y_06 decision(garbage) harmfulness wrong			
				Y_04 garbage(disposed) location wrong			
Voice of Business (VoB)				Solution-Ideas			
The satisfaction of the process-owners with the Consumption in the Creation Process of the GROUND-CLEANING is: 50%. The total costs of the specified 3 problems are estimated by 1500\$ / year. They are primarily the result of consumption costs due to waste of input and resources. The solution of the problems is rated as: - major URGENT (80%-Level) / - medium IMPORTANT (70%-Level)				Complete cleaning of the trash cans and surrounding harvest area			
				Make a specific plan for ground cleaning			
				Change the littering behavior of villagers, visual and sign the trash can			
Comment				Comment			
				This project is very good. Because nowadays, pollution has become worse and more serious in almost all villages in Viet Nam, all environmental protection actions are encouraged in Trung Hung village.			
In Scope		Out of Scope		Management			
in:	Littering in village	out:	Littering in city central	Sponsor A_ccountable A_ccountable Controlling	Mrs. Quang	Supplier Customer ...? ...?	Garbage Removal service
in:	Littering on harvest are	out:	Littering at bus station		Mrs. Thay		Trung Hung villagers
in:	Littering around trash can	out:	Littering at airport		Mr. Ty		
in:		out:	Littering at mega mall		Mr. Chen		
Targets		Timeline		Experts			
Y_03	Reduce pieces left on the ground (in range 0 - 10 pieces)	14 June 2022		Black-Belt Green-Belt Green-Belt Expert	Mr. Dieu	Master-Black-Belt	Dr. Reiner
Y_06	Identify and classify garbage hamfulness in 3 types of trash bins (Organic, Inorganic, Recycling) correctly (up to 75%)	14 June 2022			Tim		...?
Y_04	Improve disposed garbage in correct location (up to 80%)	14 June 2022					...?
					Mr. Luan		...?
Timeline	Define	Measure	Analyse	Improve	Control*	Control	End
Target-Date:	12 May 2022	02 June 2022	23 June 2022	07 July 2022	21 July 2022	18 August 2022	02 September 2022
Completion-Date:							
Evaluation:	days remaining : 0	days remaining : 21	days remaining : 42	days remaining : 56	days remaining : 70	days remaining : 98	days remaining : 113

Results

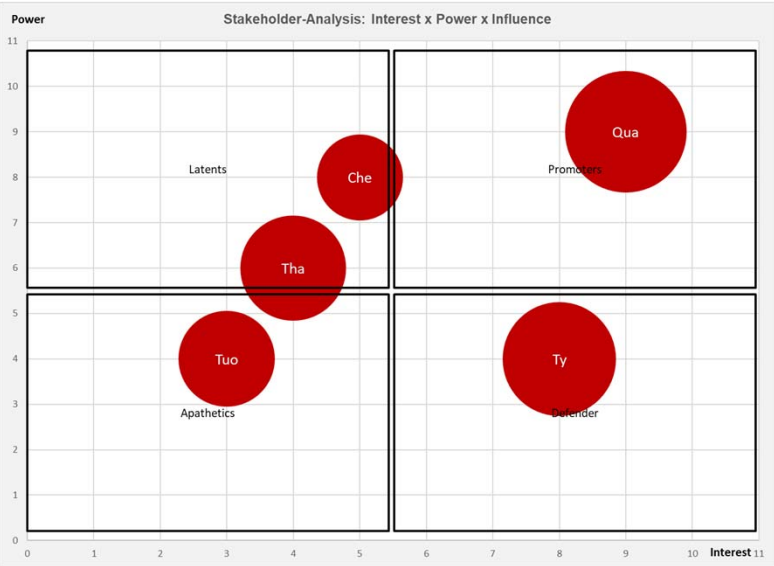
1. The business case is clear
2. The three main problems are Identified based on SMART
3. The Voice of customer and The Voice of business are quantified
4. Scope, targets and team defined
5. Timeline evaluation

Interpretation and implication

The clean environment of Trung Hung village is greatly influenced by the number of garbage littered on the ground

Stakeholder-Analysis and communication plan

Stakeholder-Communication			Interested in ...	Power to support the ...	How do you want to win the support of this Person?						Degree of your Influence on this Person	Rank (Power x Interest x Influence)
Select one of your targets	Who in the company is positively/negatively affected by the achievement of this target? (Name)	Pseudonym	... target-achievement		Type of communication	Frequency	Type of communication	Frequency	Type of communication	Frequency		
Y_04 Improve disposed garbage in correct location (up to 80%)	Mrs. Chen	Che	5	8	personal talk	weekly	team discussion	biweekly	phase steering	as needed	4	3
Y_04 Improve disposed garbage in correct location (up to 80%)	Mr. Tuong	Tuo	3	4	personal talk	weekly	team discussion	monthly	phase steering	as needed	5	5
Y_04 Improve disposed garbage in correct location (up to 80%)	Mr. Quang	Qua	9	9	team discussion	biweekly	phase steering	monthly	final presentation	at fixed dates	8	1
Y_03 Reduce pieces left on the ground (in range 0 - 10 pieces)	Mr. Ty	Ty	8	4	personal talk	weekly	workshop	biweekly	team discussion	monthly	7	2
Y_06 Identify and classify garbage hamfulness in 3 types of trash bins (Organic, Inorganic, Recycling) correctly (up to 75%)	Mrs. Thay	Tha	4	6	personal talk	weekly	workshop	biweekly	team discussion	monthly	6	4



Interpretation and implication

- 1. The principal stakeholders are Mr. Quang, Mr. Tuong, Mr. Ty, Mrs. Thay and Mrs. Chen
- 2. Mr. Quang forms the promoter group as they have power and interest
- 3. Mrs. Chen has power but not so aware about the Project
- 4. Mr. Ty is interest but does not have strong power
- 5. Mrs. Thay is also belong to Latens group
- 6. Mr. Tuong show the least power and less influence

Results

- 1. The effective ranking of each person are assigned
- 2. The strategy which is needed to be adopted for each category are Identified
- 3. The unawareness among Mrs. Chen and Mrs. Thay is need to be addressed

Results of the *DEFINE*-Steering

Define-Steering				
Tool	Application	Documentation	Comment	Decision
Introduction, Presentation of Critical Product/ Service	ok	ok		Master-Black-Belt
Project-Topic	ok	ok		Dr. Reiner Hutwelker reiner.hutwelker@tum.de
Project-Definition	ok	ok		11-May-2022
SIPOC	ok	ok		passed
VoC/ VoB/ CtQ (Voice to Criticals)	ok	ok		Sponsor
Project-Charter	ok	ok		Pham Van Quang Phamvanquang.trunghung@gmail.com
Stakeholder Communication	ok	ok		13-May-2022
Additional Notes			Dear Tim, this is a great start. You applied all tool correctly and documented their results reasonably. I can additionally see a great motivation to be clear and comprehensible. I also appreciate that you could win a sponsor! – To be successful you might want to focus on just two different spots/ locations and gain experience about the feasibility. - With this performance you will become a candidate of our Environment Green Belt Award. (If you like, please contact Awe Olamide David from Lagos in our fb-group and exchange experiences). Go to MEASURE.	passed

Only proceed to the next phase after a positive decision of MBB and Sponsor

MEASURE

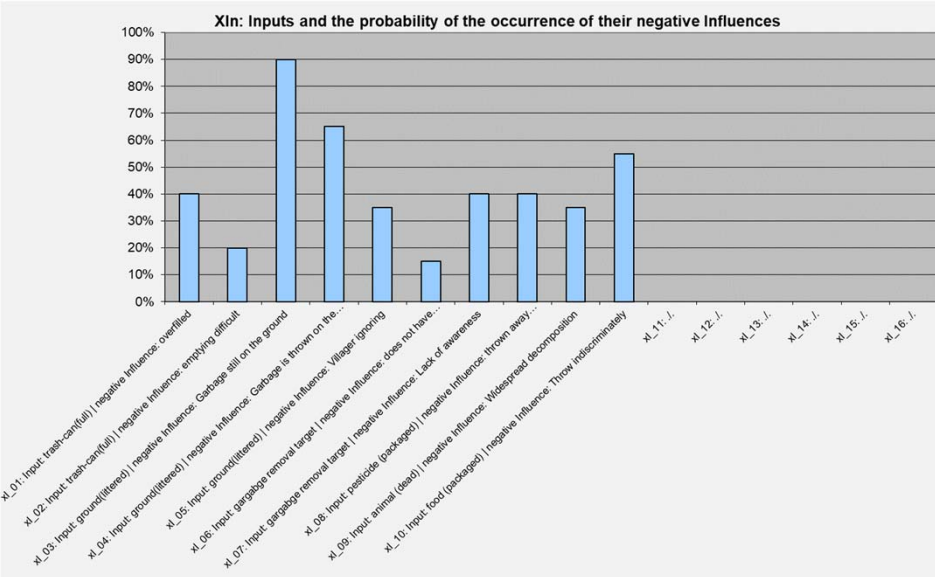
Input-Analysis, Process-Mapping/ -Analysis, C&E-Matrix, Data-Collection-Plan, Hypothesis

10 negative influence input ware identified, 5 inputs are related to ground littering...

xl_01		
Which Input is necessary for the Process CLEAN THE HARVEST AREA?	trash-can(full)	Input
	Please select an answer.	
What do you require from TRASH-CAN(FULL)?	emptied before overfilling	Requirement
	Please enter your answer.	
To which category does the Requirement EMPTIED BEFORE OVERFILLING belong?	Availability (right Quantity just in Time)	Requirement-Category
	Please select an answer.	
Which deviation of TRASH-CAN(FULL) from the Requirement is problematic for the Process?	overfilled	negative Influence
	Please enter your answer.	
How often does the negative Influence TRASH-CAN(FULL) OVERFILLED occur?	40%	Probability of Occurrence
	Please enter a value between: 0% - 100%.	

Results

- 10 negative influence inputs were identified
- The highest negative influence was identified with 90%, it related to ground is not completed clean because garbage is still on the ground
- The lowest negative influence was identified with 15%, it is penalties for violations
- The category has 9 inputs related to quality and just 1 input of availability
- xl_05 (Villager ignoring) and xl_07 (Lack of awareness) directly related to villagers, it can be very important reason of ground littering
- xl_06 (does not have sanctions) is up to local government, it can impact to villager



Interpretation and implication

- 5 inputs are related to a direct or indirect ground littering, 2 are related to the trash-can itself and 3 are related to the villagers
- Quality category is the major, 90% inputs belong to quality
- Garbage is generated from 3 main sources: domestic waste, animal carcasses and pesticide shells. Each type requires a different treatment before disposing of the garbage
- People's awareness can be the root cause of indiscriminate littering, it is necessary to handle both visible and invisible causes of the problems simultaneously

... 2 are related to the trash-can and 3 are related to the villagers

Please keep using affirmative statements, to always describe „as is“ situation e.g.

- Suitability of used tools low
- Picking garbage manually

13 activities are mapped in the single Activities gives a more detailed perspective ...

Process-Mapping-Analysis of the Process: clean the harvest area														
Who does what?	Please specify the Process-Steps in detailed Activities the format: Verb + Noun (e.g.: weigh Ingredients)												
		1. Activity	2. Activity	3. Activity	4. Activity	5. Activity	6. Activity	7. Activity	8. Activity	9. Activity	10. Activity	11. Activity	12. Activity	13. Activity
1. Process-Step	Villager	consume food	consume pesticide	animal carcasses dispose	decide on harmfulness	select disposal option	select disposal location	dispose garbage						
2. Process-Step	Garbage Removal service								develop garbage removal plan	schedule garbage removal	assign garbage removal manpower	assign garbage removal equipment		
3. Process-Step	Garbage Collector												empty the trash-can	clean the ground
Input:	Which Inputs are necessary to start the Activity?	food (packaged)	pesticide (packaged)	animal (dead)	garbage	decision(garbage)	decision(disposal option)	decision(disposal location)	gargabge removal target	removal(plan)	J.	J.	trash-can(full)	ground(littered)
Methods:	Which Instructions/ Rules direct how to perform the Activity?	Personal habit	Personal habit	Personal habit	Information about harmfulness	Personal knowledge	Visualization		Team brainstorming	Calendar-entry	Persuasion skill	Purchasing	Throw garbage in the trash-bin	Garbage collecting
Resources:	Which Equipment/ Machines/ Tools operate or support the Activity?					Google search			Microsoft Excel			Trash-bin, gloves, masks, brooms, dustpans	Trash-bin, gloves, masks	Gloves, masks, brooms, dustpans
Output:	Which Output results from the Activity?	garbage (domestic waste)	garbage (pesticide shells)	garbage (animal carcasses)	decision(garbage)	decision(disposal option)	decision(disposal location)	garbage(disposed)	removal(plan)	removal(schedule)	removal(team)	removal(equipment)	trash-can(empty)	ground(cleaned)
Which Influences of the: - Methods and - Resources negatively affect:	... the Quality (Faultlessness/ Fulfilment of Purpose) of the Output?				wrong assessment of harmfulness	Wrong decision disposal option	Wrong decision disposal location						Dumping trash-bin uncleanly	ground is not cleaned completely
	... the Availability (right Quantity just in Time) of the Output?							Long distance to the trash-can		Planning time delay				
	... the Consumption and Waste of Input and/ or Resources?							Take time to search trash-can			Expected manpower is not enough	Missing the necessary tools		Require big deal of effort
How often are the Activities affected by these negative Influences?					40%	20%	90%	80%		30%	50%	20%	60%	95%

Interpretation and implication

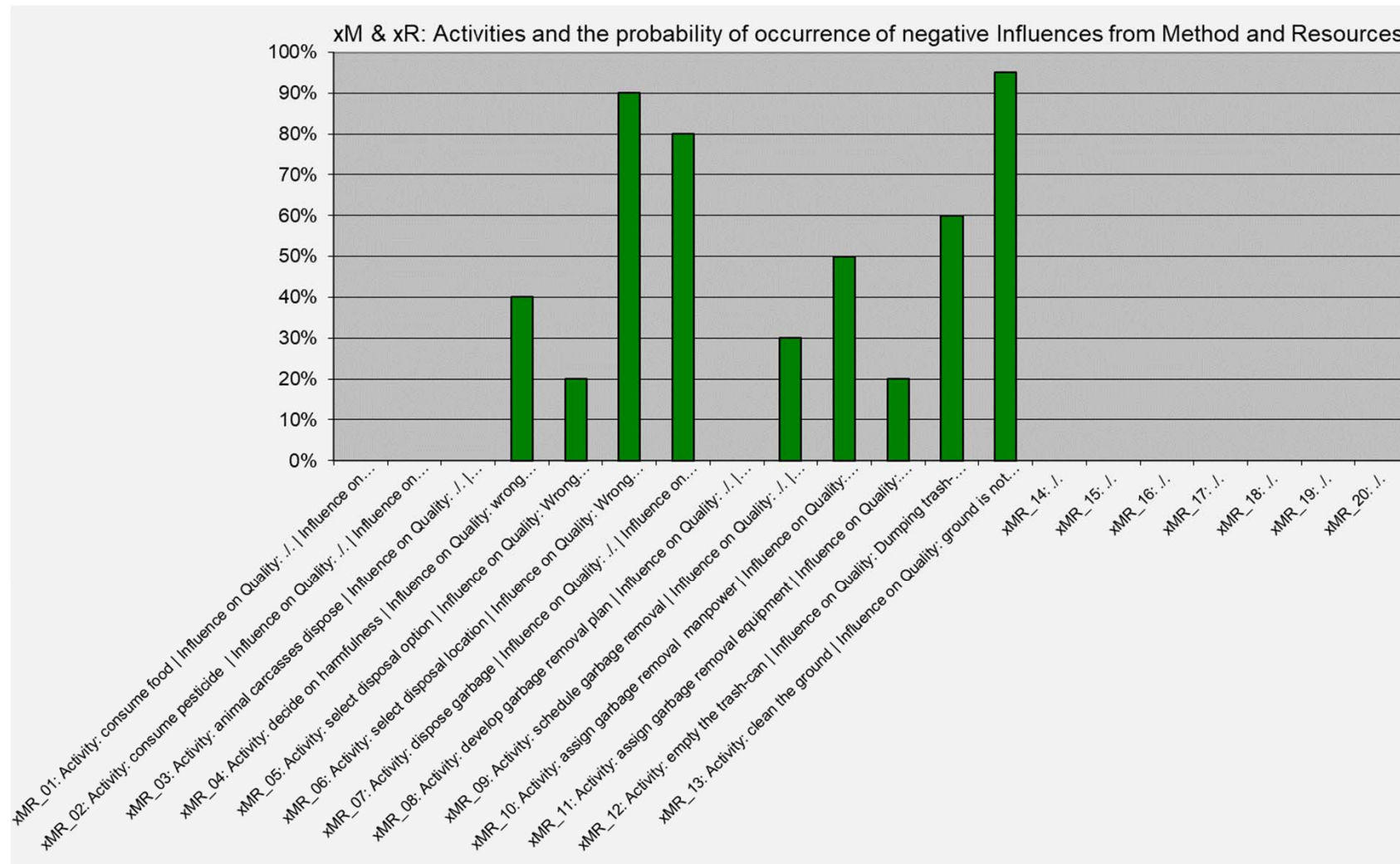
- The Process-Steps in the SIPOC is specified in the sequence of Activities, precise enough description of the Activities so all negative process Influences are identified

Results

- Process mapping analysis of the Process clean the harvest includes 13 single activities
- The maximum negative influence is 13th activity (clean the ground) with 95 %
- 2 minimum negative impacts are 5th (select disposal option) and 11th (assign garbage removal equipment), both equal 20%

... on the Process-Steps than the SIPOC (underlying Methods and Resources)

9 of 13 activities and the probability of occurrence of negative influences ...



Results

- 9 of 13 activities and the probability of occurrence of negative influences from Method and Resource are show in the Influence of xM & xR Chart
- The activity xMR_13: clean the ground has the highest negative influence on Method and resources

Interpretation and implication

- xMR_13 (Clean the ground) is the highest negative influence (95%), but it is end of the process, unlikely to be the root cause
- xMR_05 (select disposal option) is also high (90%) but this activities is qualitative, not easy for analysis
- xMR_07 (dispose garbage) is 3rd (80%), it is directly related to ground littering, easy to assessment. This influence should be selected for analysis

... influences from Method and Resource are show in the Influence of xM & xR Chart

A photograph of four men standing in a room. From left to right: the first man is wearing a grey button-down shirt and grey trousers; the second man is wearing a light blue button-down shirt and dark trousers; the third man is wearing a dark blue button-down shirt and dark trousers; and the fourth man is wearing a light blue polo shirt and dark trousers. They are standing in front of a window with a wooden frame and a calendar with many colorful sticky notes. The man on the far right is smiling.



C&E Matrix 23 Influences (x) in the rows is contrasted with 7 Problems (Y) in the columns ...

C&E Matrix	Output (Y)	Severity	40%	70%	96%	83%	60%	90%	25%	Results for: Impact of Influences (xI & xP) on the Outputs (Y)		
		Kano-Category	More/Less-Is-Better	More/Less-Is-Better	Must-Be	Must-Be	More/Less-Is-Better	More/Less-Is-Better	Delighter			
		Problems (= Effects)	Y_01 Problem: GROUND(CLEANED) CLEANING-EFFORT > 8 WORKING HOURS PER WEEK	Y_02 Problem: TRASH-CAN(EMPTY) VISIBILITY/ ATTRACTION TOO LOW	Y_03 Problem: GROUND(CLEANED) PIECES LEFT > 20	Y_04 Problem: GARBAGE(DISPOSED) LOCATION WRONG	Y_05 Problem: REMOVAL(SCHEDULE) GARBAGE IN TRASH-CAN FULL	Y_06 Problem: DECISION(GARBAGE) HARMFULNESS WRONG	Y_07 Problem: GROUND(CLEANED) FLYING INSECT SOUND NOISE	Product Sum of the Impact of each Influence (xI & xP) on all Outputs (Y)	Percentual Impact of each Influence (xI & xP) on all Outputs (Y)	Ranking of the Impact of each Influence (xI & xP) on all Outputs (Y)
Influences from Input (xI) (= Causes)	Probability	Rank										
xI_01: Input: trash-can(full) Requirement: emptied before overflowing Requirement-Category: Availability (ight Quantity just in Time) negative Influence: overfilled	40%	4	10%	30%	10%		50%			0.26	4%	7
xI_02: Input: trash-can(full) Requirement: emptying should be easy Requirement-Category: Quality (Faultlessness/ Fulfillment of Purpose) negative Influence: emptying difficult	20%	9	25%				5%		5%	0.03	0%	16
xI_03: Input: ground(littered) Requirement: Ground completely cleaned Requirement-Category: Quality (Faultlessness/ Fulfillment of Purpose) negative Influence: Garbage still on the ground	90%	1	15%	5%	95%			5%	10%	0.97	17%	2
xI_04: Input: ground(littered) Requirement: Garbage is thrown in trash-can Requirement-Category: Quality (Faultlessness/ Fulfillment of Purpose) negative Influence: Garbage is thrown on the ground	65%	2	20%	5%	30%	30%		10%	5%	0.49	8%	5
xI_05: Input: ground(littered) Requirement: Villager good sense Requirement-Category: Quality (Faultlessness/ Fulfillment of Purpose) negative Influence: Villager ignoring	35%	7		20%	5%	5%		5%		0.10	2%	12
xI_06: Input: garbage removal target Requirement: Penalties for violations Requirement-Category: Quality (Faultlessness/ Fulfillment of Purpose) negative Influence: does not have sanctions	15%	10		5%	5%	10%		20%		0.05	1%	15
xI_07: Input: garbage removal target Requirement: Be aware of emergency environmental protection Requirement-Category: Quality (Faultlessness/ Fulfillment of Purpose) negative Influence: Lack of awareness	40%	4	5%		5%	50%		5%		0.21	4%	8
xI_08: Input: pesticide (packaged) Requirement: Put in hazardous trash-can Requirement-Category: Quality (Faultlessness/ Fulfillment of Purpose) negative Influence: thrown away confusedly	40%	4		5%		10%		10%		0.08	1%	13
xI_09: Input: animal (dead) Requirement: wrapped in the bag Requirement-Category: Quality (Faultlessness/ Fulfillment of Purpose) negative Influence: Widespread decomposition	35%	7		5%		5%		10%	50%	0.10	2%	10
xI_10: Input: food (packaged) Requirement: Segregate of recyclables and garbage Requirement-Category: Quality (Faultlessness/ Fulfillment of Purpose) negative Influence: Throw indiscriminately	55%	3	5%	5%	40%	10%		20%		0.39	7%	6
Influences from Process-Step (xMR) (= Causes)	Probability	Rank										
xMR_01: Activity: consume food Input: food (packaged) Methods: Personal habit Resources: <i>J.</i> Output: garbage (domestic waste) Influence on Quality: <i>J.</i> Influence on Availability: <i>J.</i> Influence on Consumption: <i>J.</i>												
xMR_02: Activity: consume pesticide Input: pesticide (packaged) Methods: Personal habit Resources: <i>J.</i> Output: garbage (pesticide shells) Influence on Quality: <i>J.</i> Influence on Availability: <i>J.</i> Influence on Consumption: <i>J.</i>												
xMR_03: Activity: animal carcasses dispose Input: animal (dead) Methods: Personal habit Resources: <i>J.</i> Output: garbage (animal carcasses) Influence on Quality: <i>J.</i> Influence on Availability: <i>J.</i> Influence on Consumption: <i>J.</i>												
xMR_04: Activity: decide on harmfulness Input: garbage Methods: Information about harmfulness Resources: <i>J.</i> Output: decision(garbage) Influence on Quality: wrong assessment of harmfulness Influence on Availability: <i>J.</i> Influence on Consumption: <i>J.</i>	40%	6				30%				0.10	2%	11
xMR_05: Activity: select disposal option Input: decision(garbage) Methods: Personal knowledge Resources: Google search Output: decision(disposal option) Influence on Quality: Wrong decision disposal option Influence on Availability: <i>J.</i> Influence on Consumption: <i>J.</i>	20%	8		20%				20%		0.06	1%	14
xMR_06: Activity: select disposal location Input: decision(disposal option) Methods: Visualization Resources: <i>J.</i> Output: decision(disposal location) Influence on Quality: Wrong decision disposal location Influence on Availability: <i>J.</i> Influence on Consumption: <i>J.</i>	90%	2	15%			70%	15%			0.66	11%	4
xMR_07: Activity: dispose garbage Input: decision(disposal location) Methods: <i>J.</i> Resources: <i>J.</i> Output: garbage(disposed) Influence on Quality: <i>J.</i> Influence on Availability: Long distance to the trash-can Influence on Consumption: Take time to search trash-can	80%	3		75%	15%	15%	5%	90%	15%	1.34	23%	1
xMR_08: Activity: develop garbage removal plan Input: garbage removal target Methods: Team brainstorming Resources: Microsoft Excel Output: removalplan Influence on Quality: <i>J.</i> Influence on Availability: <i>J.</i> Influence on Consumption: <i>J.</i>												
xMR_09: Activity: schedule garbage removal Input: removalplan Methods: Calendar-entry Resources: <i>J.</i> Output: removal(schedule) Influence on Quality: <i>J.</i> Influence on Availability: Planning time delay Influence on Consumption: <i>J.</i>	30%	7								0.00		
xMR_10: Activity: assign garbage removal manpower Input: <i>J.</i> Methods: Persuasion skill Resources: <i>J.</i> Output: removal(team) Influence on Quality: <i>J.</i> Influence on Availability: <i>J.</i> Influence on Consumption: Expected manpower is not enough	50%	5								0.00		
xMR_11: Activity: assign garbage removal equipment Input: <i>J.</i> Methods: Purchasing Resources: Trash-bin, gloves, masks, brooms, dustpans Output: removal(equipment) Influence on Quality: <i>J.</i> Influence on Availability: <i>J.</i> Influence on Consumption: Missing the necessary tools	20%	8		60%				40%		0.16	3%	9
xMR_12: Activity: empty the trash-can Input: trash-can(full) Methods: Throw garbage in the trash-bin Resources: Trash bin, gloves, masks Output: trash-can(empty) Influence on Quality: Dumping trash-bin unclearly Influence on Availability: <i>J.</i> Influence on Consumption: <i>J.</i>	60%	4								0.00		
xMR_13: Activity: clean the ground Input: ground(littered) Methods: Garbage collecting Resources: Gloves, masks, brooms, dustpans Output: ground(cleaned) Influence on Quality: ground is not cleaned completely Influence on Availability: <i>J.</i> Influence on Consumption: Require big deal of effort	95%	1	30%		50%		30%		10%	0.77	13%	3
Results for: Determination of Outputs (Y) by Influences (x)	Product Sum of the Determination of each Output (Y) by the Influences (xI & xP)		0.3290	0.7700	1.8769	1.1684	0.4020	1.0023	0.1303			
	Percentual Determination of each Output (Y) by the Influences (xI & xP)		6%	13%	33%	20%	7%	19%	2%			
	Ranking of the Determination of each Output (Y) by the Influences (xI & xP)		6	4	1	2	5	3	7			

Results

- 60 connections were identified between 10 inputs (xI), 13 activities (xP) and 7 outputs (Y)
- 42 connections are based on inputs and 18 are base on activities

Interpretation and implication

- Y_03: GROUND(CLEANED) PIECES LEFT > 20 has highest ranking of the Determination of each Output (Y) by the Influences (xI & xP) with 33%
- xMR_07 (dispose garbage) has highest ranking of the Impact of each Influence (xI & xP) on all Outputs (Y) with 23%

... xY-intersection cell is the strength of each impact (0%-100%)

The C&E Matrix indicate causal relationships between the 23 negative Influences ...

Chart: C&E Heatmap		Intensity	40%	70%	80%	80%	80%	80%	80%	20%	Results for Impact of Influences (xI & xP) on the Outputs (Y)		
The cells indicate the strength of each relationship between influences (I) and the related Outputs (Y) (see Risks Probability x Severity). The Risks are the basis for prioritizing of the corresponding Hypothesis between x and Y. Nothing needs to be entered here!		Count of Y x Influences I	1 (1 Problem: DISORDER/CLEANING EFFORT > 4 WORKING HOURS PER WEEK)	2 (1 Problem: TRASH/CAUSE OF LIABILITY ATTRACTION TOO LOW)	3 (1 Problem: BROODING/PECES LEFT > 20)	4 (1 Problem: GARBAGE/DEPOSED LOCATION WRONG)	5 (1 Problem: PERSONAL/SCHEDULE GARBAGE IN TRASH/CAN FULL)	6 (1 Problem: DISORDER/GARBAGE) ANIMAL/FEELNESS WORKING	7 (1 Problem: BROODING/PECES LEFT > 20)	8 (1 Problem: BROODING/PECES LEFT > 20)	risk-weighted Product Score of the Impact of each Influence (xI & xP) on all Outputs (Y)	risk-weighted Product Score of the Impact of each Influence (xI & xP) on all Outputs (Y)	Ranking of the risk-weighted Impact of each Influence (xI & xP) on all Outputs (Y)
Influences from Inputs (xI) > Cause		Probability	D	E	F	G	H	I	J				
xI_01: Input: trashcan full (Requirement: emptied before use/emptying (Requirement: Category: Availability right/Quality just in Time) (negative influence: verified)		40%	0.30%	0.12%	0.42%			0.90%			0.204	4%	1
xI_02: Input: trashcan full (Requirement: emptied before use/emptying (Requirement: Category: Availability right/Quality just in Time) (negative influence: verified)		20%	1.07%					0.90%		0.90%	0.090	0%	16
xI_03: Input: ground/litter (Requirement: Ground completely cleaned (Requirement: Category: Quality (Failure/Success: Fullness of Purpose) (negative influence: Garbage left on the ground)		80%	1.30%	1.02%	0.210%			1.07%		0.210%	0.091	10%	2
xI_04: Input: ground/litter (Requirement: Garbage is thrown in trash can (Requirement: Category: Quality (Failure/Success: Fullness of Purpose) (negative influence: Garbage is thrown on the ground)		80%	1.41%	1.02%	0.210%	0.130%		0.40%		0.90%	0.474	9%	4
xI_05: Input: ground/litter (Requirement: Village and area (Requirement: Category: Quality (Failure/Success: Fullness of Purpose) (negative influence: Village empty)		30%		0.30%	0.30%	0.20%		0.20%			0.120	2%	12
xI_06: Input: garbage removal legal (Requirement: Penalties for violations (Requirement: Category: Quality (Failure/Success: Fullness of Purpose) (negative influence: does not have sanctions)		10%		0.90%	0.20%	0.20%		1.07%			0.104	2%	10
xI_07: Input: garbage removal legal (Requirement: Be aware of emergency environmental protection (Requirement: Category: Quality (Failure/Success: Fullness of Purpose) (negative influence: Lack of awareness)		40%	0.30%		0.210%	0.140%		0.20%			0.270	9%	1
xI_08: Input: pesticide (garbage) (Requirement: Put in hazardous trash can (Requirement: Category: Quality (Failure/Success: Fullness of Purpose) (negative influence: thrown away responsibly)		40%		0.210%		0.20%		0.30%			0.110	2%	14
xI_09: Input: animal (skull) (Requirement: wrapped in the bag (Requirement: Category: Quality (Failure/Success: Fullness of Purpose) (negative influence: Widespread decomposition)		30%		0.20%		0.20%		0.30%		0.90%	0.091	2%	10
xI_10: Input: food (garbage) (Requirement: Separate of recyclables and garbage (Requirement: Category: Quality (Failure/Success: Fullness of Purpose) (negative influence: Thrown indiscriminately)		80%	0.30%	0.12%	0.210%	0.42%		0.210%			0.472	9%	1
Influences from Processings (xMR) > Cause		Probability											
xMR_01: Activity: consume food (input: food (garbage) (Methods: Personal habit) (Resources: / / Output: garbage (domestic waste) (Influence on Quality: / / Influence on Availability: / / Influence on Consumption: /											0.000		
xMR_02: Activity: consume pesticide (input: pesticide (garbage) (Methods: Personal habit) (Resources: / / Output: garbage (pesticide shells) (Influence on Quality: / / Influence on Availability: / / Influence on Consumption: /											0.000		
xMR_03: Activity: animal carcasses disposal (input: animal (skull) (Methods: Personal habit) (Resources: / / Output: garbage (animal carcasses) (Influence on Quality: / / Influence on Availability: / / Influence on Consumption: /											0.000		
xMR_04: Activity: decide on harmfulness (input: garbage (Methods: Information about harmfulness) (Resources: / / Output: decision (garbage) (Influence on Quality: wrong assessment of harmfulness) (Influence on Availability: / / Influence on Consumption: /		40%				0.210%					0.120	2%	11
xMR_05: Activity: select disposal option (input: decision (garbage) (Methods: Personal knowledge) (Resources: Group event) (Output: decision (disposal option) (Influence on Quality: Wrong decision disposal option) (Influence on Availability: / / Influence on Consumption: /		20%		0.20%				0.20%			0.120	2%	10
xMR_06: Activity: select disposal location (input: decision (disposal option) (Methods: Visualization) (Resources: / / Output: decision (disposal location) (Influence on Quality: Wrong decision disposal location) (Influence on Availability: / / Influence on Consumption: /		30%	1.30%			0.010%	0.010%				0.420	0%	6
xMR_07: Activity: dispose garbage (input: decision (disposal location) (Methods: / / Resources: / / Output: garbage (disposed) (Influence on Quality: / / Influence on Availability: Long distance to the trash can) (Influence on Consumption: Take time to search trash can)		80%		0.210%	0.140%	0.20%	0.10%	0.210%	0.210%		1.098	30%	1
xMR_08: Activity: develop garbage removal plan (input: garbage removal legal (Methods: Team brainstorming) (Resources: Microsoft Excel) (Output: removal plan) (Influence on Quality: / / Influence on Availability: / / Influence on Consumption: /											0.000		
xMR_09: Activity: include garbage removal (input: removal plan) (Methods: Calendar entry) (Resources: / / Output: removal (trash can) (Influence on Quality: / / Influence on Availability: Putting time delay) (Influence on Consumption: /		30%									0.000		
xMR_10: Activity: assign garbage removal responsibility (input: / / Methods: Presentation skill) (Resources: / / Output: removal plan) (Influence on Quality: / / Influence on Availability: / / Influence on Consumption: Expected responsibility not met)		80%									0.000		
xMR_11: Activity: assign garbage removal responsibility (input: / / Methods: Purchasing) (Resources: Trashbin, gloves, mask, broom, dustpan) (Output: removal plan) (Influence on Quality: / / Influence on Availability: / / Influence on Consumption: Missing the necessary tools)		20%		0.210%				0.420%			0.220	0%	7
xMR_12: Activity: empty the trash can (input: trash can full) (Methods: These garbage in the trash bin) (Resources: Trash bin, gloves, mask) (Output: trash can empty) (Influence on Quality: Carrying trashbin outside) (Influence on Availability: / / Influence on Consumption: /		80%									0.000		
xMR_13: Activity: clean the ground (input: ground/litter) (Methods: Garbage collecting) (Resources: Gloves, mask, broom, dustpan) (Output: ground/litter) (Influence on Quality: ground is not cleaned completely) (Influence on Availability: / / Influence on Consumption: Requiring good air flow)		80%	1.40%		0.140%		0.210%		0.210%		0.947	10%	2
Results for: Determination of Outputs (Y) by Influences (xI)													
risk-weighted Product Sum of the Determination of each Output (Y) by the Influences (xI & xP)		0.001	0.001	2.001	1.100	0.200	1.500	0.100	0.100				
risk-weighted Product Sum of the Determination of each Output (Y) by the Influences (xI & xP)		2%	12%	3%	21%	4%	24%	0%	0%				
Ranking of the risk-weighted Determination of each Output (Y) by the Influences (xI & xP)		4	4	1	3	5	2	7					

Results

- The C&E Heatmap indicates 42 relationships which are more or less strong between influences from inputs and outputs, simultaneously 18 relationships are highlighted between the influences from process-steps and outputs. These relationships are built from information & data of the C&E matrix
- 14 of them are highlighted in red (strong relationship), 25 in yellow (middle-strong relationship) and 11 green (weak relationship)
- The top 3 risks are 37 % (1st risk-Y_03), 24 % (2nd risk-Y_06) and 21 % (3rd risk-Y_04) relatively near to each other and clearly separated to the 4st risk-Y_02 (12 %), 5st risk-Y_05 (4 %), 6st risk-Y_01 (2 %) and 7st risk-Y_07 (~0 %)
- 6 activities (xMR_01, xMR_02, xMR_03, xMR_08, xMR_09, xMR_10) from process-steps show no probability and no relationship

Interpretation and implication

- Highest ranking of the risk-weighted Determination is Output Y_03 (37%) by the Influences (xI & xP). Y_03 is very important output
- 2nd ranking of the risk-weight is Output Y6 (24%) by the Influences (xI & xP)
- Highest ranking of the risk-weighted Impact is Influence xMR_07 on all Outputs (Y)
- 2nd ranking of the risk-weighted Impact is Influence xI_03 on all Outputs (Y)

... of the 10 Inputs (xI) and 13 Activities (xMR) on the Problems of the 7 Outputs (Y)

3-level ordinal scales might not be suitable for regression/ correlation
In statistics we always want to differetiatier as much as we can, to allow dispersion
You can always recode data of used scale down (from 6 to 3) but you can never upscale data

Data Collection Plan for the Outputs (Y) ...

Data Collection Plan													Recommendations for first Analysis:		
Ranking of Influences (xi & xMR) and Outputs (Y)	Influences (xi & xMR) and Outputs (Y)	What should be measured?	Please specify the measurand (e.g. Time)	Please specify the units of the measurand (e.g. days)	Please specify the Target and its Specification Limits if known - in the format: Target: USL: LSL:	Which different values can the Measurand take? (Scale of Data)	How should the Data be collected?	Is a Measurement-System-Analysis (MSA) necessary?	Which Data about the circumstances should additionally be collected? (Blocking/ Condition-Variables)	How large should the Sample Size be?	Where should the Data be collected? (Location/ Source)	For which Time Interval should the Data be collected? (Start/ End)	Which Variable-Name will you assign to the Measurand?	In which File will the Data be stored?	Who is responsible for the collection of the data?
Output (Y)															
6	Y_01 Problem: GROUND(CLEANED) CLEANING-EFFORT > 8 WORKING HOURS PER WEEK	Effort to clean the ground around a trash-can	Time	working hours	Target: 6 USL: 8 LSL: 4	Data discrete or continuous (Cardinal-Scale)	collect new data	no	day; team; area	20	Trung Hung harvest area	05.15.2022 - 05.30.2022	Y_01_Effort	Littering_project_Output.xlsx	Luong Van Tim
4	Y_02 Problem: TRASH-CAN(EMPTY) VISIBILITY/ ATTRACTION TOO LOW	location for trash-cans attraction	3 level rating scale	Grade 1 2 3	Target: 3 LSL: 2	Data Rank Ordered (Ordinal-Scale)	collect new data	no	cultivation area: , riverside, sidewalk	20	Trung Hung harvest area	05.15.2022 - 05.30.2022	Y_02_Visibility	Littering_project_Output.xlsx	Luong Van Tim
1	Y_03 Problem: GROUND(CLEANED) PIECES LEFT > 20	Number of garbage pieces surrounding trash cans	Amount	Number of pieces within a radius of 5 meters around a trash-can	Target: 10 USL: 20	Data discrete or continuous (Cardinal-Scale)	collect new data	no	Garbage-Type, e.g.: Bottles, boxes, plastic bags, animal carcasses, leftovers, pesticide shells.	40	Trung Hung harvest area	05.15.2022 - 06.05.2022	Y_03_Pieces	Littering_project_Output.xlsx	Luong Van Tim
3	Y_04 Problem: GARBAGE(DISPOSED) LOCATION WRONG	Number of garbage piece's locations are wrong	Amount	Number of wrong pieces's location in trash-cans and on the ground	Target: 6 USL: 14	Data discrete or continuous (Cardinal-Scale)	collect new data	no	Garbage-Type, e.g.: Bottles, boxes, plastic bags, animal carcasses, leftovers, pesticide shells.	20	Trung Hung harvest area	05.15.2022 - 05.30.2022	Y_04_Location	Littering_project_Output.xlsx	Luong Van Tim
5	Y_05 Problem: REMOVAL(SCHEDULE) GARBAGE IN TRASH-CAN FULL	habit strength of throwing away garbage in public	3 level rating scale	Grade 1 2 3	Target: 3 LSL: 2	Data Rank Ordered (Ordinal-Scale)	collect new data	no	day; team; area	20	Trung Hung harvest area	05.15.2022 - 05.30.2022	Y_05_Full	Littering_project_Output.xlsx	Luong Van Tim
2	Y_06 Problem: DECISION(GARBAGE) HARMFULNESS WRONG	habit strength of throwing away garbage in public	6 level rating scale	Grade 1...6	Target: 5 LSL: 2	Data Rank Ordered (Ordinal-Scale)	collect new data	no	age, gender, socioeconomic status	30	Trung Hung harvest area	05.15.2022 - 05.30.2022	Y_06_Harmfulness	Littering_project_Output.xlsx	Luong Van Tim
7	Y_07 Problem: GROUND(CLEANED) FLYING INSECT SOUND NOISE	flying insect sound noise level	3 level rating scale	Grade 1 2 3	Target: 3 LSL: 2	Data Rank Ordered (Ordinal-Scale)	collect new data	no	day; team; area	10	Trung Hung harvest area	05.15.2022 - 05.30.2022	Y_07_Sound	Littering_project_Output.xlsx	Luong Van Tim

Interpretation and implication

Determine subject for the measurement, measurand and the unit of measurement, target and specification limits, scale level of the data, Type of data collection, MSA, conditions and circumstances, sample size, location and source, time interval, name of the variables, name of the data, responsible persons

Results

- The detail plan for new data collection of
- All 7 Outputs
 - All 13 Influences of the Inputs (Xi)
 - Has 8 in 13 Influences of the Processes (Xp)

... All 7 Outputs are planned to collect data

Data Collection Plan for the Influences of the Inputs (xI) ...

Ranking of Influences (xI & xMR) and Outputs (Y)	Influences (xI & xMR) and Outputs (Y)	What should be measured?	Please specify the measurand (e.g. Time)	Please specify the units of the measurand (e.g. days)	Please specify the Target and its Specification Limits if known - In the format: Target: USL: LSL:	Which different values can the Measurand take? (Scale of Data)	How should the Data be collected?	Is a Measurement-System-Analysis (MSA) necessary?	Which Data about the circumstances should additionally be collected? (Blocking-/ Condition-Variables)	How large should the Sample Size be?	Where should the Data be collected? (Location/ Source)	For which Time Interval should the Data be collected? (Start/ End)	Which Variable-Name will you assign to the Measurand?	In which File will the Data be stored?	Who is responsible for the collection of the data?
Influences from Input (xI) (= Causes)															
9	xI_01: Input: trash-can(full) negative Influence: overfilled	filling level	4 level rating scale	4 level rating scale (empty, half filled, full, overfilled)	USL: overfilled	Data Rank Ordered (Ordinal-Scale)	collect new data	no	day; area; time	20	Trung Hung harvest area	05.20.2022 - 06.10.2022	XI_01_Over	Littering_Project_xI.xlsx	Luong Van Tim
16	xI_02: Input: trash-can(full) negative Influence: emptying difficult	difficulty level	3 level rating scale	Grade 1 2 3	Target: 3 LSL: 2	Data Rank Ordered (Ordinal-Scale)	collect new data	no	day; gender; area	10	Trung Hung harvest area	05.20.2022 - 06.10.2022	XI_02_Empty	Littering_Project_xI.xlsx	Luong Van Tim
2	xI_03: Input: ground(littered) negative Influence: Garbage still on the ground	Garbage on the ground level	Amount	Grade 1 2 3	Target: 3 LSL: 2	Data Rank Ordered (Ordinal-Scale)	collect new data	no	Garbage-Type, e.g.: Bottles, boxes, plastic bags, animal carcasses, leftovers, pesticide shells.	30	Trung Hung harvest area	05.20.2022 - 06.10.2022	XI_03_Ground	Littering_Project_xI.xlsx	Luong Van Tim
4	xI_04: Input: ground(littered) negative Influence: Garbage is throw n on the ground	number of littering times	selection	Number of personal thrown garbage on the ground	Target: 3 USL: 5 LSL: 0	Data discrete or continuous (Cardinal-Scale)	collect new data	no	day; area; time	20	Trung Hung harvest area	05.20.2022 - 06.10.2022	XI_04_Throw	Littering_Project_xI.xlsx	Luong Van Tim
12	xI_05: Input: ground(littered) negative Influence: Villager ignoring	villager attention	6 level rating scale	Grade 1...6	Target: 4 LSL: 2	Data Rank Ordered (Ordinal-Scale)	collect new data	no	age, gender, socioeconomic status	15	Trung Hung harvest area	05.20.2022 - 06.10.2022	XI_05_Ignoring	Littering_Project_xI.xlsx	Luong Van Tim
10	xI_06: Input: gargabge removal target negative Influence: does not have sanctions	available sanctions	selection	Yes / No / Not sure	Target: Yes	Data in > 2 Levels (Nominal-Scale)	collect new data	no	age, gender, socioeconomic status	15	Trung Hung harvest area	05.20.2022 - 06.10.2022	XI_06_Sanction	Littering_Project_xI.xlsx	Luong Van Tim
8	xI_07: Input: gargabge removal target negative Influence: Lack of aw areness	awareness	6 level rating scale	Grade 1...6	Target: 2 USL: 4	Data Rank Ordered (Ordinal-Scale)	collect new data	no	age, gender, socioeconomic status	10	Trung Hung harvest area	05.20.2022 - 06.10.2022	XI_07_Awareness	Littering_Project_xI.xlsx	Luong Van Tim
14	xI_08: Input: pesticide (packaged) negative Influence: throw n away confusedly	thrown away pesticide (packaged) confusedly	selection	Yes / No	Target: No	Data in 2 Levels (Nominal-Scale)	collect new data	no	Garbage-Type, e.g.: Bottles, boxes, plastic bags, animal carcasses, leftovers, pesticide shells.	15	Trung Hung harvest area	05.20.2022 - 06.10.2022	XI_08_Confuse	Littering_Project_xI.xlsx	Luong Van Tim
15	xI_09: Input: animal (dead) negative Influence: Widespread decomposition	Widespread animal (dead) decomposition	selection	Yes / No	Target: No	Data in 2 Levels (Nominal-Scale)	collect new data	no	Garbage-Type, e.g.: Bottles, boxes, plastic bags, animal carcasses, leftovers, pesticide shells.	10	Trung Hung harvest area	05.20.2022 - 06.10.2022	XI_09_Decomposition	Littering_Project_xI.xlsx	Luong Van Tim
5	xI_10: Input: food (packaged) negative Influence: Throw indiscriminately	Throw food (packaged) indiscriminately	Amount	Number of pieces within a radius of 5 meters around a trash-can	Target: 1 USL: 5	Data discrete or continuous (Cardinal-Scale)	collect new data	no	Garbage-Type, e.g.: Bottles, boxes, plastic bags, animal carcasses, leftovers, pesticide shells.	15	Trung Hung harvest area	05.20.2022 - 06.10.2022	XI_10_Indiscriminate	Littering_Project_xI.xlsx	Luong Van Tim

... All 13 Influences of the Inputs (xI) are planned to collect data

Data Collection Plan for the Processes (xMR) ...

Influences from Input (xI) (= Causes)															
Influences from Process-Step (xMR) (= Causes)															
	xMR_01: Activity: consume food Input: food (packaged) Methods: Personal habit Resources: <i>J.</i> Output: garbage (domestic waste) Influence on Quality: <i>J.</i> Influence on Availability: <i>J.</i> Influence on Consumption: <i>J.</i>					...?	...?	...?							
	xMR_02: Activity: consume pesticide Input: pesticide (packaged) Methods: Personal habit Resources: <i>J.</i> Output: garbage (pesticide shells) Influence on Quality: <i>J.</i> Influence on Availability: <i>J.</i> Influence on Consumption: <i>J.</i>					...?	...?	...?							
	xMR_03: Activity: animal carcasses dispose Input: animal (dead) Methods: Personal habit Resources: <i>J.</i> Output: garbage (animal carcasses) Influence on Quality: <i>J.</i> Influence on Availability: <i>J.</i> Influence on Consumption: <i>J.</i>					...?	...?	...?							
11	xMR_04: Activity: decide on harmfulness Input: garbage Methods: Information about harmfulness Resources: <i>J.</i> Output: decision(garbage) Influence on Quality: wrong assessment of harmfulness Influence on Availability: <i>J.</i> Influence on Consumption: <i>J.</i>	knowledge about the harmfulness	6 level rating scale	Grade 1...6	Target: 4 LSL: 2	Data Rank Ordered (Ordinal-Scale)	collect new data	no	day; area; time	20	Trung Hung harvest area	05.25.2022 - 06.15.2022	XP_04_Decide	Littering_Project_xMR.xlsx	Luong Van Tim
13	xMR_05: Activity: select disposal option Input: decision(garbage) Methods: Personal knowledge Resources: Google search Output: decision(disposal option) Influence on Quality: Wrong decision disposal option Influence on Availability: <i>J.</i> Influence on Consumption: <i>J.</i>	estimated harmfulness wrong	selection	Yes / No	Target: No	Data in 2 Levels (Nominal-Scale)	collect new data	no	day; area; time	10	Trung Hung harvest area	05.25.2022 - 06.15.2022	XP_05_Option	Littering_Project_xMR.xlsx	Luong Van Tim
6	xMR_06: Activity: select disposal location Input: decision(disposal option) Methods: Visualization Resources: <i>J.</i> Output: decision(disposal location) Influence on Quality: Wrong decision disposal location Influence on Availability: <i>J.</i> Influence on Consumption: <i>J.</i>	decision wrong disposed location	selection	Yes / No	Target: No	Data in 2 Levels (Nominal-Scale)	collect new data	no	day; area; time	20	Trung Hung harvest area	05.25.2022 - 06.15.2022	XP_06_Location	Littering_Project_xMR.xlsx	Luong Van Tim
1	xMR_07: Activity: dispose garbage Input: decision(disposal location) Methods: <i>J.</i> Resources: <i>J.</i> Output: garbage(disposed) Influence on Quality: <i>J.</i> Influence on Availability: Long distance to the trash-can Influence on Consumption: Take time to search trash-can	Distance between the typical consumption place and the nearest trash can	distance	meter	Target: 10 USL: 20	Data discrete or continuous (Cardinal-Scale)	collect new data	no	cultivation area: , riverside, sidewalk	20	Trung Hung harvest area	05.25.2022 - 06.15.2022	XP_07_Dispose	Littering_Project_xMR.xlsx	Luong Van Tim
	xMR_08: Activity: develop garbage removal plan Input: garbage removal target Methods: Team brainstorming Resources: Microsoft Excel Output: removal(plan) Influence on Quality: <i>J.</i> Influence on Availability: <i>J.</i> Influence on Consumption: <i>J.</i>					...?	...?	...?							
	xMR_09: Activity: schedule garbage removal Input: removal(plan) Methods: Calendar-entry Resources: <i>J.</i> Output: removal(schedule) Influence on Quality: <i>J.</i> Influence on Availability: Planning time delay Influence on Consumption: <i>J.</i>	delay plan	selection	Yes / No	Target: No	Data in 2 Levels (Nominal-Scale)	collect new data	no	day; gender; area; time	10	Trung Hung harvest area	05.25.2022 - 06.15.2022	XP_09_Schedule	Littering_Project_xMR.xlsx	Luong Van Tim
	xMR_10: Activity: assign garbage removal manpower Input: <i>J.</i> Methods: Persuasion skill Resources: <i>J.</i> Output: removal(team) Influence on Quality: <i>J.</i> Influence on Availability: <i>J.</i> Influence on Consumption: Expected manpower is not enough					...?	...?	...?							
7	xMR_11: Activity: assign garbage removal equipment Input: <i>J.</i> Methods: Purchasing Resources: Trash-bin, gloves, masks, brooms, dustpans Output: removal(equipment) Influence on Quality: <i>J.</i> Influence on Availability: <i>J.</i> Influence on Consumption: Missing the necessary tools	equipment	selection	Lack / Enough / Redundant	Target: Enough	Data in > 2 Levels (Nominal-Scale)	collect new data	no	day; equipment; time	10	Trung Hung harvest area	05.25.2022 - 06.15.2022	XP_11_Equipment	Littering_Project_xMR.xlsx	Luong Van Tim
	xMR_12: Activity: empty the trash-can Input: trash-can(full) Methods: Throw garbage in the trash-bin Resources: Trash-bin, gloves, masks Output: trash-can(empty) Influence on Quality: Dumping trash-bin uncleanly Influence on Availability: <i>J.</i> Influence on Consumption: <i>J.</i>	trash-bin status	selection	Clean / Not clean	Target: Clean	Data in 2 Levels (Nominal-Scale)	collect new data	no	day; people; time	10	Trung Hung harvest area	05.25.2022 - 06.15.2022	XP_12_Dumpling	Littering_Project_xMR.xlsx	Luong Van Tim
3	xMR_13: Activity: clean the ground Input: ground(dirtied) Methods: Garbage collecting Resources: Gloves, masks, brooms, dustpans Output: ground(cleaned) Influence on Quality: ground is not cleaned completely Influence on Availability: <i>J.</i> Influence on Consumption: Require big deal of effort	ground cleanliness	selection	Yes / No	Target: Yes	Data in 2 Levels (Nominal-Scale)	collect new data	no	Garbage-Type, e.g.: Bottles, boxes, plastic bags, animal carcasses, leftovers, pesticide shells.	30	Trung Hung harvest area	05.25.2022 - 06.15.2022	XP_13_Clean	Littering_Project_xMR.xlsx	Luong Van Tim

On the basis of the scale level recommendations are given for ...

[illegible]

Results

After the basis of the scale level, each Output (Y), Influence (xI & xMR) is given recommendation for:

- Graphical Representation
- Parameter of Central Tendency
- Dispersion Parameter
- Process-Capability
- Control-Charts
- Test of one Sample vs. Limit/ Target

Interpretation and implication

- Appropriate charts for graphical representations of the data, the appropriate statistical parameters, procedures to calculate the process capability, appropriate control charts and one-sample tests
- Green means full recommendation. Yellow means might interpret the results with reservation

... how to process and graphically display these collection data ✓

Input and process driven 3 chosen hypothesis ...

1.	Risk	Y_03: Output: ground(cleaned) [Degree of: Amount (Number of pieces within a radius of 5 meters around a trash-can)]	
	28.89%	There is a/ no Relationship between: xI_10: Input: food (packaged) [Degree of: Amount (Number of pieces within a radius of 5 meters around a trash-can)] and: Y_03: Output: ground(cleaned) [Degree of: Amount (Number of pieces within a radius of 5 meters around a trash-can)] according to the Principle: The larger the value of x, the larger (resp. smaller) is the value of Y.	
	Relationship Hypothesis	Product-Moment-Correlation (Pearson)/ General Regression	
2.	Risk	Y_04: Output: garbage(disposed) [Degree of: Amount (Number of wrong pieces's location in trash-cans and on the ground)]	
	21.42%	There is a/ no Relationship between: xI_07: Input: gargabge removal target [Ranking Position of: 6 level rating scale (Grade 1...6)] and: Y_04: Output: garbage(disposed) [Degree of: Amount (Number of wrong pieces's location in trash-cans and on the ground)] according to the Principle: The larger the value of x, the larger (resp. smaller) is the value of Y.	
	Relationship Hypothesis	Rank Correlation (Spearman)/ General Regression	
3.	Risk	Y_06: Output: decision(garbage) [Ranking Position of: 6 level rating scale (Grade 1...6)]	
	62.26%	There is a/ no Relationship between: xMR_07: Activity: dispose garbage [Degree of: distance (meter)] and: Y_06: Output: decision(garbage) [Ranking Position of: 6 level rating scale (Grade 1...6)] according to the Principle: The larger the value of x, the larger (resp. smaller) is the value of Y.	
	Relationship Hypothesis	Rank Correlation (Spearman)/ Ordinal-Logistic-Regression/ General Regression	

Interpretation and implication

- Hypothesis testing is a form of inferential statistics that allows to draw conclusions about an entire population based on a representative sample, it gains tremendous benefits
- The input driven hypotheses are more or less questionable in their severity. For example, the more general garbage on the ground will indicate more food packages and plastic bag on the ground in a radius 5 meters
- Some hypotheses have high relationships with each other, but we need to consider the possibility and difficulty of testing. Not the highest is the best, we have to find the most suitable hypotheses

Results

- Three main hypotheses were chosen
- Hypothesis 1 is related to garbage around trash-cans relating to food packages, plastic bags, and bottles
- Hypothesis 2 is related to the awareness of villagers about the emergency environmental protection
- Hypothesis 3 relates the attitude of littering and fast dispose garbage (take time to search trash-can) with wrong decision of garbage harmfulness

... The largest to smallest risks are 62.26 %, 28.89% and 21.42%

Great, that you also tried this.

Formulate additional hypotheses to create additional hypotheses ...

Hypotheses	Relationship-Hypothesis: Y= f(x)					
There is a relationship between: Variable/ Measurand x	... and ...	Variable/ Measurand Y	Scale-Level: x	Scale-Level: Y	Graphical Representation:	Statistical Test:
			nominal/ ordinal/ cardinal	nominal/ ordinal/ cardinal	Scatterplot/ Bar Chart	Chi-Square/ Correlation/ Regression
Completeness of cleaning equipment (X)	... and ...	Level of cleanliness (Y)	Ordinal	Ordinal	Scatterplot	Correlation / Regression

Hypotheses	Difference-Hypothesis Y1= Y2					
There is a difference in: Variable/ Measurand Y	between levels of:	Variable/ Measurand x	Scale-Level: Y	Scale-Level: x	Graphical Representation:	Statistical Test:
			nominal/ ordinal/ cardinal	nominal/ ordinal/ cardinal	Box-Plot/ Line-Chart	Chi-Square/ t-Test/ ANOVA
Comsume food and drink in public (Y)	between levels of:	Gender (X)	Ordinal	Nominal	Box-Plot	t-Test
Comsume food and drink in public (Y)	between levels of:	Relationship Age (X)	Ordinal	Ordinal	Box-Plot	ANOVA

Interpretation and implication

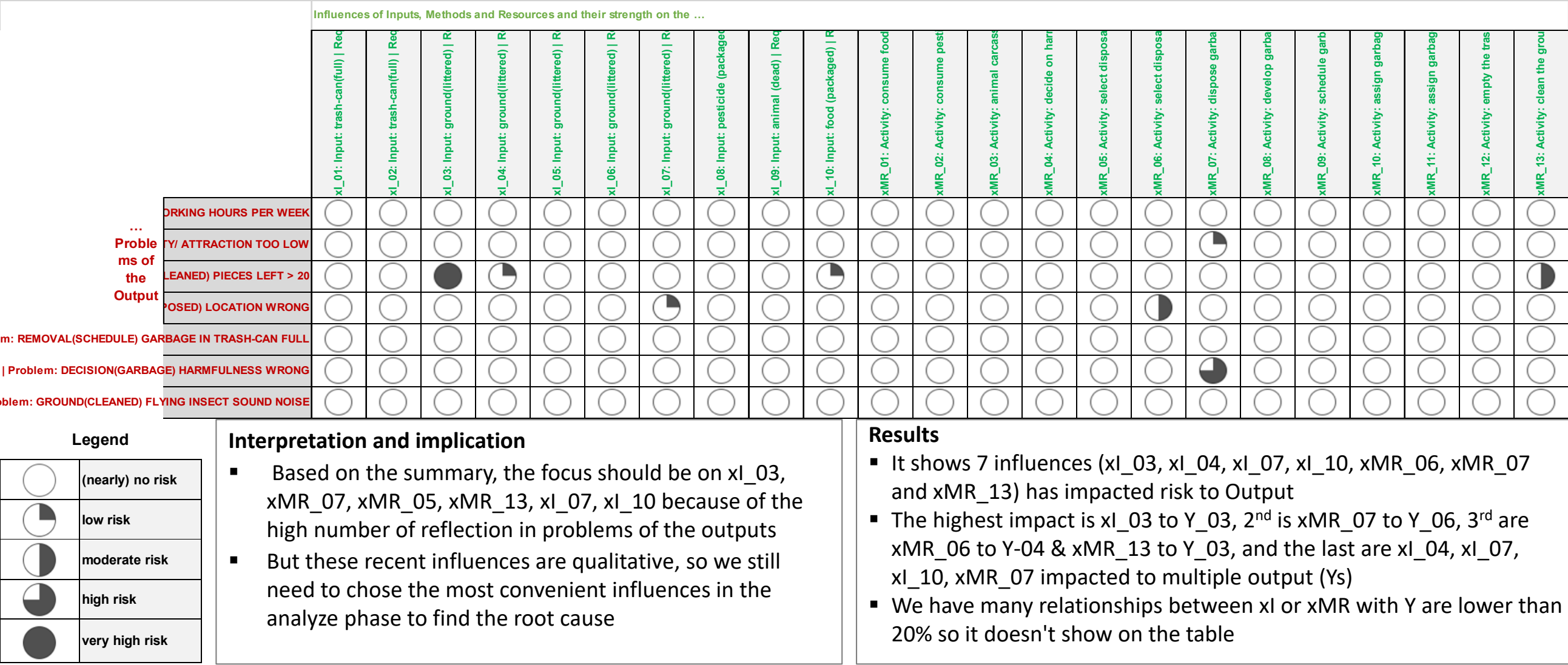
- The first hypothesis propose a relationship between completeness of cleaning equipment and level of cleanliness. For example if they do not have enough trash-can, it increase the garbage on the ground
- The second and third hypotheses were proposed to study the difference between people consume food and drink in public. Consume food and drink in public can be the main reason of garbage on the ground. Because it motivates people to throw garbage away

Results

- The additional hypotheses show:
- 2 difference hypotheses and 1 relationship hypothesis are formulated
 - Ordinal and Nominal scale levels are used to formulate
 - Regression, t-Test and ANOVA are applied
 - Scatterplot and Box-plot are graphically

... for influences and problems not included in the Data-Collection-Plan

Summarize the most important risks from the C&E Heatmap ...



40 villagers interviewed results based on questionnaire (enclosed in the Standard-Project_Files) ...

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
	Q1_Y_Consume	Q2_Y_Frequency	Q3_Y_Metal	Q3_Y_Plastic	Q3_Y_Paper	Q3_Y_Animal	Q3_Y_Leftovers	Q3_Y_Pesticide	Q4a_x_Stress	Q6_x_TrashCan-Suppl
1	4	6	4	3	1	5	2	6	3	
2	3	5	3	4	2	6	1	5	2	
3	4	4	4	3	1	6	2	5	1	
4	3	3	3	1	2	6	4	5	1	
5	3	4	5	1	2	6	3	4	3	
6	3	4	3	1	2	6	4	5	4	
7	4	5	1	4	2	6	3	5	3	
8	5	3	4	2	1	5	3	6	2	
9	4	5	3	2	1	5	4	6	2	
10	3	3	4	2	3	5	1	6	1	
11	1	2	3	2	1	4	5	6	1	
12	4	5	4	3	1	5	6	2	3	
13	6	4	5	3	2	4	1	6	4	
14	3	2	1	4	3	6	1	5	2	
15	4	4	6	1	2	4	3	5	3	
16	6	6	1	3	2	5	4	6	4	
17	3	3	1	2	3	4	5	6	2	
18	6	4	3	2	1	6	4	5	3	
19	5	5	6	3	1	2	4	5	2	
20	4	4	4	2	1	6	3	5	4	
21	4	6	5	3	2	6	1	4	3	
22	4	3	6	3	1	2	4	5	3	
23	4	6	3	2	1	6	4	5	2	
24	4	2	2	1	4	5	3	6	1	
25	5	5	2	4	1	5	3	6	1	
26	1	3	3	2	1	6	4	5	6	

Results

- More than 40 villagers were interviewed and to get this 40 available results
- Interviews are done more with male, the major age is 30 – 50 years old.
- Most villagers are in low economic status, so they do not pay attention on environment protection.
- Garbage in village areas can be classified into 6 types: Metal (cans/ screw caps), Plastic (bottles/ cups/bags), Paper (flyer/ newspaper), Animal (carcasses), Leftovers, Pesticide (bottles/ jars)

Interpretation and implication

- It generally can show that villagers ignore the garbage littering, they think throwing garbage away is not a problem
- Villagers believe that their environment recently turn bad, but they seem do not have the obvious action to improve that
- Some villager think they decrease littering in recent years

... to record the type and frequency of littering (Y), to find triggering causes (x) ✓

Collecting data about 1

It would be useful – especially in Minitab but also for other stat. software, to recode: Enough:= 1 and Lack:= 0, and also the yes:= 1 and no:= 0 – as you did it in your questionnaire This will allow to apply the performance indicator calculation and Chi-sq Great, that you extended the questionnaire according to your needs ☺

↓	C1	C2	C3	C4	C5	C6	C7
	C1_Y_Metal	C2_Y_Plastic	C3_Y_Paper	C4_Y_Animal	C5_Y_Leftovers	C6_Y_Pesticide	C7_Y_Garbage
1	1	2	3	2	3	2	13
2	2	6	5	2	2	2	19
3	4	7	3	1	4	1	20
4	4	3	4	2	3	3	19
5	2	6	5	2	2	4	21
6	3	6	7	1	3	4	24
7	3	7	5	3	2	2	22
8	3	4	3	3	1	1	15
9	2	2	5	1	2	4	16
10	5	7	6	2	1	4	25
11	4	5	4	2	3	2	20
12	1	3	5	0	2	2	13
13	5	7	2	4	3	5	26
14	1	7	5	4	4	2	23
15	4	4	1	2	1	6	18
16	2	6	4	2	4	5	23
17	1	7	5	1	2	2	18
18	3	3	5	1	1	1	14
19	4	7	2	2	2	3	20
20	0	7	3	4	2	4	20
21	1	4	6	1	3	1	16
22	3	6	4	3	1	2	19
23	4	5	4	3	4	2	22
24	2	5	6	1	2	2	18
25	5	3	2	1	4	3	18
26	3	3	5	2	4	2	19

↓	C1	C2	C3	C4	C5
	X1_Equipment	X2_Man-power	X3_Time	X4_Salary	X5_Happy
1	Enough	Lack	14	No	No
2	Lack	Lack	13	No	No
3	Lack	Enough	11	No	Yes
4	Lack	Lack	15	No	No
5	Enough	Lack	12	No	No
6	Lack	Lack	12	Yes	No
7	Lack	Enough	14	No	Yes
8	Lack	Enough	13	Yes	No
9	Lack	Lack	14	No	No
10	Enough	Lack	13	No	Yes

X1	Do you have enough equipment for ground cleaning?	<input type="checkbox"/> Lack (0)	<input type="checkbox"/> Enough (1)
X2	Do you have enough manpower for ground cleaning?	<input type="checkbox"/> Lack (0)	<input type="checkbox"/> Enough (1)
X3	How long do you need for ground cleaning in a week?	Give the estimated number (h)	
X4	Are you satisfied with your current salary?	<input type="checkbox"/> No (0)	<input type="checkbox"/> Yes (1)
X5	Are you happy with ground cleaning job?	<input type="checkbox"/> No (0)	<input type="checkbox"/> Yes (1)

Results

- Data of 40 different places near trash can was collected
- 5 questions were added by myself
- Data of 10 member of garbage remover team was collected
- Pesticide and Animal dead is the bad input to enviroment

Interpretation and implication

- All collecting time has number of garbage more than 10
- Every time has lastic piecies
- Most of garbage remover team member think they lack equipment for garbage remover task, lack manpower to finish many job.
- The time for remover usually larger than 8 standard hours per week
- Member share the salary is low and they do not feel happy with their job

... And data of my additional question to garbage remover team

This is another great idea!
I very much appreciate this
😊

Some pictures and voice records ...



MP3 voice record of a 63 years old female interview



MP3 voice record of a 33 years old female interview

... of villager interviews

Results of the MEASURE-Steering

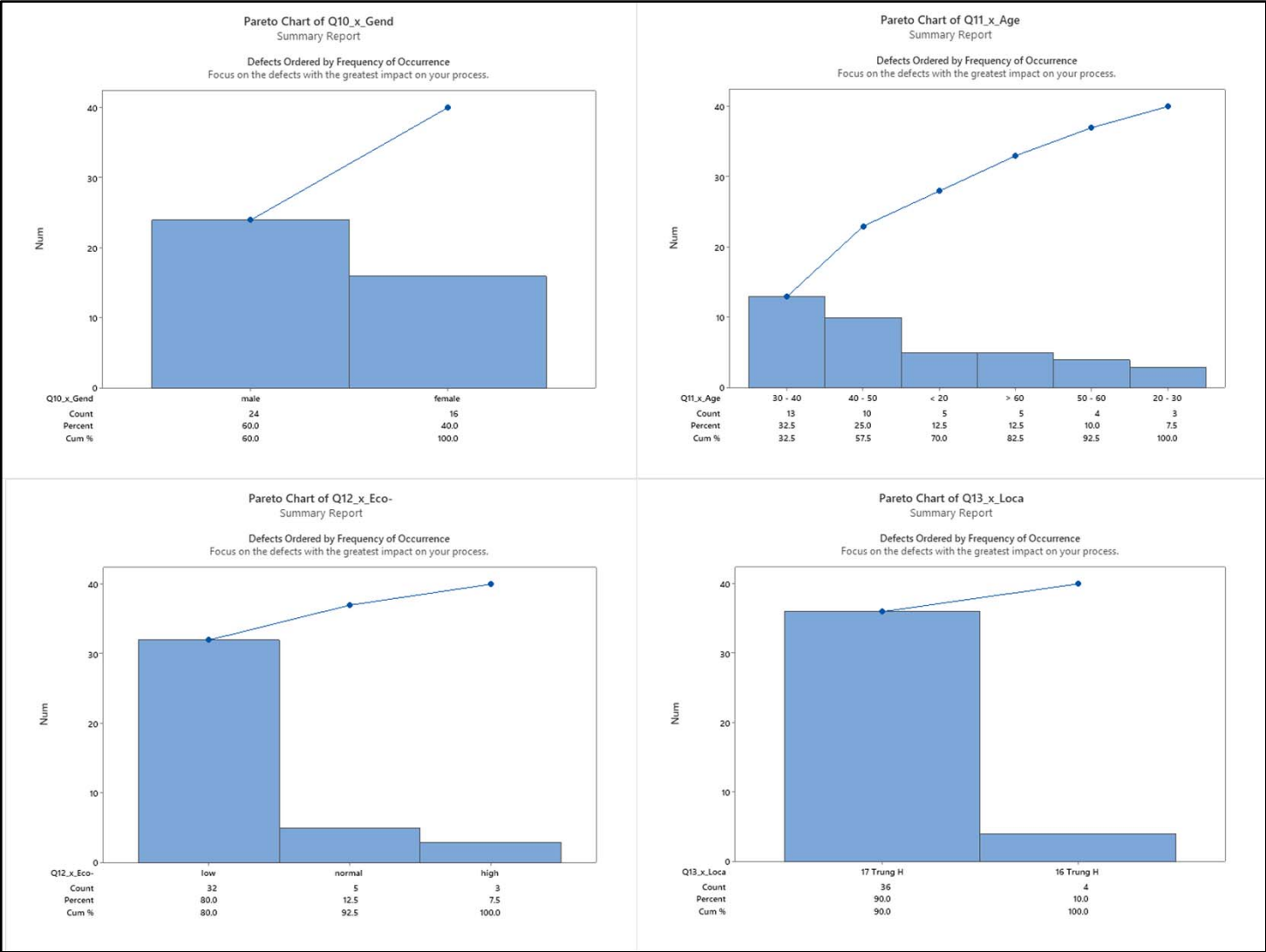
Measure-Steering				
Tool	Application	Documentation	Comment	Decision
Input-Analysis	ok	ok		Master-Black-Belt
Process-Mapping/ -Analysis	ok	ok	See my notes	Dr. Reiner Hutwelker reiner.hutwelker@tum.de
C&E-Matrix & -Heatmap / Summary for Sponsor	ok	ok		30-May-2022
Data-Collection-Plan	ok	ok	See my notes	passed
MSA (optional)	ok	ok		Sponsor
Hypotheses	ok	ok	See my notes	Pham Van Quang Phamvanquang.trunghung@gmail.com
Data-Worksheet	ok	ok	See my notes	31-May-2022
Additional Notes			Dear Tim, this is another great phase of your project. You applied all tools correctly and applied them reasonably. And I can see, that you do this great work and develop additional ideas not just for the certificate – which would be ok – but make a difference! - I very much appreciate that. Please continue this way, append the next phase to this graded version and go to ANALYSE - Reiner	passed
Sponsor Notes			Hi Tim, on behalf of the local government, I would like to say thanks to you. You are doing a good job. You are young, bring new ideas to us about the environment protection theme. Keep going ahead, I empowered you without any local barriers. Just do the right things!.	

Only proceed to the next phase after a positive decision of MBB and Sponsor

Analyse

Data Evaluation, Process Performance, Test of Hypotheses, Root Cause Analysis

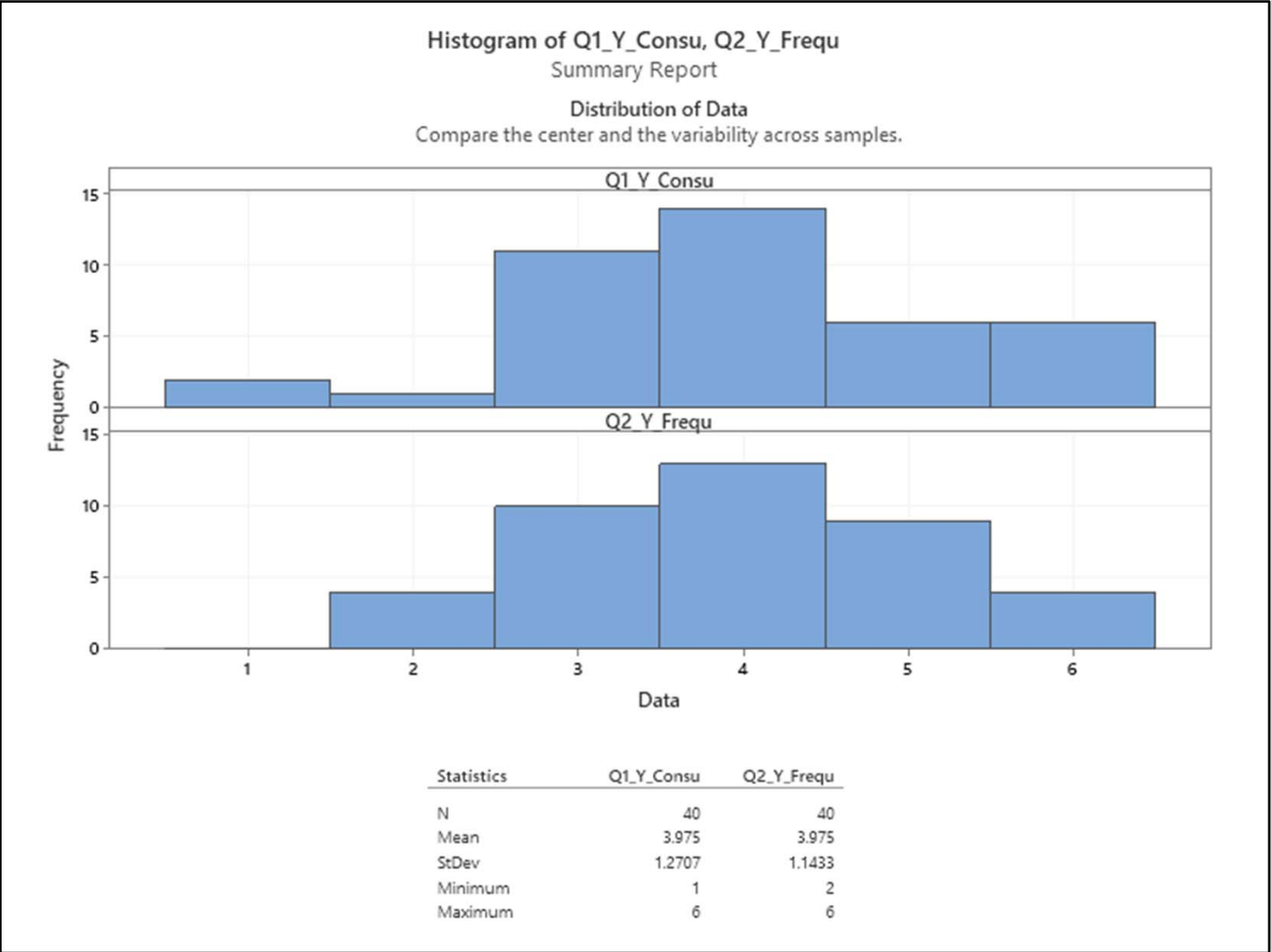
Data & Graphical evaluation of personal answer from 40 interviewees ...



- Results**
- 40 villagers had been willing to answer the interview. 24 males and 16 females. All of them go to the harvest area for daily working.
 - TrungHung village divides by 2 parts: 16th and 17th areas. 90% interviewees from 17th and 10% from 16th area.
 - The major age ranges are 30 – 40 & 40 – 50 years old, it counted 57,5 % of all the interviewees
 - The result shows important information that 80% (32 people) are in low economic status. This result reflects the truth, because most of the TrungHung villagers are farmers

- Interpretation and implication**
- 24 males/ 40 interviewees (60%) makes sense because the village man has main responsibility for farming
 - The people are between 30 – 50 years old, They are of labor age, so it is very easy to meet them at harvest area, < 20 years old, they focus on studying, older than 50 they are retire age. From 20 to 30, they are interested in factory worker
 - The main economic status is low, because the people who live in the countryside (village), their income is very low. So low economic status is very suitable situation in TrungHung village

Graphical evaluation of littering behaviour of participants ...

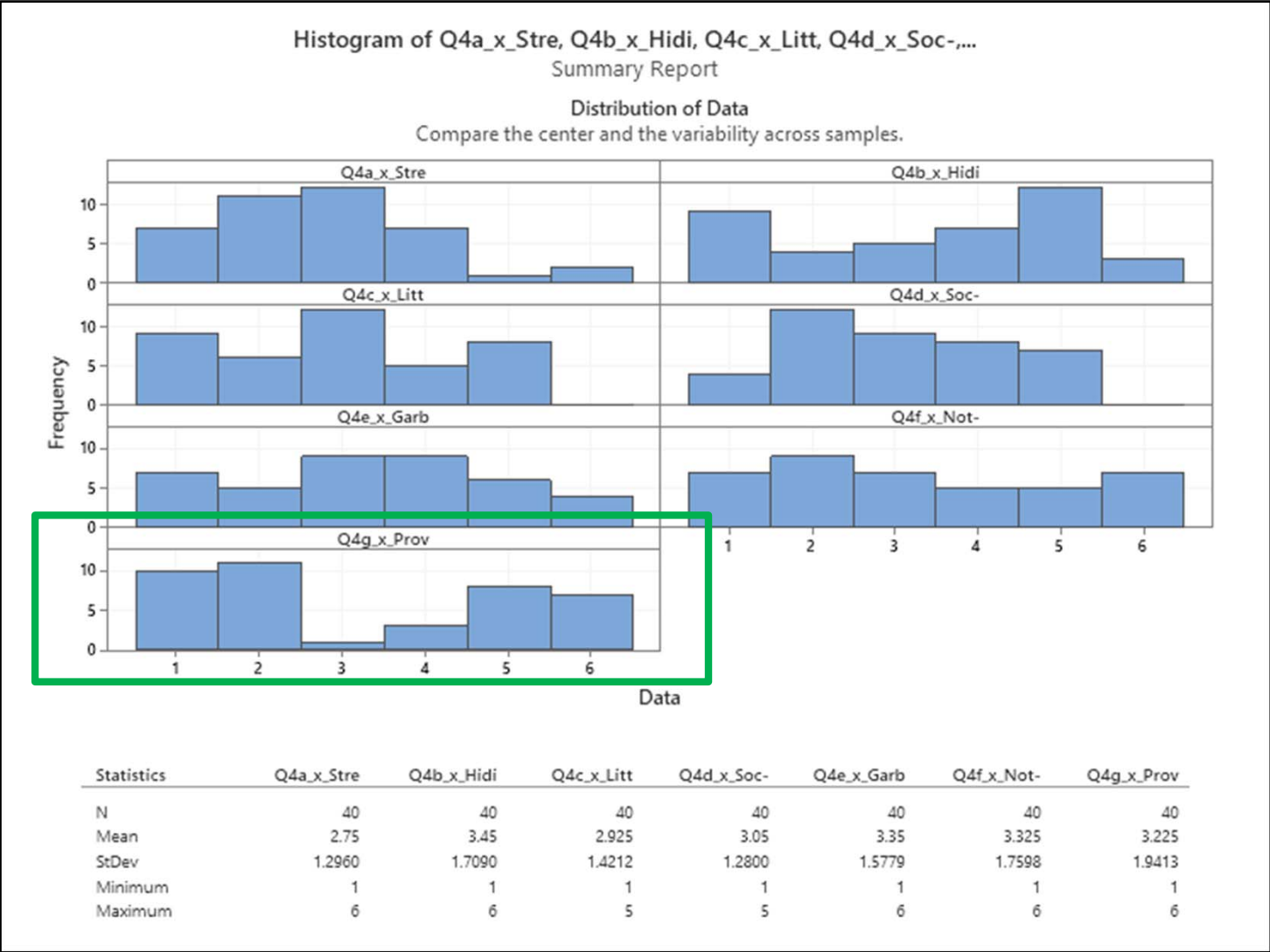


- Results**
- The upper histogram performs the “public consumption frequency” and the lower histogram performs the “the public littering frequency” of 40 villagers
 - Both Q1_public consumption frequency and Q2_public littering frequency mostly focus on answering 3rd & 4th options.
 - Q2 does not have any answer is 1st option, the rest is larger than 1
 - Q1 just has 2 answers are 1st and 1 answer are 2nd , the rest is larger than 2

- Interpretation and implication**
- The interviewees are not hesitate to answer that their frequency of consumption and littering is middle range (from almost never to very often), contrary to expectations that they usually want to hide this to make themselves seem better in front of some straight questions
 - Some honesty answers show that the people usually consume food and litter garbage in public, that can be the big impact to littering in village
 - The main 3rd & 4th options maybe are not correct because people usually want to show their better version, this result can be increased to 4th & 5th. We need to think carefully about this assumption

This bimodal distribution indicates, that there might be a grouping influence, e.g. gender.
Thus: If you identify bimodal distributions then always state a difference-hypothesis on a nominal grouping variable (x)
and test it (if you also collected the respective data for this x)

Graphical evaluation of littering behaviour of participants ...



Results

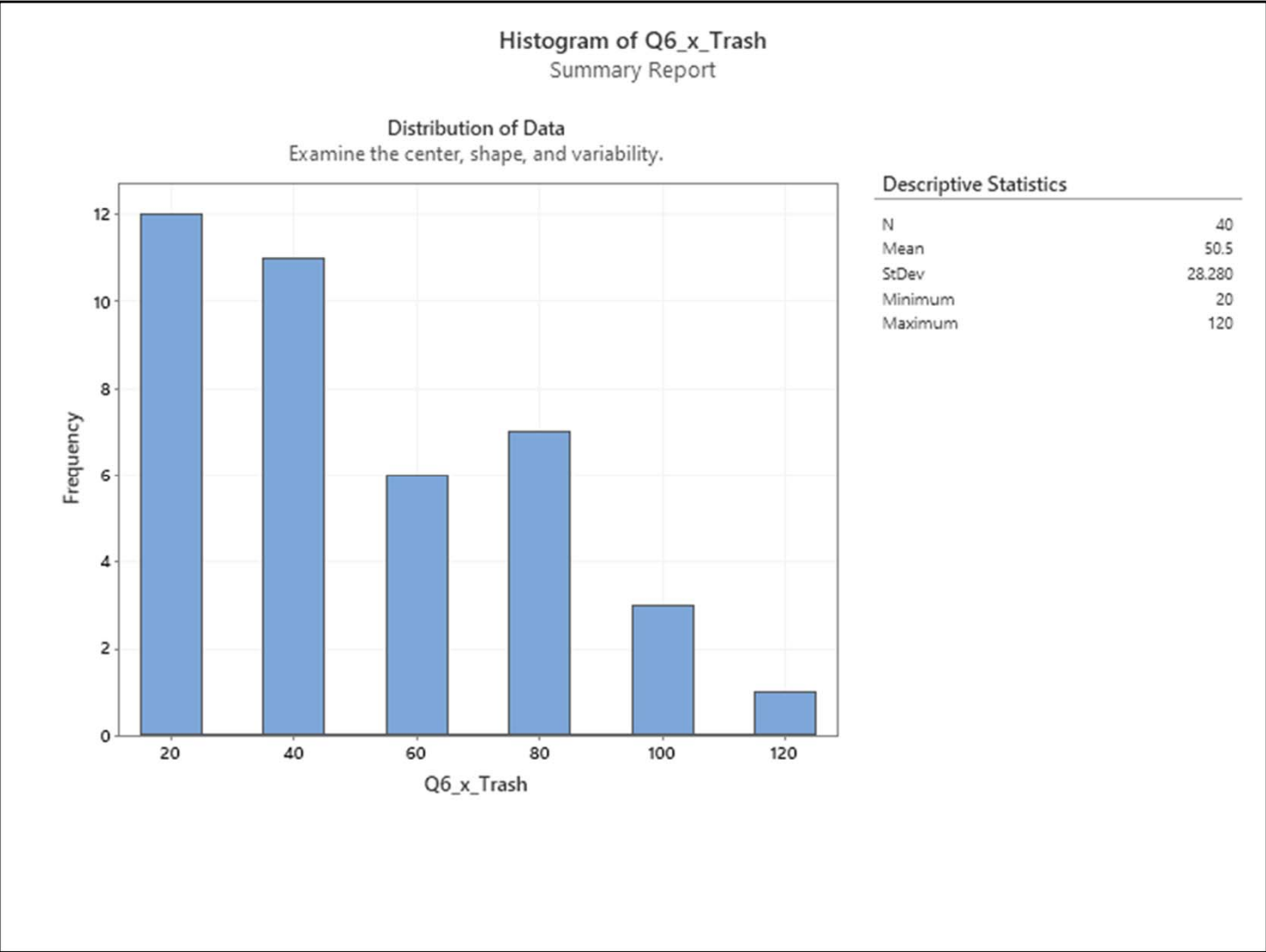
- The collected data has a range with a minimum of 1 and maximum of 6 (1 = almost never ... 6 = very often)
- In 7 statements apply most to interviewees, 5 answer groups have all opinions from 1st to 6th, 2 answer groups just have 1st to 5th opinions
- When people is pressed for time, most of them didn't totally agree that sometimes they throw garbage away
- Q4f (Ignoring) and Q4g (provoke) have 7 times of 6th answer for each.
- About Q4e, opinions are approximately equally distributed

Interpretation and implication

- The villagers are not steadfast for correct garbage throwing when they are pressed for time
- when people throw trash, they don't want to public that
- Villager's awareness of environmental protection is not good
- Has number of people nearly agree that sometimes they put garbage in a place where it can not be seen
- Almost divided the number of answers about provoking other people by throwing garbage on the ground, that shows they may do not want to follow the right garbage disposal

... Part 2 about Q4a & Q4b & Q4c & Q4d & Q4e & Q4f & Q4g by histogram

Graphical evaluation of littering behaviour of participants ...



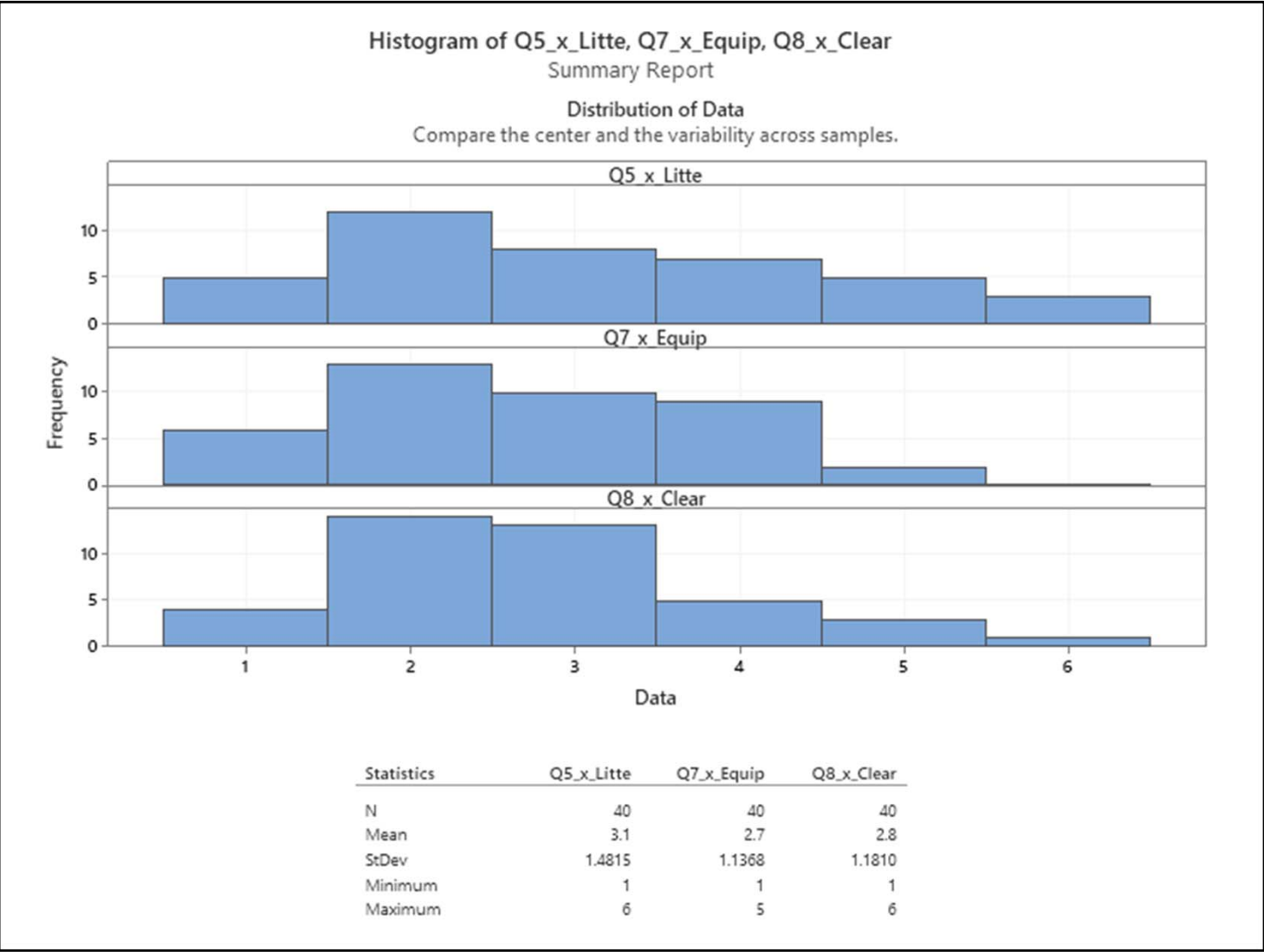
Results

- The collected data is in the valid range with a minimum of 0 (m) and maximum of 120 (m), 120 m means that people carry their garbage infinitely to an available trash-can.
- 13 participants would like to have short distance from their garbage to trash-can, 5 participants choose 20 meters and 8 participants choose range 20 to 40 meters
- Just has 1 participant accept the distance 120 meters

Interpretation and implication

- Participants mainly want to carry their garbage with a shorter distance. This can show us that the villagers do not have a good attitude of environmental awareness
- It is show that there is not much visible difference between the number of participants carrying their trash 20 (m) or 40 (m) and 60 (m) or 80 (m), this lead us to save money with trash-can and clean equipment arrangement
- But it is shown there is very visible difference between the number of participants carrying their trash can 20 (m) or 100 (m), also 120 (m) which can lead us to assumption that this people are well impact by trash-can distance to garbage disposal

Graphical evaluation of littering behaviour of participants ...



Results

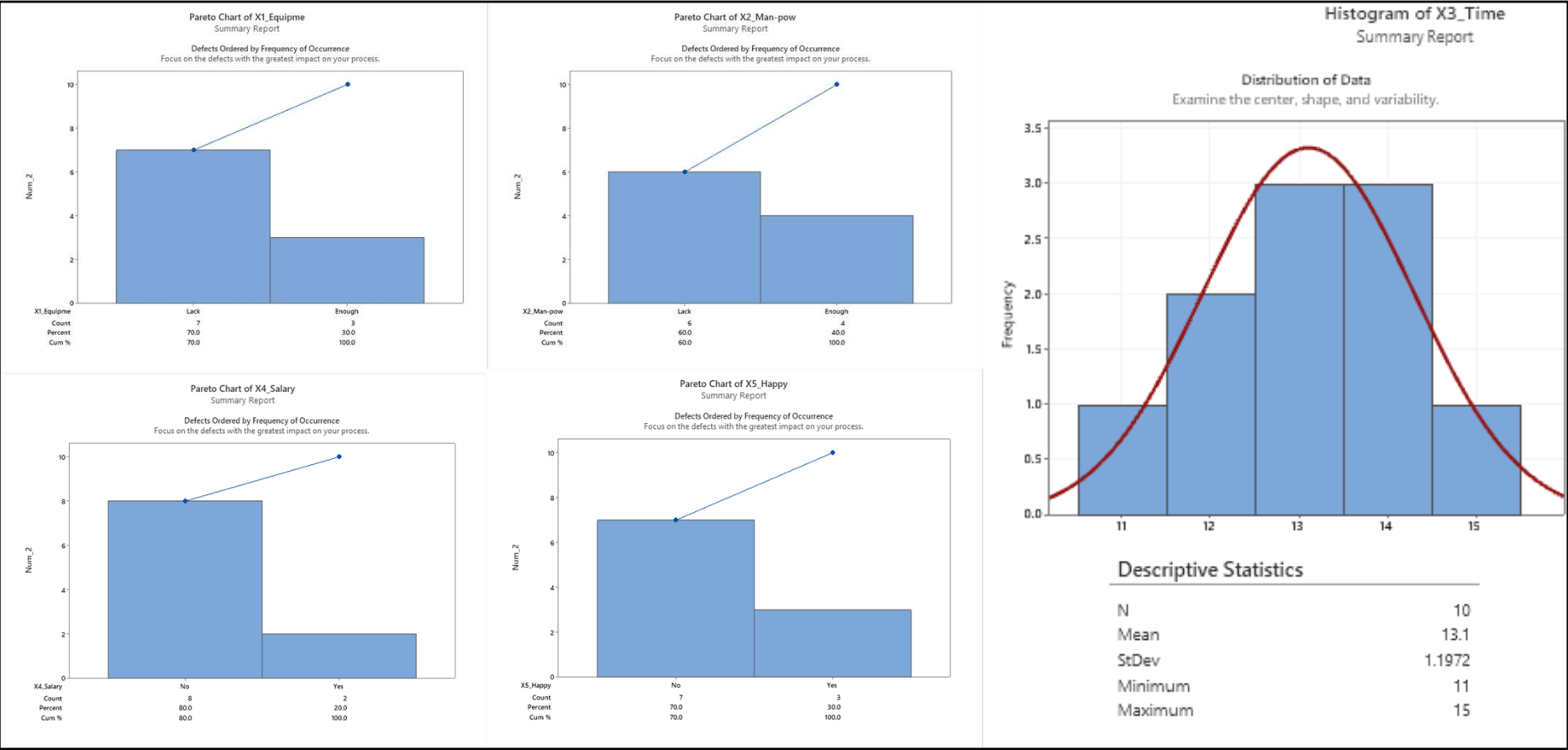
- The collected data is in the valid range with a minimum of 1 (extremely decreased, very bad/dirty) and a maximum of 6 (extremely increased, very good/clean)
- The histogram of all three attributes have the similar trend
- Concentration at level 2 to 4 and descending at level 5 and 6
- The readiness of trash-can and the harvest area cleanness are underrated
- The people mostly believe that the quality of environment need to be improved, so they rate the level relate to quality nearly bad/dirty

Interpretation and implication

- The interviewees want to show they changed the extent of littering in recent years by decreasing the trend. But this information need to be carefully consider because the people usually want to show their better version
- The equipped trash-cans and the area cleanness have similar trend, lead us to an consumption about a positive relationship: Lacking trash-can is a reason of ground littering
- Many people suggested we should add more trash-can to prevent littering on the ground. It will be reviewed in detail for root cause analysis

... Part 4 about Q5 & Q7 & Q8 by histogram ✓

Graphical evaluation of collected data from garbage collector’s interview ...



Results

- 70% of garbage collectors answer that they lack the cleaning equipment, for example: Trash-bin, gloves, masks, brooms, dustpans
- 80% members believe that their salary is low, this can be the main reason leads to 70% members feel they are not happy at recent cleaning job
- 60% members show that their team is lack manpower, so they usually have to do more job than standard, it could be a reason make they are not happy at work also
- The recent hour standar’s payment is 8 hour, but actually the mean of histogram real collected time is more than 13 hours, nearly double the standard time

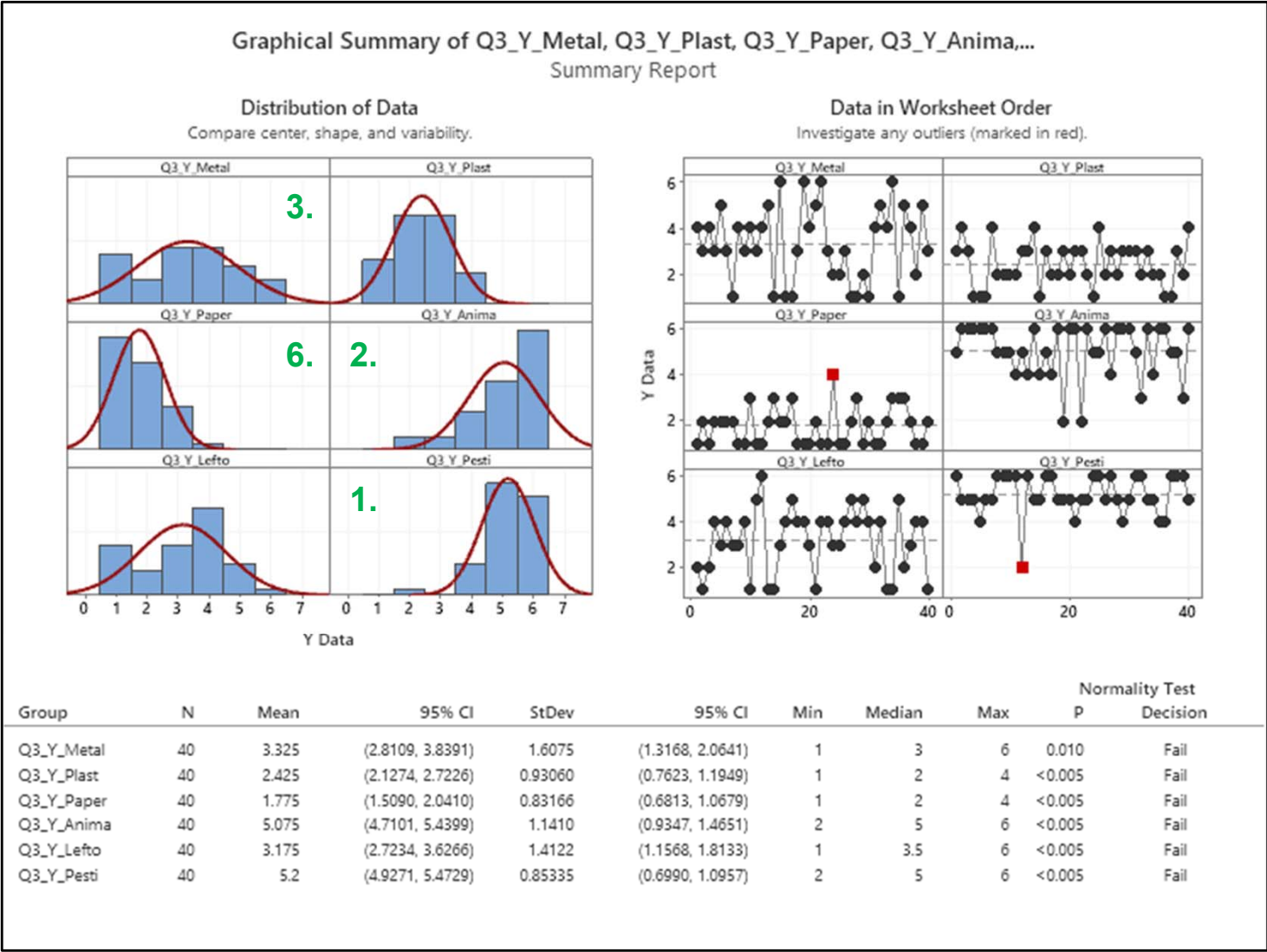
Interpretation and implication

- Some reasons could lead garbage collectors to feel not happy at work like: lack of equipment, lack of manpower, low salary, too much effort of our standard time. The mood of collectors is very important, it directly impacts garbage removing results. These information may need to be carefully consider in the improve phase to improve quality of ground cleaning

... Additional question modified to suitable with TrungHung village

Graphical evaluation harmfulne

The time series plot probably makes no sense in this context
As there is no chronological determination of sequence in the questionnaire data.
Q-Paper and Q-Anima show a floor-, respective a ceiling-effect, meaning, that the answers might reach values beyond the given limit by the rating scale.



Results

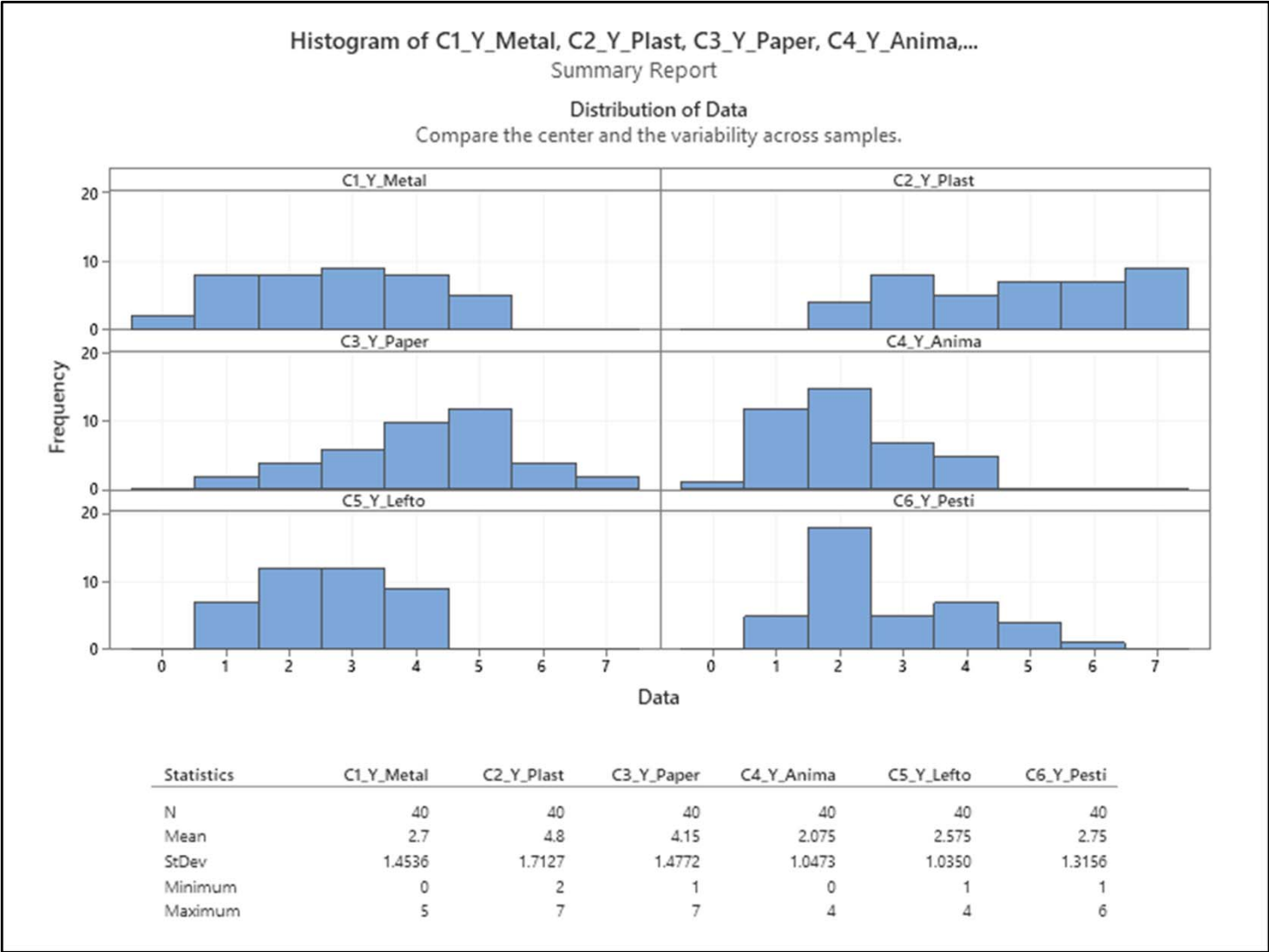
- 6 TrungHung garbage’s types are: Metal, Plastic, Paper, Animal carcasses, Leftovers, Pesticide. The interviewees ranked these objects in a hierarchy, based on their harmfulness
- The time series plots of Q3_Y_Leftovers & Q3_Y_Pesticide has 1 outline were found for each
- The centers of the different garbage types shift from left centered with a low mean for Paper (1.775) and Plastic (2.425) to middle centered with a increase mean for Leftovers (3.175) and Metal (3.325) and right centered with a high mean for Animal dead (5.075) and Pesticide (5.2)

Interpretation and implication

- The harmfulness level of garbage is inverse proportion to the frequency of littering.
- The mean of Paper and Plastic is low means that villagers often litter paper and plastic and less often litter Animal dead and Pesticide which are high means (harmfulness level)
- The people ranked harmfulness levels by their opinion randomly
- If harmfulness level of garbage’s perception is not uniform, it will lead villagers to litter in the wrong position, which can make ground and trash can more difficult to clean up.

... rank of these objects in a hierarchy (1= least harmful to 6= most harmful)

Graphical evaluation summary of 6 collected garbage types ...

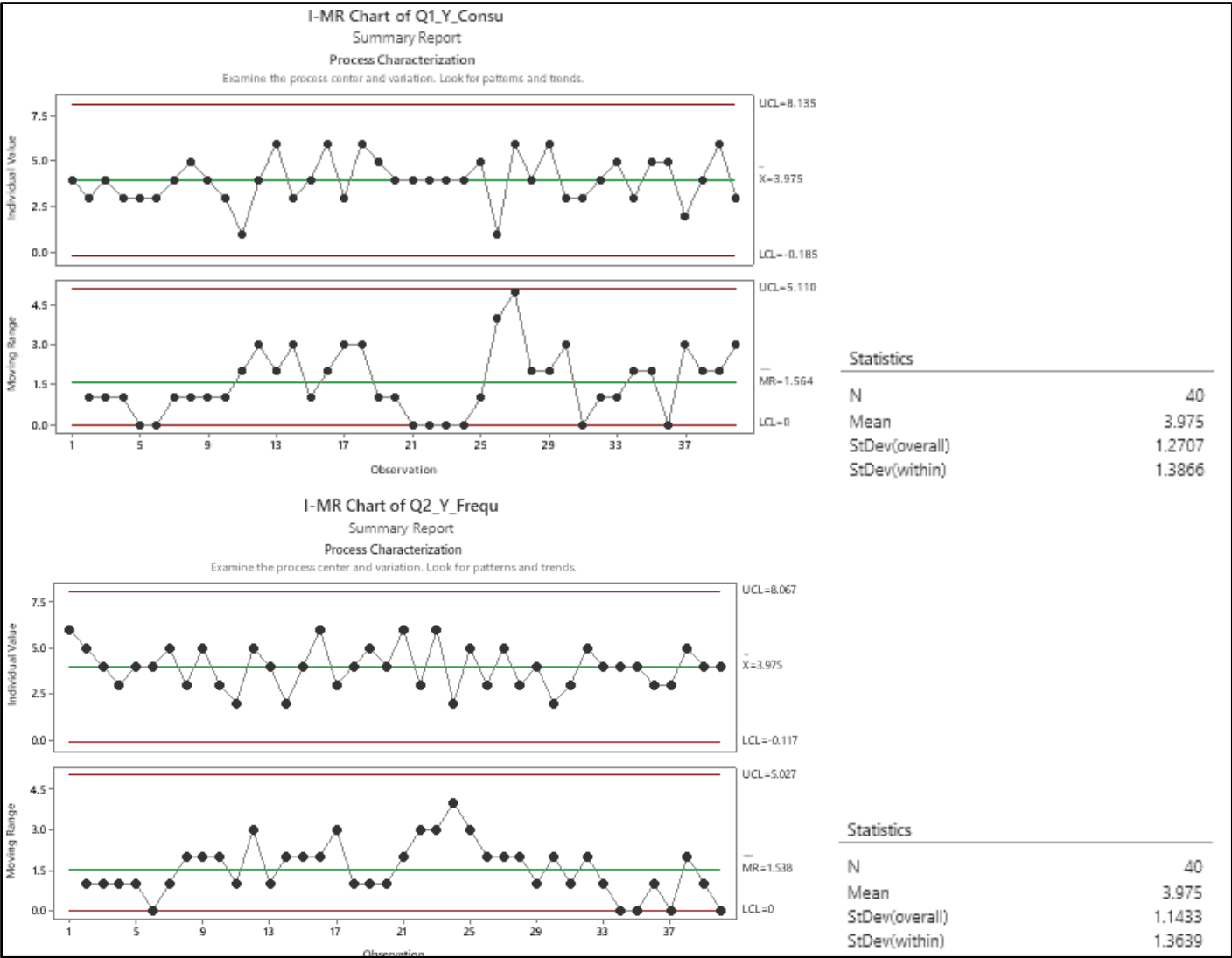


- Results**
- The data table shows that N=40 (double N=20 is planed for an original stratified sample of the field study) which corresponds to the 40 different places near trash cans
 - The collected data is in inside of the valid range with number of garbage pieces from 0 to 7 (largest range)
 - The number of metal pieces is from 0 to 5
 - The number of plastic pieces is from 2 to 7
 - The number of paper pieces is from 1 to 7
 - The number of animal carcasses is from 0 to 4
 - The number of leftover is from 1 to 4
 - The number of pesticide shells is from 1 to 6

- Interpretation and implication**
- The largest range is plastic, its min is 2 and max is 7, and 7 pieces it appeared 9 times. It is high value and high occurrence. It really makes sense with Graphical evaluation of the harmfulness level of garbage types. Both of them indicate that plastic could be the most common garbage type on the ground.
 - The minimum mean is Animal carcasses (2.075), that shows us people generally dispose animal carcasses into the environment in lowest number

It is good, that you applied control-charts, but patterns cannot be interpreted, as there is no natural sequence
Or chronological causal dependency. This would however be great for field data on littering on subsequent days/ weeks

I-MR chart of Q1_Y_Con Overall, again a strong impression of your work!



Results

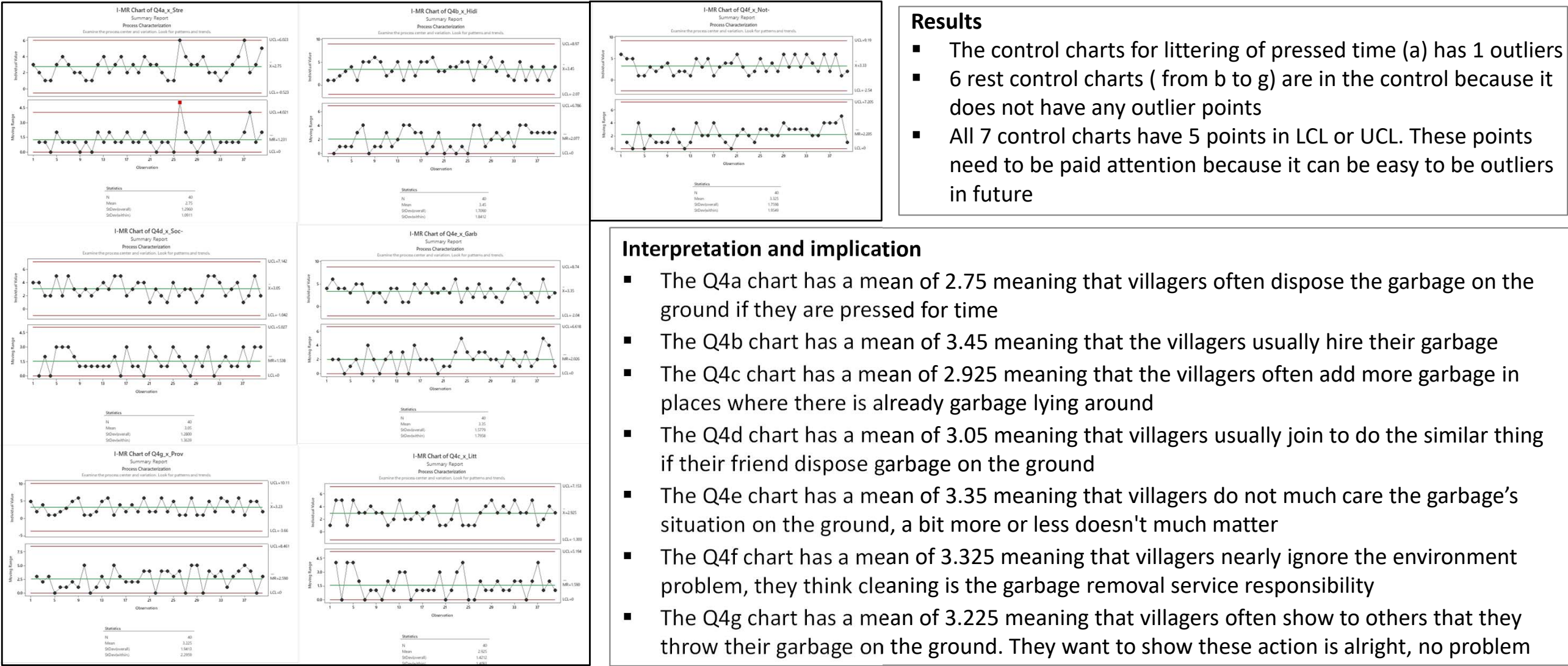
- Both consumption trend and littering frequency are in the control because it does not have any outlier points
- Moving range plot of Q1_Y_Consume has 1 points is in UCL, 8 points are in LCL
- Moving range plot of Q2_Y_Frequency has 5 points are in LCL
- These points need to be paid attention because it can be easy to be outliers in future
- The mean value of consumption trend is 3.975 meaning that villagers often consume food or drink in public
- The mean value of littering frequency is 3.975 meaning that villagers often dispose garbage in public

Interpretation and implication

- Villagers usually consume food or drink in harvest areas because of their old habits. Most villagers are farmers, so they usually have to wake up early for farm jobs, so they have breakfast near a field. Additionally, they usually have lunch on field to save time
- Villagers often throw away garbage in harvest areas because they lack awareness about the importance of emergency environmental protection. A lot of villagers share that they do not hesitate to throw away garbage in the most convenient location for them

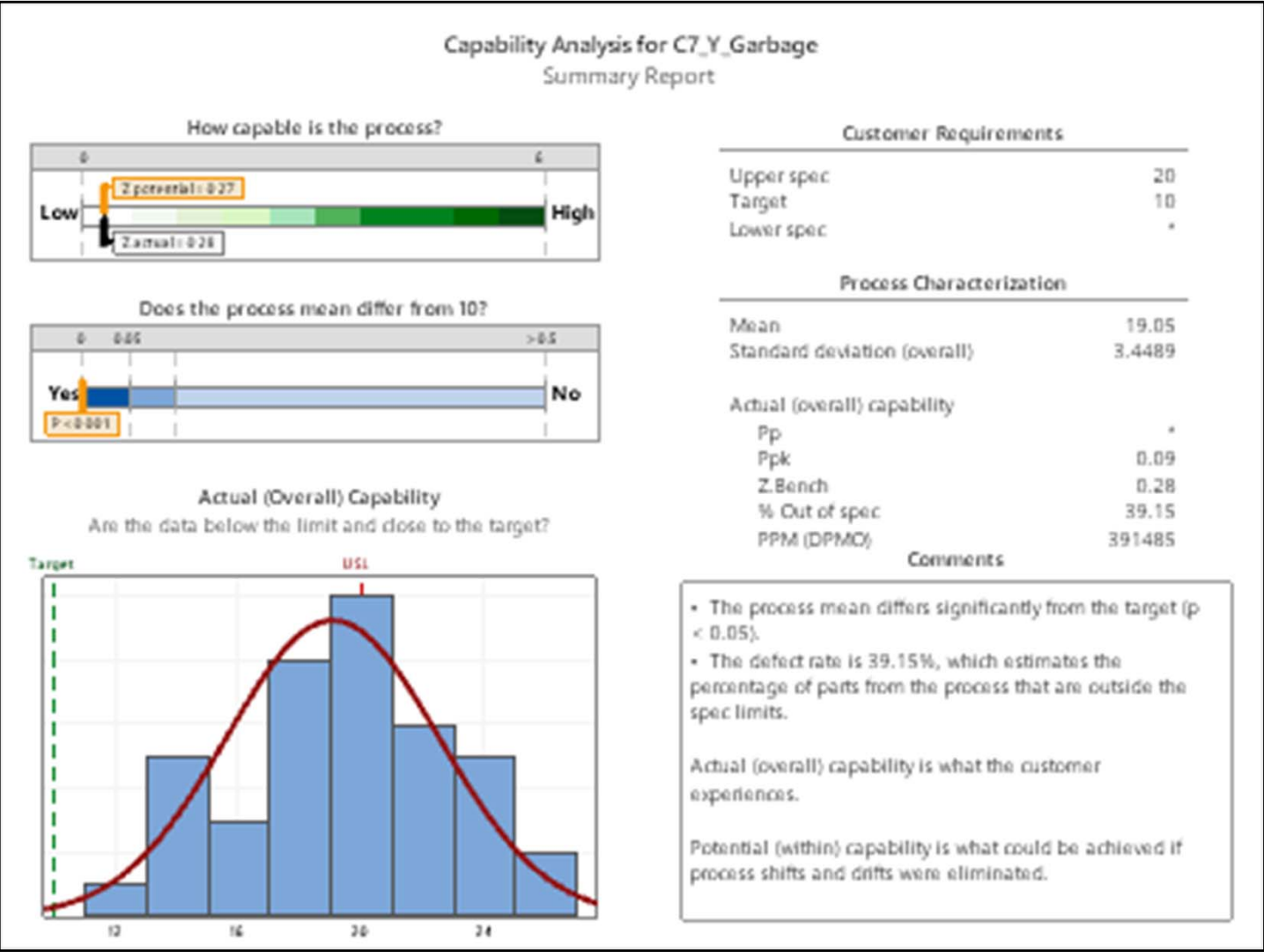
... And I-MR chart of Q2_Y_Frequency (frequency of throw away garbage in public)

I-MR chart of the 7 important statements apply most to interviewees, these are Q4a_x_Pressed, Q4b_x_Hiding



... Q4c_x_Littered-Ground, Q4d_x_Soc-Conformity, Q4e_x_Garbage-Worry, Q4f_x_Not-Responsible, Q4g_x_Provocation

Process capability analysis about the amount of found garbage ...



Results

- The process means significant differs from the target ($p < 0.05$)
- The defect rate is 39.15%, which estimate the percentage of parts from the process that are outside the spec limits
- The graph shows the process centered very closed to USL with a higher spread than capable process
- Pp value = invalid because only USL define
- Ppk value = 0.09
- PPM (DPMO) = 391,485

Interpretation and implication

- The process center needs to be shifted to the left side and the spread needs to be reduced in order for the capable process
- Pp and Ppk are not equal, therefore the process is not centered as show in the above graph
- Data centered around the number 20, in case our target should be 10, so we will need a lot of efforts to achieve this target
- Z actual value (0.28) and Z potential (0.27) value only differ in 0.01 points which means that even eliminating the shift and drift is not enough. The process need to be centered and the spread of distribution need to be reduced

... in filed study's data collection plan

Indices of Process Capability calculations...

Indices of Process Capability			
Calculation of Process Capability based on Units, Defects and Opportunities for Defects			
Definitions	Symbol	Enter Your Data	
Units	U		40
Defects	D		362.00
Opportunities for a defect	O		26
Number of operation steps	m		
defective Units	Symbol	Calculation	Result
Defects per Unit	DPU	D/ U	9.0500000
Defect Parts per Million	PPM	D/ U x 10^6	9,050,000.00
Defects per Unit			
Total Opportunity	TOP	U x O	1,040
Defects per Unit Opportunity	DPO	DPU/ O	0.3480769
Defects per million Opportunity	DPMO	DPO x 10^6	348,076.9230769
without consideration of the Opportunities			
Yield (%)		(1- DPU)* 100	-805.0000000
Defect (%)		100 - Yield	905.0000000
for prediction of long-term Sigma-Level from short-term measurement	Sigma-Level (long-term)	z-Value	
for prediction of short-term Sigma-Level from long-term measurement	Sigma-Level (short-term)	z-Value + 1,5	
with consideration of the Opportunities			
Yield (%)		(1- DPO)* 100	65.1923077
Defect (%)		100 - Yield	34.8076923
for prediction of long-term Sigma-Level from short-term measurement	Sigma-Level (long-term)	z-Value	0.39
for prediction of short-term Sigma-Level from long-term measurement	Sigma-Level (short-term)	z-Value + 1,5	1.89
Conversion of Yield% into corresponding z-Values (Sigma-Level) and vice versa			
Enter Your Data		Sigma-Level (long-term)	Yield (%)
	Conversion: Sigma - Yield (Data from long-term study)	4.50	99.99966023269%
		0.00	50.00000000000%
	Conversion: Process-Sigma - Yield (Data from short-term study)	6.00	99.99966023269%
		1.50	50.00000000000%
Calculation: Pp/ Ppk and Sigma-Level			
Parameter	Enter Your Data	Sigma-Level (solely based on dispersion - unusual)	Pp
Lower Specification Limit (LSL)	0.00	34.50	11.50
Upper Specification Limit (USL)	20.00	Sigma-Level (based on position & dispersion - usual)	Ppk
Mean (xbar)	19.05		
Standard Deviation	3.45		
		3.28	1.09

Results

- The process capability analysis was done with the data found on 40 different places near trash cans
- Caculation:
 - Unit = 40 (number of sutidied places)
 - Defect = 762 (total number of garbage pieces) – 40*10(target) = 362
 - Opportunity for a defect = 26 (maximum number of garbage pieces)
- From these information, we get:
 - DPMO = 384,076, the yield is only 65,2%
 - Sigma – Level (short-term) = 0.39
 - Sigma - Level (long-term) = 1.89
 - Pp = 11.05
 - Ppk = 1.09

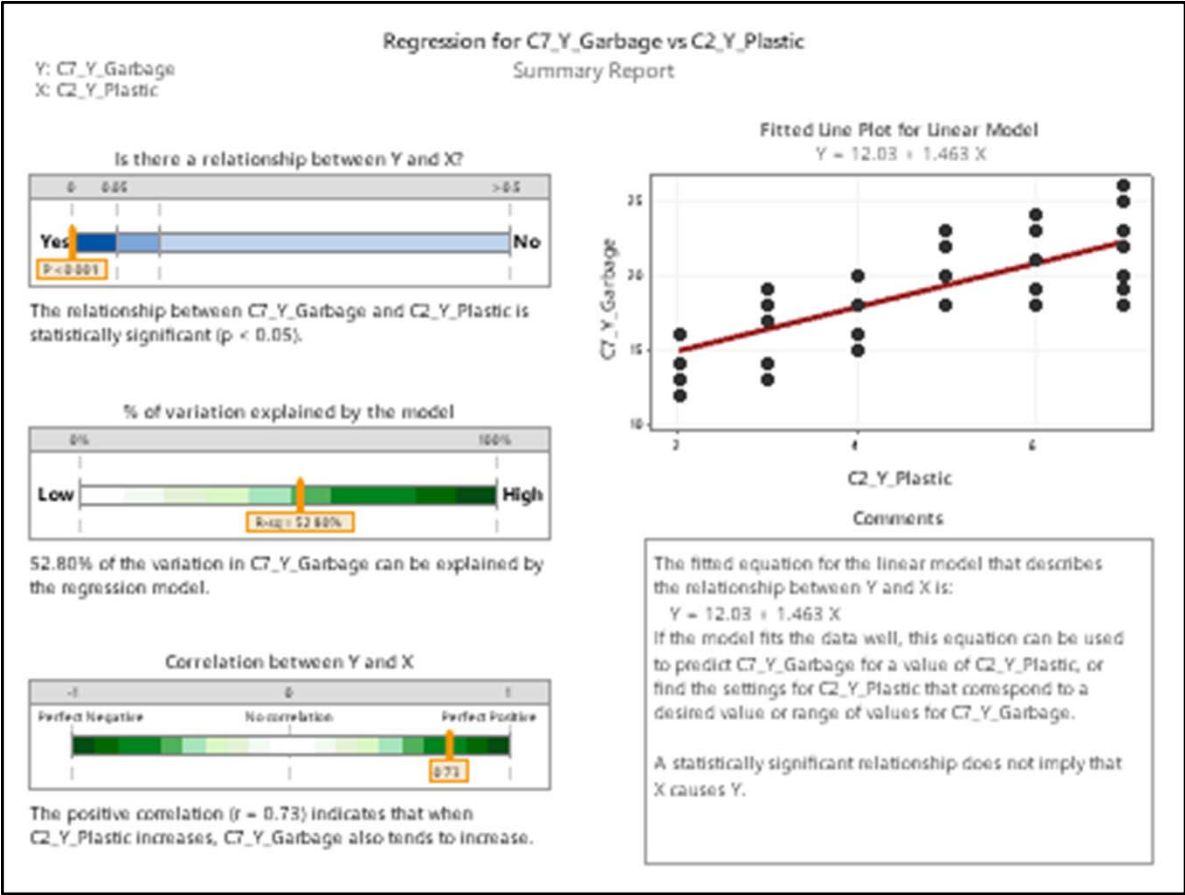
Interpretation and implication

- With a yield only 65.2 %, the process needs further improvement
- Pp and Ppk are not equal, therefore the process is not centered
- The recent mean is 19.05, differ 9.05 (nearly double) target value number is 10, that can lead us to think about big effort to make the process capable
- Pp is much larger than 1 and the Ppk is also greater than 1, this means that the tolerance is bigger than the spread so the process has the potential to be capable

These are the most important results in a regression analysis:
Statistical significance (p) and practical relevance (R^2, or e.g. the difference between means in a t-Test)

Regression analysis for C7_Y_Gargbage vs C2_Y_Plastic pieces ...

1.	Risk	Y_03: Output: ground(cleaned) [Degree of: Amount (Number of pieces within a radius of 5 meters around a trash-can)]
	28.89%	There is a/ no Relationship between: x1_10: Input: food (packaged) [Degree of: Amount (Number of pieces within a radius of 5 meters around a trash-can)] and: Y_03: Output: ground(cleaned) [Degree of: Amount (Number of pieces within a radius of 5 meters around a trash-can)] according to the Principle: The larger the value of x, the larger (resp. smaller) is the value of Y.
	Relationship Hypothesis	Product-Moment-Correlation (Pearson)/ General Regression



Interpretation and implication

- The correlation is a strong and positive correlation between (X) plastic pieces and (Y) general garbage. The positive correlation ($r=0.73$) indicates that when the plastic pieces (X) increase, total general garbage (Y - include all 6 types of garbage) also tend to increase significantly
- In the result, plastic pieces are significant in the count for general garbage, so it will be take into account in the improve phase is a solutions will need to accommodate to this type of garbage
- Plastic garbage is dangerous and difficult to decompose in natural environment conditions. Additionally, plastic has many toxic properties so we need to find the main cause which generate the plastic garbage and convince villager do not use plastic bag as less as possible

Results

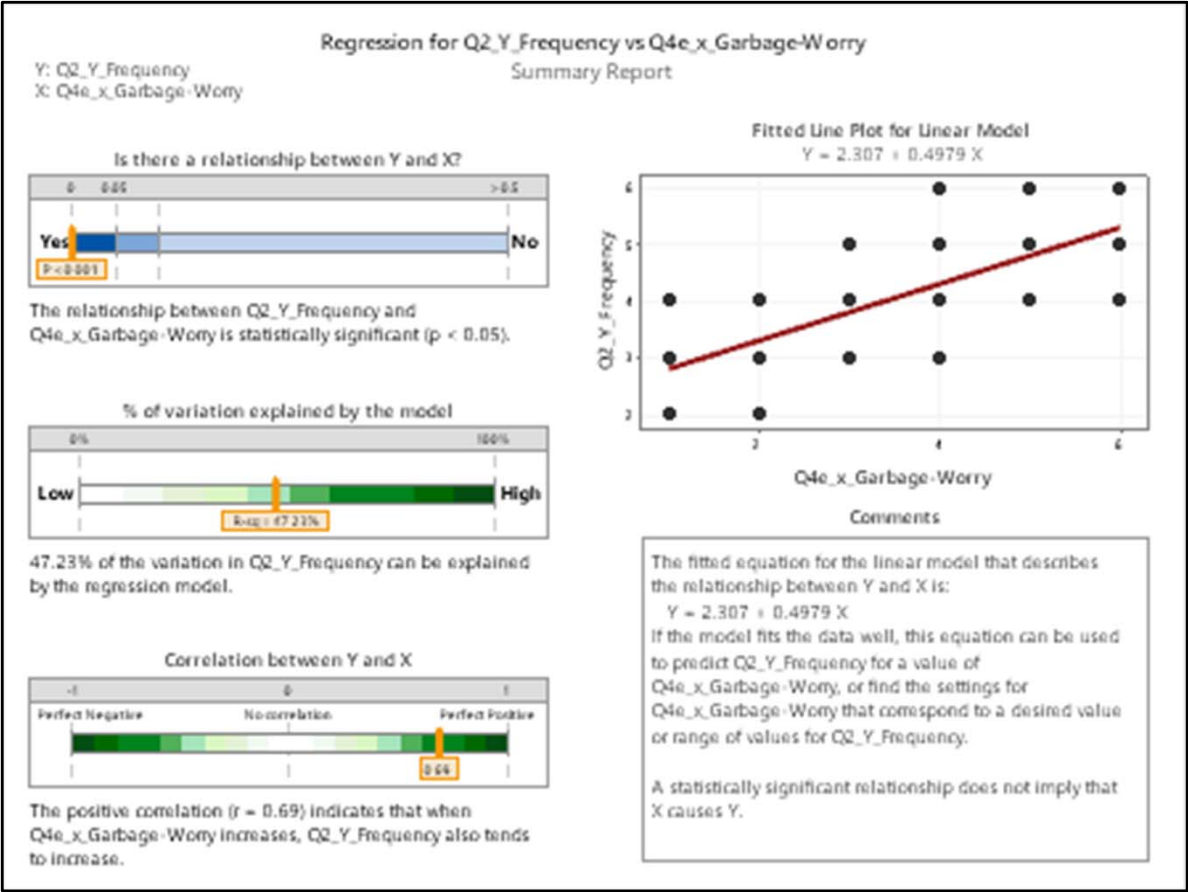
- With a p-value < 0.05 , the relationship between C2_Y_plastic (food packaged, bottles/ cups/bags) and C7_Y_garbage is statistically significant
- 52.80% of the variation in C7_Garbage can be explain by the regression model
- Fitted Line Plot for Linear Model:
 $Y = 12.03 + 1.463 * X$
Y is C7_Garbage
X is C2_Plastic

... Shows a strong positive correlation ✓

Tim, this is all very prudently analyzed

Regression analysis for Q2_Y_Frequency vs Q4e_x_Garbage-Worry ...

2.	Risk	Y_04: Output: garbage(disposed) [Degree of: Amount (Number of wrong pieces's location in trash-cans and on the ground)]
	21.42%	There is a/ no Relationship between: x1_07: Input: gargabge removal target [Ranking Position of: 6 level rating scale (Grade 1...6)] and: Y_04: Output: garbage(disposed) [Degree of: Amount (Number of wrong pieces's location in trash-cans and on the ground)] according to the Principle: The larger the value of x, the larger (resp. smaller) is the value of Y.
Relationship Hypothesis		Rank Correlation (Spearman)/ General Regression



Interpretation and implication

- The correlation is a positive correlation between (X) Garbage-Worry (Villager's awareness of necessary environmental protection) and (Y) Frequency of throwing away garbage in public.
- The positive correlation (r=0.69) indicates that when the Garbage-Worry (X) increase, Frequency (Y) also tend to increase significantly
- In the result, awareness of environmental protection is significant in the dispose garbage attitude, so it needs to be taken into account in the improve phase is a solutions will need to accommodate to this type of cause
- Villager's awareness is very important because if the people understand about it, they could adjust their habit to reduce the garbage volume which they usually dispose to public area

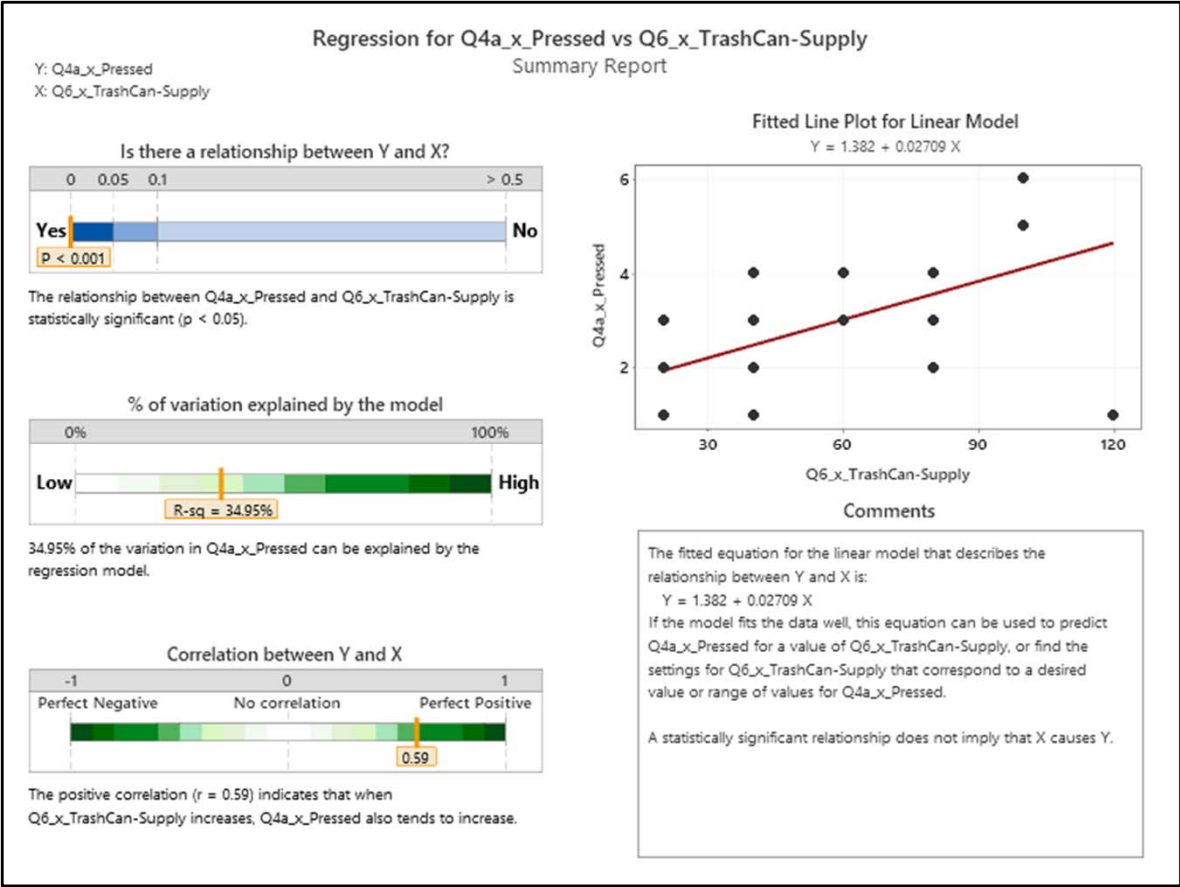
Results

- With a p-value < 0.05, the relationship between Q2_Y_Frequency throw away garbage in public and Q4e_x_Garbage-Worry is statistically significant
- 47.23 % of the variation in Q2_Y_Frequency can be explain by the regression model
- Fitted Line Plot for Linear Model:
Y = 2.307 + 0.4979 * X
Y is Q2_Y_Frequency
X is Q4e_x_Garbage-Worry

... Shows a positive correlation

Regression analysis for Q6_x_TrashCan-Supply vs Q4a_x_Pressed ...

3.	Risk	Y_06: Output: decision(garbage) [Ranking Position of: 6 level rating scale (Grade 1...6)]
	62.26%	There is a/ no Relationship between: xMR_07: Activity: dispose garbage [Degree of: distance (meter)] and: Y_06: Output: decision(garbage) [Ranking Position of: 6 level rating scale (Grade 1...6)] according to the Principle: The larger the value of x, the larger (resp. smaller) is the value of Y.
	Relationship Hypothesis	Rank Correlation (Spearman)/ Ordinal-Logistic-Regression/ General Regression



Interpretation and implication

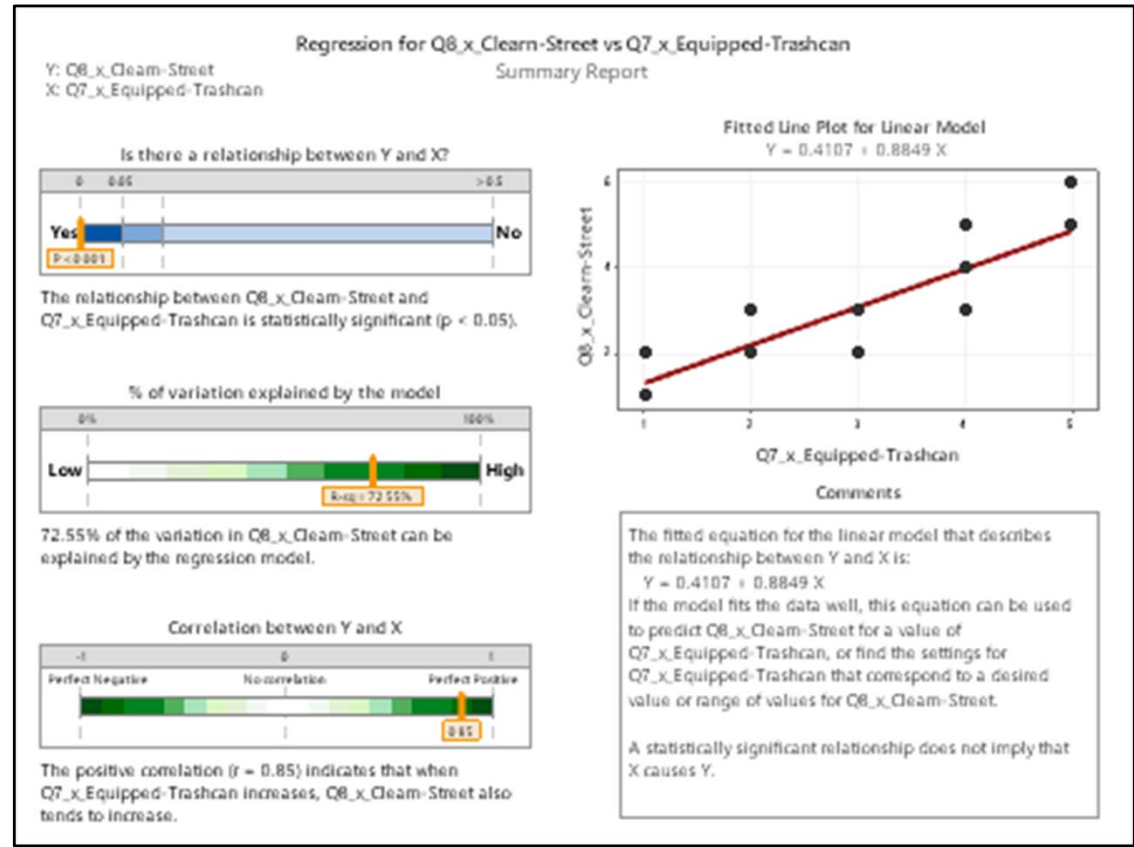
- The correlation is a positive correlation between (X) Trash-can distance and (Y) Throw garbage away when pressed time. The positive correlation (r=0.59) indicates that when the trash-can distance (X) increase, throw garbage away when pressed time (Y) also tend to increase significantly
- In the result, the distance between villagers to trash-can is significant in throw garbage away, so it needs to be taken into account in the improve phase is a solutions will need to accommodate to this type of cause
- Because villager's perception about environmental problems is not high, the long distance to trash-can can impact their disposal garbage decision. They don't willing accept the effort to take out the trash in correct position

Results

- With a p-value < 0.05, the relationship between Q6_x_TrashCan-Supply and Q4a_x_Pressed is statistically significant
- 34.95 % of the variation in Q4a_x_Pressed can be explain by the regression model
- Fitted Line Plot for Linear Model:
 $Y = 1.382 + 0.02709 * X$
Y is Q4a_x_Pressed
X is Q6_x_TrashCan-Supply

Additional Relationship-Hypothesis regression test between ...

Hypotheses		Relationship-Hypothesis: Y= f(x)					
There is a relationship between:	Variable/ Measurand x	... and ...	Variable/ Measurand Y	Scale-Level: x	Scale-Level: Y	Graphical Representation:	Statistical Test:
				nominal/ ordinal/ cardinal	nominal/ ordinal/ cardinal	Scatterplot/ Bar Chart	Chi-Square/ Correlation/ Regression
Completeness of cleaning equipment (X)		... and ...	Level of cleanliness (Y)	Ordinal	Ordinal	Scatterplot	Correlation / Regression



Interpretation and implication

- The correlation is a strong positive correlation between (X) Completeness of cleaning equipment (focus on trash-can) and (Y) Level of village cleanliness. The strong positive correlation (r=0.85) indicates that when the Completeness of cleaning equipment (X) increase, Level of village cleanliness (Y) also tend to probability increase
- In the result, the Completeness of trash-can is significant in Level of cleanliness , so it will be priority in the improve phase is a solutions will need to accommodate to this type of cause
- If do not have enough equipment, the removal team will not easily perform the work well. When the removal team can complete their job, the level of cleanliness will be improved

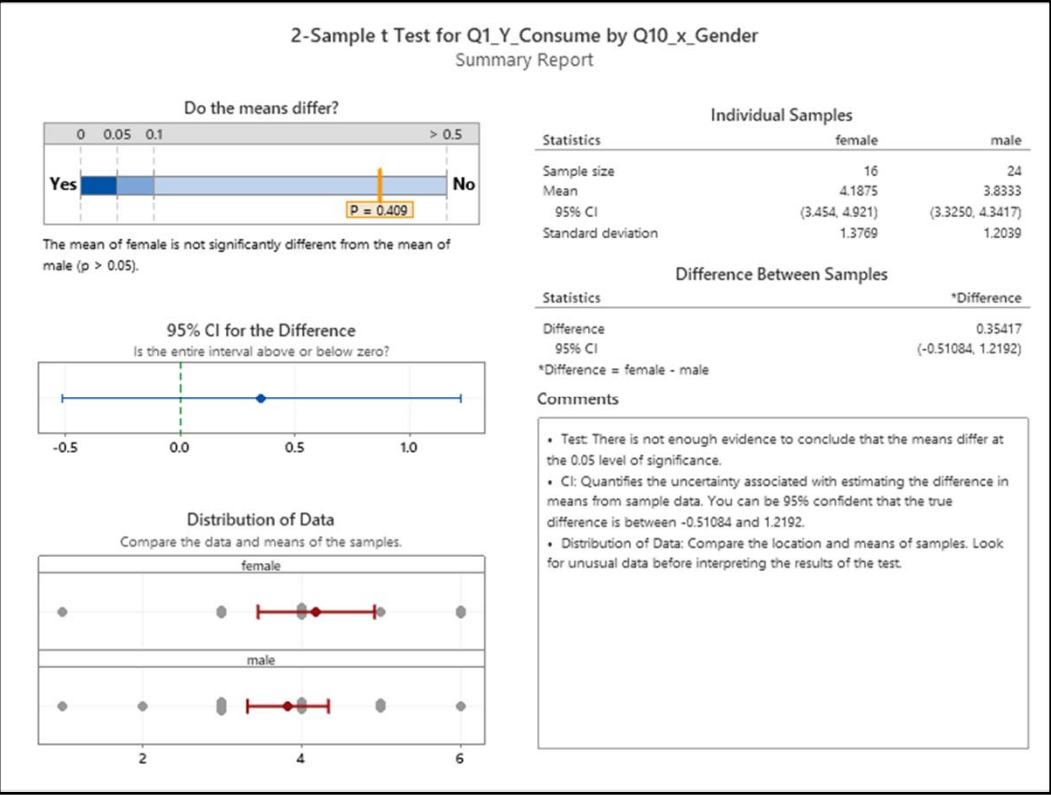
Results

- With a p-value < 0.05, the relationship between Q8_x_Clean-Street and Q7_x_Equipped-Trashcan is statistically significant
- 72.55 % of the variation in Q8_x_Clean-Street can be explain by the regression model
- Fitted Line Plot for Linear Model:
 $Y = 0.4107 + 0.8849 * X$
Y is Q8_x_Clean-Street
X is Q7_x_Equipped-Trashcan

... Completeness of cleaning equipment (X) and Level of cleanliness (Y) shows a strong positive correlation ✓

Additional Difference-Hypothesis t-Test between levels of...

Hypotheses		Difference-Hypothesis Y1= Y2					
There is a difference in:	Variable/ Measurand Y	between levels of:	Variable/ Measurand x	Scale-Level: Y	Scale-Level: x	Graphical Representation:	Statistical Test:
				nominal/ ordinal/ cardinal	nominal/ ordinal/ cardinal	Box-Plot/ Line-Chart	Chi-Square/ t-Test/ ANOVA
Comsume food and drink in public (Y)		between levels of:	Gender (X)	Ordinal	Nominal	Box-Plot	t-Test
Comsume food and drink in public (Y)		between levels of:	Age (X)	Ordinal	Ordinal	Box-Plot	ANOVA



Interpretation and implication

- We can not give conclusion about difference between the food and drink in public trend of male and female
- Try with another additional difference-Hypothesis t-Test between levels of Participant gender (X) and **throw away garbage in public frequency (Y)** (please next page)

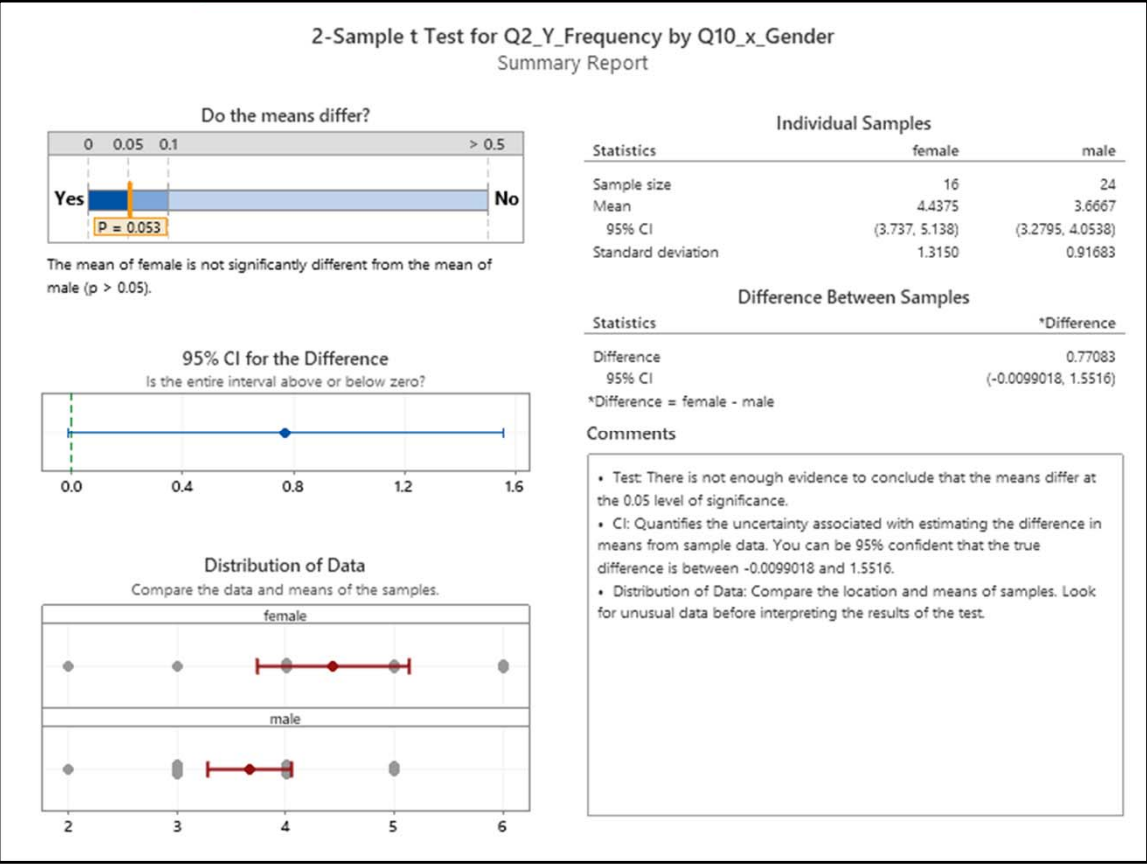
Results

- The p-value is $0.409 > 0.05$, the test show there is not difference between the food and drink in public trend of male and female
- The mean of female is not significant different from the mean of male ($p > 0.05$)
- There is not enough evidence to conclude that the means differ at the 0.05 level of significance
- CI: Quantifies the uncertainty associated with estimating the difference in means from sample data. It can be 95% confident that the true difference is between -0.51084 and 1.2192
- Mean of female is 4.1875, Standard deviation is 1.3769 with 95% Confidence Interval is (3.454, 4.921) & mean of male is 3.8333 , Standard deviation is 1.2039 with 95% Confidence Interval is (3.325, 4.3417)

... Participant gender (X) and consume food and drink in public (Y)

Modify additional Difference-Hypothesis t-Test between levels of...

Hypotheses		Difference-Hypothesis Y1= Y2					
There is a difference in:	Variable/ Measurand Y	between levels of:	Variable/ Measurand x	Scale-Level: Y	Scale-Level: x	Graphical Representation:	Statistical Test:
				nominal/ ordinal/ cardinal	nominal/ ordinal/ cardinal	Box-Plot/ Line-Chart	Chi-Square/ t-Test/ ANOVA
Throw away garbage in public (Y)		between levels of:	Gender (X)	Ordinal	Nominal	Box-Plot	t-Test



Interpretation and implication

- 0.053 is approximate to 0.05, but it is still larger than 0.05, so we can not give any correct conclusions.
- For clearer results, we should experiment with a larger sample size. But as part of this project, I decided to stop testing this hypothesis with a larger sample size
- I agree that can not give conclusion for these factorials

Results

- The p-value is $0.053 > 0.05$, the test show there is not difference between throw away garbage in public frequency of male and female
- The mean of female is not significant different from the mean of male ($p > 0.05$)
- There is not enough evidence to conclude that the means differ at the 0.05 level of significance
- CI: Quantifies the uncertainty associated with estimating the difference in means from sample data. It can be 95% confident that the true difference is between -0.0099018 and 1.5516
- Mean of female is 4.4375, Standard deviation is 1.3150 with 95% Confident Interval is (3.737, 5.138) & mean of male is 3.6667 , Standard deviation is 0.91683 with 95% Confident Interval is (3.2795, 40538)

... Participant gender (X) and throw away garbage in public frequency (Y)

Additional Difference-Hypothesis ANOVA between levels of...

Hypotheses		Difference-Hypothesis Y1= Y2					
There is a difference in:	Variable/ Measurand Y	between levels of:	Variable/ Measurand x	Scale-Level: Y	Scale-Level: x	Graphical Representation:	Statistical Test:
				nominal/ ordinal/ cardinal	nominal/ ordinal/ cardinal	Box-Plot/ Line-Chart	Chi-Square/ t-Test/ ANOVA
Comsume food and drink in public (Y)		between levels of:	Gender (X)	Ordinal	Nominal	Box-Plot	t-Test
Comsume food and drink in public (Y)		between levels of:	Age (X)	Ordinal	Ordinal	Box-Plot	ANOVA

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Q11_x_Age	5	4.478	0.8955	0.52	0.759
Error	34	58.497	1.7205		
Total	39	62.975			

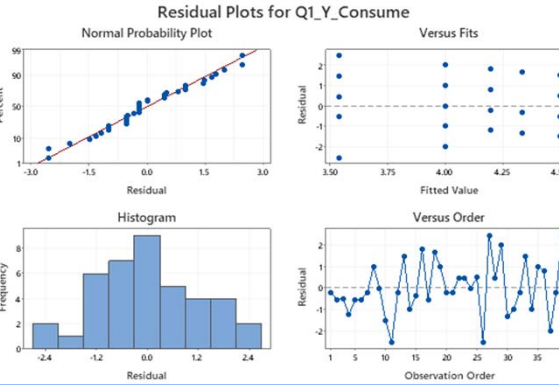
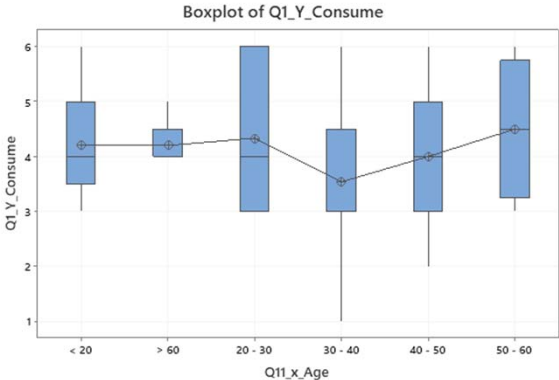
Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
1.31168	7.11%	0.00%	0.00%

Means

Q11_x_Age	N	Mean	StDev	95% CI
< 20	5	4.200	1.095	(3.008, 5.392)
> 60	5	4.200	0.447	(3.008, 5.392)
20 - 30	3	4.333	1.528	(2.794, 5.872)
30 - 40	13	3.538	1.561	(2.799, 4.278)
40 - 50	10	4.000	1.247	(3.157, 4.843)
50 - 60	4	4.500	1.291	(3.167, 5.833)

Pooled StDev = 1.31168



Interpretation and implication

- Young or old villager, all they has approximately equal level of consume food and drink in public. The solution should not just focus on a particular age range.
- The solution should be of a nature that affects all age groups of people
- Before, we assume that the young people tend to more consume food and drink in public than older people, but the statistic test show us this assumption is not correct

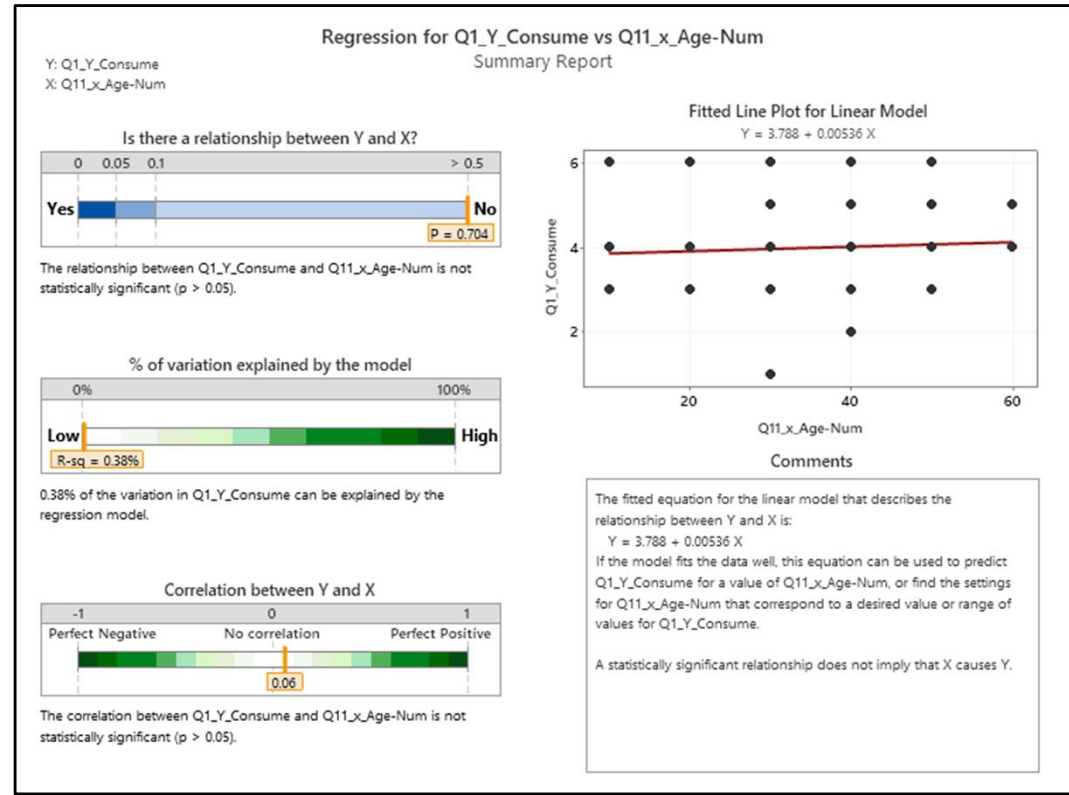
Results

- Null hypothesis: All means are equal (H0)
- Alternative hypothesis: Not all means are equal (H1)
- Significance level: $\alpha = 0.05$
- With a p-value of 0.759 and a R-squared of 7.11 %, there is not different in the Consume food and drink in public between Participant age
- From the highest mean to the lowest mean are 4.5 (50 – 60 ages), 4.333 (20 – 30 ages), 4.200 (<20 age same >60 age), 4.0 (40 – 50 ages) 3.538 (30 – 40 ages)
- With a confidence interval of 95%. The difference between means is not statistically significant

... Participant age (X) and consume food and drink in public (Y)

Additional Relationship-Hypothesis regression test between ...

Hypotheses		Difference-Hypothesis Y1= Y2				
There is a difference in:	Variable/ Measurand Y	between levels of:	Variable/ Measurand x	Scale-Level: Y	Scale-Level: x	Graphical Representation:
				nominal/ ordinal/ cardinal	nominal/ ordinal/ cardinal	Box-Plot/ Line-Chart
	Comsume food and drink in public (Y)	between levels of:	Gender (X)	Ordinal	Nominal	Box-Plot
	Comsume food and drink in public (Y)	between levels of:	Relationship Age (X)	Ordinal	Ordinal	Box-Plot



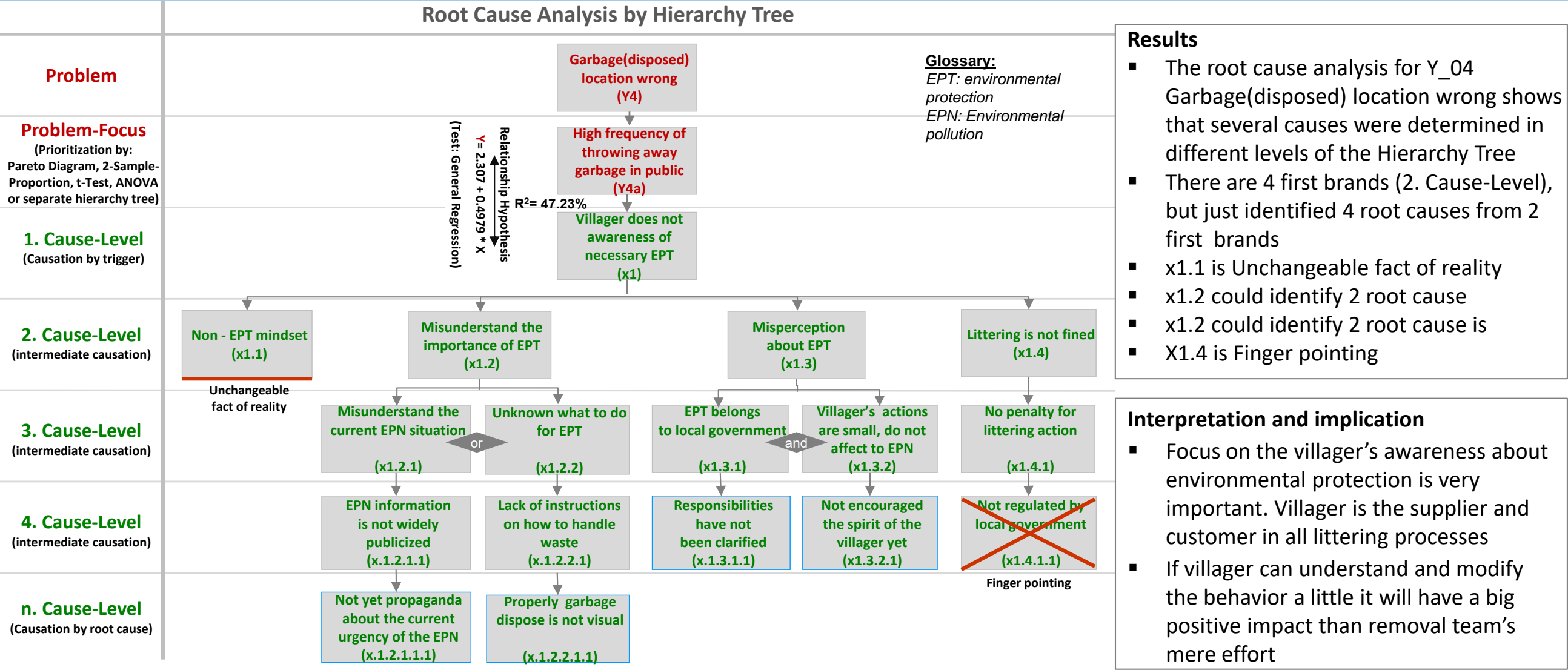
Interpretation and implication

- The correlation between Y and X is not statistically significant (p > 0.05). The non correlation (r=0.06) indicates that when the Participant age (X) change, Level of consume food & drink in public (Y) can not be used to predict
- In the result, a statistically significant relationship does not imply that Participant age causes Level of consume food & drink in public
- The gender of villagers do not show the impact to how often do they consume food or drink in public
- I agree that can not give conclusion for these factorials

Results

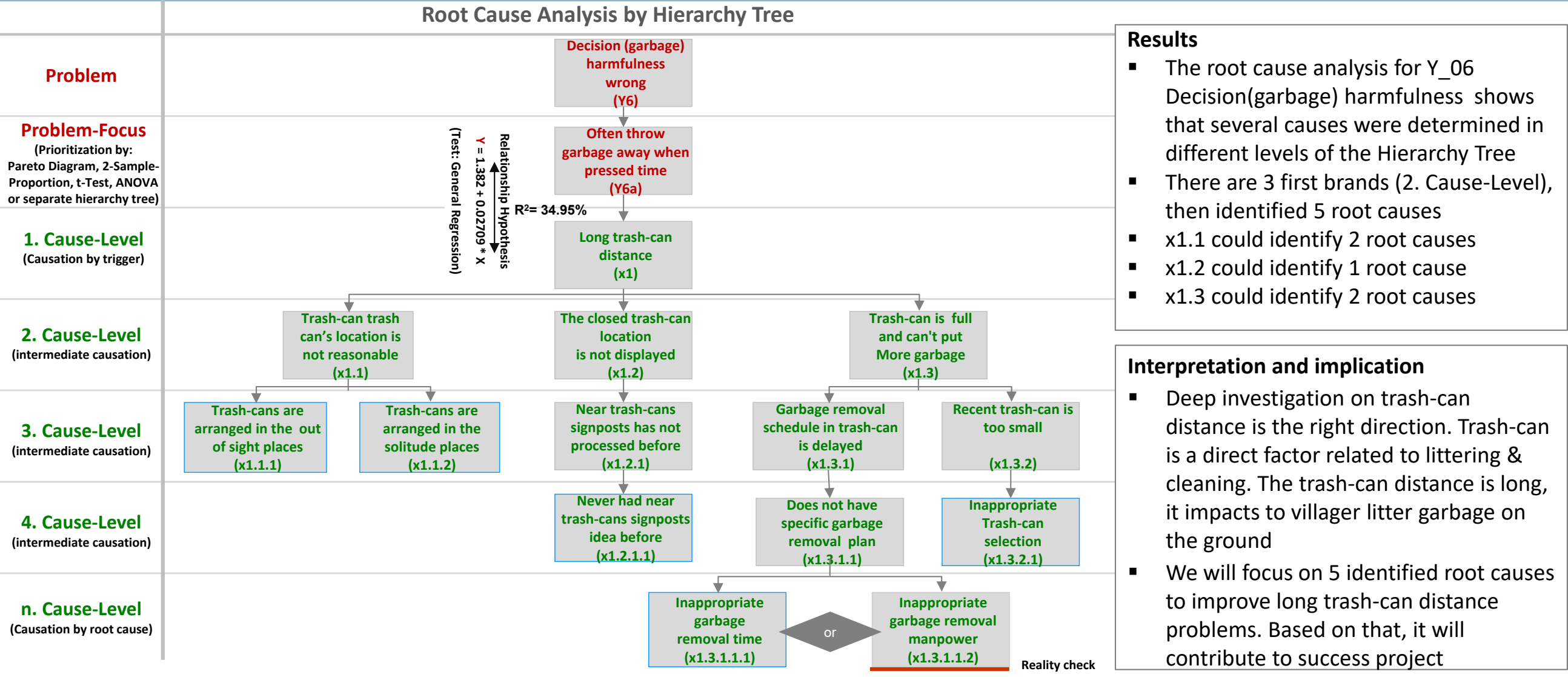
- With a p-value > 0.05, the relationship between Consume food & drink in public (Y) and Participant age (X) is not statistically significant
- 0.38 % of the variation in consume food & drink in public (Y) can be explain by the regression model
- Fitted Line Plot for Linear Model:
Y = 3.788+ 0.00536 * X
Y is consume food & drink in public
X is Participant age

Root cause analysis for Y_04 Garbage(disposed) location wrong ...



... due to multiple reason from Villager awareness and local government orientation

Root cause analysis for Y_06 Decision(garbage) harmfulness wrong ...



... due to first reason is Long trash-can distance (result from regression hypothesis testing result)

Root cause analysis for Y_03 Ground(cleaned) pieces left > 20 ...

	Root Cause Analysis by Hierarchy Tree			Results <ul style="list-style-type: none">▪ The root cause analysis for Y_03 Ground(cleaned) pieces left > 20 shows that several causes were determined in different levels of the Hierarchy Tree▪ There are 3 first brands (2. Cause-Level), then identified 5 root causes▪ x1.1 could identify 2 root causes▪ x1.2 could identify 1 root cause▪ x1.3 could identify 2 root causs
Problem	<div>Ground(cleaned) pieces left > 20 (Y3)</div>			
Problem-Focus (Prioritization by: Pareto Diagram, 2-Sample-Proportion, t-Test, ANOVA or separate hierarchy tree)	<div>Total number of garbage on the ground (Y3a)</div>			
1. Cause-Level (Causation by trigger)	<div>A lot of Plastic garbage pieces (x1)</div>			
2. Cause-Level (intermediate causation)	<div>Plastic bags, plastic bottles, medical waste (x1.1)</div> <div>Villagers throw garbage indiscriminately (x1.2)</div> <div>Garbage pieces remains after being cleaned (x1.3)</div>			
3. Cause-Level (intermediate causation)	<div>Indiscriminate domestic waste (x1.1.1)</div> <div>Messy medical waste (x1.1.2)</div> <div>Villagers do not classified garbage before littering (x1.2.1)</div> <div>The removal team did not clean up the total garbage (x1.3.1)</div> <div>Garbage is difficult to clean (x1.3.2)</div>			
4. Cause-Level (intermediate causation)	<div>Villagers eat food or drink in public (x1.1.1.1)</div> <div>Villager has littered medical waste in concealed way (x1.1.2.1)</div> <div>The removal team has too much work (x1.3.1.1)</div> <div>Garbage clings to the ground (x1.3.2.1)</div>			
n. Cause-Level (Causation by root cause)	<div>Garbage accumulated for a long time (x1.3.2.1.1)</div>			Interpretation and implication <ul style="list-style-type: none">▪ Focus on the plastic pieces is correct, because of popularity of this garbage type. Plastic accounted for the largest amount in the research scope in the project▪ If we can reduce plastic pieces from the 5 root causes that we have found from Hierarchy Tree, we will much improve our recent harvest area’s pollution situation

... due to first reason is Plastic pieces (result from regression hypothesis testing result)

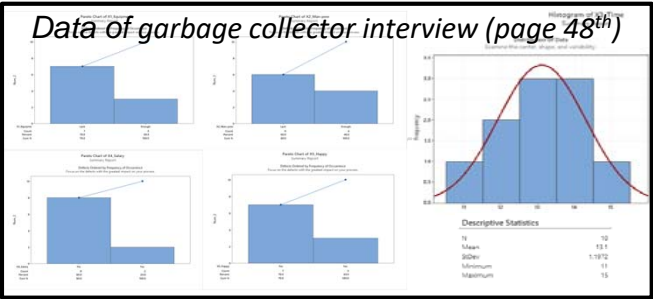
Root cause analysis for Y_02 Trash-can(empty) visibility/ attraction too low ...

	Root Cause Analysis by Hierarchy Tree			Results <ul style="list-style-type: none">The root cause analysis for Y_02 Trash-can(empty) visibility/ attraction too low shows that several causes were determined in the same levels of the Hierarchy TreeThere is 1 first brand (2. Cause-Level), then identified 4 root causes
Problem	<div>Trash-can(empty) visibility/ attraction too low (Y2)</div>			
Problem-Focus (Prioritization by: Pareto Diagram, 2-Sample-Proportion, t-Test, ANOVA or separate hierarchy tree)	<div>Low level of village cleanliness (Y2a)</div>			
1. Cause-Level (Causation by trigger)	<div>Lacking trash-can (x1)</div>			Interpretation and implication <ul style="list-style-type: none">Deep investigation on Lacking trash-can is a critical part. Lacking trash-can could lead us to major problems like there's not enough space for garbage and large amounts of concentrated garbage. These reasons make our trash-can visibility/ attraction too lowWe will focus on 4 identified root causes to improve Lacking trash-can problem. When harvest are has enough suitable trash-can number, littering situation will be will be markedly improved
2. Cause-Level (intermediate causation)	<div>The trash-can is usually overfilled (x1.1)</div>			
3. Cause-Level (intermediate causation)	<div>There's not enough space for garbage (x1.1.1)</div>	<div>Large amount of concentrated garbage (x1.1.2)</div>		
4. Cause-Level (intermediate causation)	<div>The number of trash cans is too small (x1.1.1.1)</div>	<div>The trash can is placed in too large area (x1.1.2.1)</div>		
n. Cause-Level (Causation by root cause)	<div>Lack of investment funds to buy trash-cans (x1.1.1.1.1)</div>	<div>The local government doesn't really care (x1.1.1.1.2)</div>	<div>Removal team Leader doesn't know obvious situation (x1.1.1.1.3)</div>	
			<div>Do not divide the garbage disposal location (x1.1.2.1.1)</div>	

... due to first reason is Lacking trash-can (result from regression hypothesis testing result)

Root cause analysis for Y_01 Ground(cleaned) cleaning-effort > 8 working hours per week ...

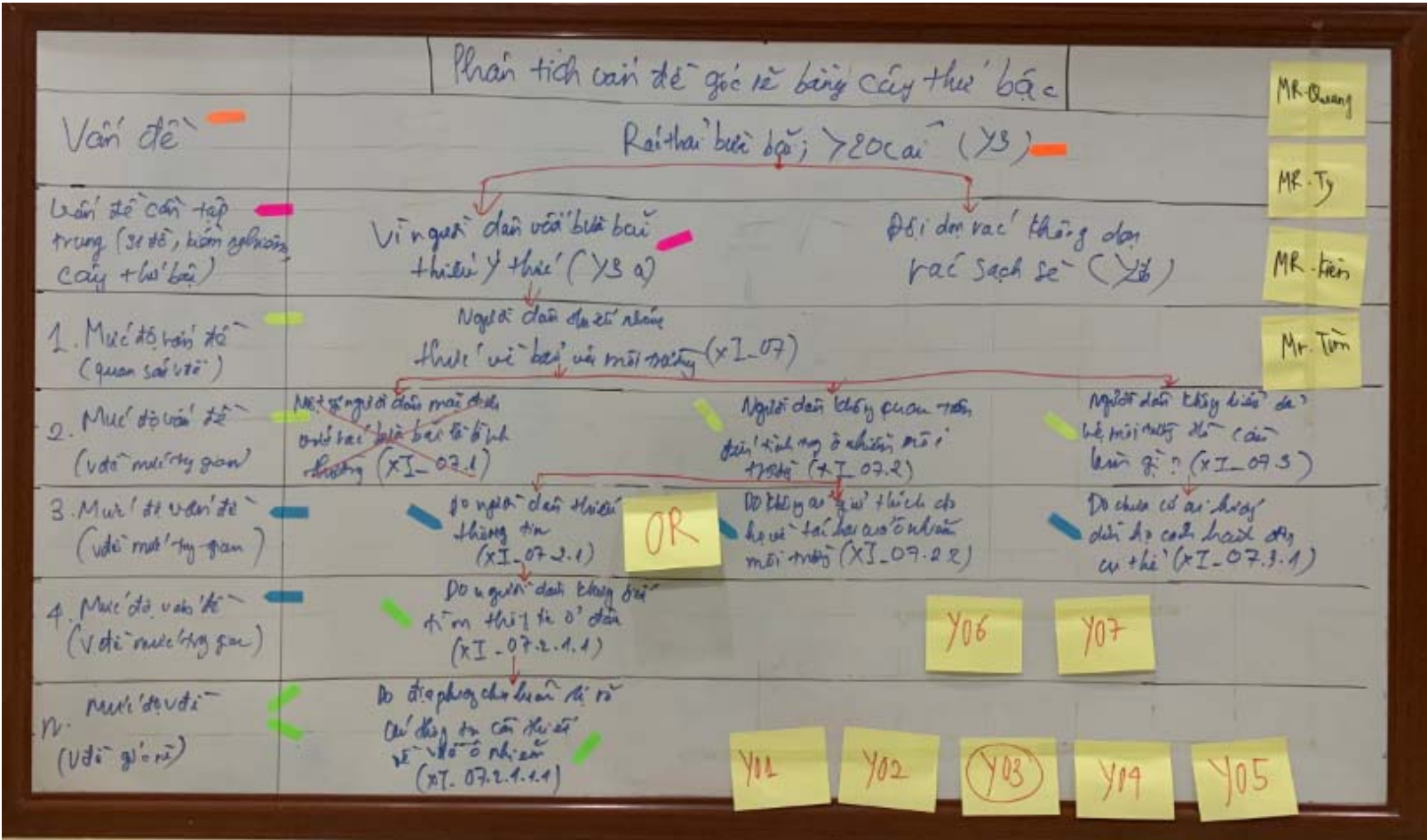
	Root Cause Analysis by Hierarchy Tree			
Problem	Ground(cleaned) cleaning-effort > 8 working hours/week (Y1)			Results <ul style="list-style-type: none">▪ The root cause analysis for Y_01 Ground(cleaned) cleaning-effort > 8 working hours per week shows that 2 causes were determined in different levels of the Hierarchy Tree▪ There are 3 Problem-Focus, but just identified 2 root causes▪ Y1a could identify 1 root cause▪ Y1b lead to Unchangeable fact of reality▪ Y1c could identify 1 root cause
Problem-Focus (Prioritization by: Pareto Diagram, 2-Sample-Proportion, t-Test, ANOVA or separate hierarchy tree)	Lack cleaning equipment (Y1a)	Lack manpower (Y1b)	Low current salary (Y1c)	
1. Cause-Level (Causation by trigger)	Removal team Leader doesn't know about equipment lacking (x1)	Usually have to work Overtime (x2)	Low welfare regime for removal team members (x3)	
2. Cause-Level (intermediate causation)	Removal members don't raise the problem (x1.1)	Village cleaning job has too much workload (x2.1)	Low investment for garbage Removal team (x3.1)	
3. Cause-Level (intermediate causation)	Removal member think the problem won't be solved (x1.1.1.)	The number of employees is too small (x2.1.1)	Underestimate the importance of cleaning up (x3.1.1)	
4. Cause-Level (intermediate causation)	Removal member raised before but problem is not resolved (x1.1.1.1)	Difficult to recruit more employees (x2.1.1.1)		
n. Cause-Level (Causation by root cause)		Unchangeable fact of reality		Interpretation and implication <ul style="list-style-type: none">▪ Taking the feedback of garbage removal members into account can help us understand their recent real situation. Then we can support them to perform better work from these information▪ They shown us their difficult condition, from that we can see most of the members are not happy. So it's hard for them to accomplish their job well



... due to multiple reason from Additional question result

I am deeply impressed – about the team, the facilitator ;-) and his fault-tree

Picture(s) of villagers & sponsor in front of the Root-Cause Analysis



... And picture of the original flipchart ✓

Summary of the problems, 19 root causes which are figured out from Analyse phase ...

Problems	Root Causes	Implement Measures	Financial Benefits	Other Benefits
Y_01 Ground(cleaned) cleaning-effort > 8 working hours per week	1. Removal member raised before but problem is not resolved (x1.1.1.1) 2. Underestimate the importance of cleaning up (x3.1.1)	To be determined in Improve phase (Next phase)	To be determined in Improve phase (Next phase)	To be determined in Improve phase (Next phase)
Y_02 Trash-can(empty) visibility/ attraction too low	3. Lack of investment funds to buy trash-cans (x1.1.1.1.1) 4. The local government doesn't really care (x1.1.1.1.2) 5. Removal team Leader doesn't know obvious situation (x1.1.1.1.3) 6. Do not divide the garbage disposal location (x1.1.2.1.1)			
Y_03 Ground(cleaned) pieces left > 20	7. Villagers eat food or drink in public (x1.1.1.1) 8. Villager has littered medical waste in concealed way (x1.1.2.1) 9. Villagers do not classified garbage before littering (x1.2.1) 10. The removal team has too much work (x1.3.1.1) 11. Garbage accumulated for a long time (x1.3.2.1.1)			
Y_04 Garbage(disposed) location wrong	12. Not yet propaganda about the current urgency of the EPN (x.1.2.1.1.1) 13. Properly garbage dispose is not visual (x.1.2.2.1.1) 14. Responsibilities have not been clarified (x.1.3.1.1) 15. Not encouraged the spirit of the villager yet (x1.3.2.1)			
Y_05 Removal(schedule) garbage in trash-can full	16. Trash-cans are arranged in the out of sight places (x1.1.1) 17. Trash-cans are arranged in the solitude places (x1.1.2)			
Y_06 Decision(garbage) harmfulness wrong	18. Never had near trash-cans signposts idea before (x1.2.1.1) 19. Inappropriate garbage removal time (x1.3.1.1.1)			

Interpretation and implication

- Improvements are made by eliminating the root causes in the next phase (Improve phase)
- The information of Implement Measures & Financial Benefits & Other Benefits will be determined in Improve phase

Results

- After analysis phase from 6 Problems (from Y_01 to Y_06), we have found all 19 root causes
- The detail number of root cause corresponding to Problems is: 2 for Y_01; 4 for Y_02; 5 for Y_03; 4 for Y_04; 4 for Y_06 & Y_05
- Note: EPN means Environmental pollution

Results of the ANALYSE-Steering

Analyse-Steering				
Tool	Application	Documentation	Comment	Decision
Graphical Analysis	ok	ok		Master-Black-Belt
Process-Capability	ok	ok		Dr. Reiner Hutwelker reiner.hutwelker@tum.de
Control-Charts	ok	ok	See my notes	16-Jun-2022
Statistical Tests of Hypotheses	ok	ok	See my notes	passed
Root-Cause-Analysis	ok	ok		Sponsor
				Pham Van Quang Phamvanquang.trunghung@gmail.com
				16-Jun-2022
Additonal Notes			Dear Tim, also your ANALYSE is excellent, just see my few notes on control charts and hypothesis testing. I am deeply impressed about your competence, motivation and about the sovereignty with which you treat the topic. Wonderful, please go to IMPROVE and continue with this graded version of your story-book. - Reiner	passed
Sponsor Notes			Hi Tim, I have seen your ANALYSE once before and like I said, I feel quite surprised because many of the root causes come from the local management aspect besides the villager's awareness that needs to be improved. You are doing very well, go ahead like this way. – Pham Van Quang	

Only proceed to the next phase after a positive decision of MBB and Sponsor

IMPROVE

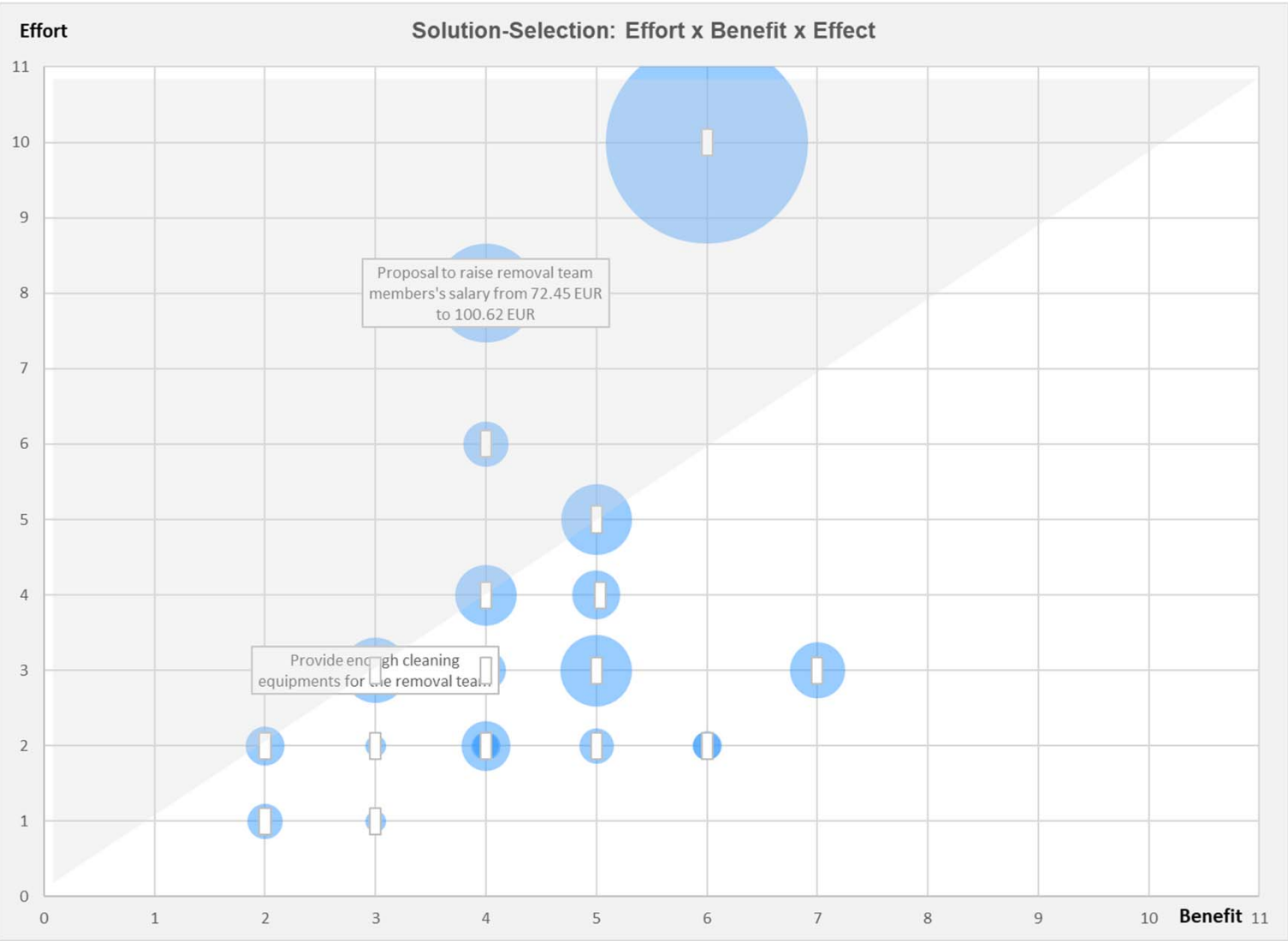
Development and selection of Solutions, Measures and risk prevention, Implementation

Solutions for 6 problems from Y_03, Y_04 (Must-Be) & Y_01, Y_02, Y_05, Y_06 (More/Less-Is-Better) ...

Solutions											
Rank	Kano-Category	Costs of the Problem/ Year:	Problem	Root-Causes	Cause determines the Problem to:	Sum of Determination	Solutions	Benefit	Effort	Rank (Effort/ Benefit)	Reduction of Problem-Costs
6	More/Less-Is-Better	800.00 €	Y_01 Problem: GROUND(CLEANED) CLEANING EFFORT > 8 WORKING HOURS PER WEEK	x1.1.1.1) Removal member raised before but lack cleaning equipment is not resolved	15%	50%	Provide enough cleaning equipments for the removal team	3	3	14	120 \$
				x3.1.1) Underestimate the importance of cleaning up	35%		Proposal to raise removal team members's salary from 72.45 EUR to 100.62 EUR	4	8	21	280 \$
								...?	...?		./. \$
4	More/Less-Is-Better	704.00 €	Y_02 Problem: TRASH-CAN(EMPTY) VISIBILITY/ ATTRACTION TOO LOW	x1.1.1.1.1) Lack of investment funds to buy trash-cans	20%	50%	Request budget for additional trash-cans	5	5	14	140.8 \$
				x1.1.1.1.2) The local government doesn't really care	10%		Attract local government attention about Lacking trash-can problem	4	2	6	70.4 \$
				x1.1.1.1.3) Removal team Leader doesn't know obvious situation	5%		Detail explain about Lacking trash-can problem to Removal team Leader to find common request	2	1	6	35.2 \$
				x1.1.2.1.1) Do not divide the garbage disposal location	15%		Arrange appropriate trash-cans according to the size of the area	4	4	14	105.6 \$
								...?	...?		./. \$
1	Must-Be	442.00 €	Y_03 Problem: GROUND(CLEANED) PIECES LEFT > 20	x1.1.1.1) Villagers eat food or drink in public	10%	65%	Propagate villagers to limit consuming food and drinking in public harvest area	3	3	14	44.2 \$
				x1.1.2.1) Villager has littered medical waste in concealed way	10%		Request people not to throw medical waste indiscriminately	2	2	14	44.2 \$
				x1.2.1) Villagers do not classified garbage before littering	10%		Request people to classify their garbage before throwing it away	4	3	12	44.2 \$
				x1.3.1.1) The removal team has too much work	15%		Organize volunteer activities to clean up trash with the garbage collection team	5	4	13	66.3 \$
				x1.3.2.1.1) Garbage accumulated for a long time	20%		Mobilize villagers to thoroughly clean up garbage accumulated for a long time	7	3	5	88.4 \$
								...?	...?		./. \$
3	Must-Be	121.00 €	Y_04 Problem: GARBAGE(DISPOSED) LOCATION WRONG	x.1.2.1.1.1) Not yet propaganda about the current urgency of the	20%	55%	Organize propaganda for villagers about the current urgency of the Environmental pollution	6	2	1	24.2 \$
				x.1.2.2.1.1) Properly garbage dispose is not visual	10%		Visualize properly garbage dispose method	3	1	1	12.1 \$
				x.1.3.1.1) Responsibilities have not been clarified	10%		Clarify everyone's roles and responsibilities	3	2	11	12.1 \$
				x1.3.2.1) Not encouraged the spirit of the villager yet	15%		Encourage and motivate people to participate in environmental protection movements	4	2	6	18.15 \$
								...?	...?		./. \$
5	More/Less-Is-Better	2,897.00 €	Y_05 Problem: REMOVAL(SCHEDULE) GARBAGE IN TRASH-CAN FULL	x1.3.1.1.1) Inappropriate garbage removal time	5%	45%	Make a suitable garbage removal schedule	5	3	10	144.85 \$
				x1.3.1.1.2) Inappropriate garbage removal manpower	40%		Proposal to increase manpower of removal team from 13 to 16 members	6	10	20	1158.8 \$
								...?	...?		./. \$
2	More/Less-Is-Better	231.00 €	Y_06 Problem: DECISION(GARBAGE) HARMFULNESS WRONG	x1.1.1) Trash-cans are arranged in the out of sight places	15%	60%	Arrange trash-cans in the attractive places (easy to find out)	5	2	4	34.65 \$
				x1.1.2) Trash-cans are arranged in the solitude places	10%		Arrange trash-can in the crowded places	4	2	6	23.1 \$
				x1.2.1.1) Never had near trash-cans signposts idea before	10%		Post signs to the nearest trash-can	6	2	1	23.1 \$
				x1.3.2.1) Inappropriate Trash-can selection	25%		Select and replace with the right size trash-cans	4	6	19	57.75 \$
								...?	...?		./. \$

... Identify estimated Quality-Cost, strong of problems, the portion, solution ideas, rank of Effort & Benefit

The Chart: Solution Selection shows all 21 Solutions in a Effort x Benefit Diagram



Results

- Analyse phase figured out 21 root causes, then improve phase, totally 21 solutions have been developed
- 13 bubbles located on the lower middle line of effort/benefit rank, 5 bubbles located on the line and 3 bubbles located above the line

Interpretation and implication

- Every root cause has a solution developed
- If any of the solutions have any hope of being possible, I would like to process
- Some highly effective and beneficial solutions directly related to the local budget of the government. But these are also the solutions that require the most effort.
- Solutions such as propagandizing and mobilizing villagers to raise their awareness of environmental protection usually do not need to spend too much effort, but the benefits are high. we should focus on completing these solutions
- The solutions related to organizing volunteering sessions and garbage collection has benefits and effort at an approximate level, these are also very effective solutions

... Compare rank of Effort and Benefit, it shows 3 larger, 5 equal, 13 smaller

Specify solutions in the action plan (from solution 1 to solution 11) ...

Action-Plan													
Rank (Effort/ Benefit)	Reduction of Problem- Costs		Solutions	Measure-No.	Measure (What has to be done?)	Result (What will be achieved?)	Risk-Reduction-Measure (from FMEA)	Costs of Implementation	Cost center	Deadline	Responsibility	Decision on implementation	Implementation- Status in %
14	120	\$	Provide enough cleaning equipments for the removal team	1	1. Collect current shortage of cleaning equipment from removal team members (Gloves, masks, brooms, dustpans) 2. On behalf of removal team members communicate with removal team leader 3. Proposing removal team leader to provide adequate equipment for removal team members	Removal team members have enough cleaning equipments	Communicate clearly with removal members to understand what type and quantity they needed equipment. Communicate with management based on clear numbers, unified information	85.00 €	Village budget	15 July 2022	Mrs. Thin	partially	30%
21	280	\$	Proposal to raise removal team members's salary from 72.45 EUR to 100.62 EUR	2	1. Collect the current and desired salary of removal team members 2. Collect data to show that current income level is not enough for removal team members's life 3. Convince the local government of the importance of garbage collectors 4. Proposal to raise removal team members salary from 72.45 EUR to 100.62 EUR (write a proposal, signed by villagers)	Removal team members get a raise in salary, meeting expectations	Try to find the most convincing evidence to local government. Persuading removal team members to accept the offer to increase some, but not all exactly like their expectation. Writing a proposal, signed by villagers	700.00 €	Village budget	01 July 2022	Mr. Sung	partially	10%
	J.	\$...?	...?
14	140.8	\$	Request budget for additional trash-cans	3	1. Gather about the current local trash-can shortage 2. Convince local government that the lacking trash-cans is one of the main causes of littering 3. Proposing the local government to provide a budget to buy more trash cans 4. Discuss with people about the option of making their own trash cans for temporary	The village has enough trash cans	Try to find the most convincing evidence to local government. Persuading villager make their own trash-can for temporary	400.00 €	Village budget	01 July 2022	Mr. Quang	partially	20%
6	70.4	\$	Attract local government attention about Lacking trash-can problem	4	1. Gather about the current serious pollution situation in the village 1. Gather about the current local trash-can shortage 3. Convince local governments that the lacking trash-cans is one of the main causes of littering 4. Outlining the effectiveness of having enough trash cans to convince local local government	Local government will concern about the lacking trash-cans and will agree to increase budget to buy more trash-cans	Try to find the most convincing evidence to local government	- €		06 June 2022	Tim	yes	60%
6	35.2	\$	Detail explain about Lacking trash-can problem to Removal team Leader to find common request to local government	5	1. Gather about the current local trash-can shortage in TrungHung village 3. Convince removal team leader that the lacking trash-cans is one of the main causes of littering 4. Find consensus from removal team leader on the request with the government for the lacking trash-cans	Find a common voice with the removal team leader, propose together to local government	Try to find the most convincing evidence to removal team leader	- €		06 June 2022	Tim	yes	80%
14	105.6	\$	Arrange appropriate trash-cans according to the size of the area	6	1. Assess the frequency of garbage disposal of the areas 2. Arrange large trash-cans in large areas 3. Arrange small trash-cans and homemade trash-cans in residential areas to reduce the amount of garbage for large trash-cans	Divide the garbage area so that the trash-can are not often overfilled	Assess the area thoroughly with local people to understand the level of littering of each area	200.00 €	Village budget	02 June 2022	Tim, Mr. Ty	yes	20%
	J.	\$...?	...?
14	44.2	\$	Propagate villagers to limit consuming food and drinking in public harvest area	7	1. Collect data on how often people eat and drink in public in the current locality 2. Collect data on current local environmental pollution 3. Collect data to share with villagers about the harmful effects of environmental pollution 4. Prepare content to propagate to people to limit consumption of food and drink in public 5. Broadcast on local radio station weekly	Reduce frequency of consume food and drink in public	Request local government to propagate more propaganda at all-villagers meetings, together with broadcast on local radio station weekly	20.00 €	Village budget	31 May 2022	Tim, Mrs. Thin	yes	80%
14	44.2	\$	Request people not to throw medical waste indiscriminately	8	1. Collecting data on Villagers has littered medical waste in concealed way 2. Collect data on current local environmental pollution 3. Collect data to share with villagers about the harmful effects of environmental pollution 4. Prepare content to propagate to people not to dump medical waste into the environment 5. Broadcast on local radio station weekly	Reduce the disposal of medical waste into the environment	Request local government to propagate more propaganda at all-villagers meetings, together with broadcast on local radio station weekly	15.00 €	Village budget	30 June 2022	Tim, Mr. Quang	yes	30%
12	44.2	\$	Request people to classify their garbage before throwing it away	9	1. Prepare content to guide villagers to classify garbage, not to throw garbage indiscriminately 2. Broadcast on local radio station weekly 3. Posting instructions for garbage classification in crowded areas 4. Distributing instruction leaflets and mobilizing villagers do not to litter	Minimizing the sorting job when taking out trash for the removal team, making use of recyclable waste	Spread the usefulness of garbage classify to the entire villagers and visualize the garbage classify instructions	15.00 €	Village budget	01 July 2022	Tim, Mr. Quang	yes	30%
13	66.3	\$	Organize volunteer activities to clean up trash with the garbage collection team	10	1. Mobilize and set up a local volunteer team 2. Disseminate the plan of volunteering to clean up with removal team once a month 3. Carry out the implementation according to the plan	Reduce the workload for the removal team	Propaganda and campaign widely to all villagers, all ages. Upholding the spirit of environmental protection of outstanding individuals weekly	22.00 €	Village budget	02 July 2022	Tim, Mrs. Huong	yes	40%
5	88.4	\$	Mobilize villagers to thoroughly clean up garbage accumulated for a long time	11	1. Collaborate with the local government to gather a group of villagers willing to participate in environmental protection 2. Motivating and encouraging the spirit of all villagers to participate in environmental protection 3. Plan to clean up local hotspot contaminated areas 2 times a month 4. Carry out the implementation according to the plan	Clean areas with a lot of garbage that can't be handled by just removal team	Propaganda and campaign widely to all villagers, all ages. Upholding the spirit of environmental protection of outstanding individuals monthly	30.00 €	Village budget	02 June 2022	Tim, Mr. Quang	yes	100%
	J.	\$...?	...?

... More detail in Measure, Result, cost, time, responsibility, decision & status

Specify solutions in the action plan (from solution 12 to solution 21) ...

1	24.2	\$	Organize propaganda for villagers about the current urgency of the Environmental pollution	12	1. Collecting data on general environmental pollution in Vietnam recently 2. Collecting data on general environmental pollution in Trunghung recently 3. Collect data to share with villagers about the harmful effects of environmental pollution 4. Propagating and persuading people about urgent issues that need environmental protection	Raise people's awareness about environmental protection	Give a clear explanation the current urgency of the Environmental pollution in Trunghung village. Request local authorities to jointly propagate to the people and broadcast on local radio station weekly	10.00 €	Village budget	31 May 2022	Tim, Mr. Quang	yes	20%
1	12.1	\$	Visualize properly garbage dispose method	13	1. Figure out how to properly classify garbage 2. Design some signboards guiding how to classify garbage 3 Color print out to make a signboard 4. Posting instruction signs in crowded places and some areas where littering often occurs	Everyone knows how to properly classify garbage	Go to distric or city center to print the signs with better quality color printers	5.00 €	Personal budget	31 May 2022	Tim, Mrs. Thay	yes	100%
11	12.1	\$	Clarify everyone's roles and responsibilities	14	1. Discuss with the local government about orientation for environmental protection in Trunghung village 2. Sort out the current villagers of Trunghung village in some common groups 3. Clearly define the roles and tasks of each population group 4. Propaganda on local loudspeakers about the role and responsibility of individuals in environmental protection so that everyone can understand clearly what they need to do	Everyone understands their roles and responsibilities in environmental protection	Give a clear explanation of the villager's role and duties based on the actual situation of the current village. Request local authorities to jointly propagate to the people in collective activities. broadcast on local radio station weekly	12.00 €	Village budget	31 May 2022	Tim, Mr. Ty	yes	100%
6	18.15	\$	Encourage and motivate people to participate in environmental protection movements	15	1. Propaganda to mobilize all villagers to participate in to protect the environment, inform once a week at the local radio program 2. Commendation of individuals' and organizations for good observance of the environmental protection action 3. Distributing leaflets, spreading the spirit of environmental protection to everyone	Encourage everyone to participate in environmental protection	Request local government to propagate more propaganda at all-villagers meetings, together with broadcast on local radio station weekly	15.00 €	Village budget	31 May 2022	Tim, Mr. Tinh	yes	100%
	J.	\$...?	...?
10	144.85	\$	Make a suitable garbage removal schedule	16	1. Analyze the unreasonable points of the current garbage removal plan 2. Discuss with the removal team to have a suitable garbage removal plan 3. Make a plan based on consensus 4. Request the removal members to follow the plan and perform the checksheet after clearing the ground and trash-can	The garbage collection team has a suitable plan to avoid frequent delays	Planning based on the consensus of the majority of participants	3.00 €	Personal budget	02 June 2022	Tim, Mrs. Duan	yes	100%
20	1158.8	\$	Proposal to increase manpower of removal team from 13 to 16 members	17	1. Collect the daily workload of the garbage removal members 2. Analysis with local governments on the current shortage of human resources 3. Convince local government that the lack of human resources to clean up garbage can lead to negative impacts on environmental protection 4. Proposed increase from 13 people to 16 people in the current situation	Increase the number of removal team members to 16 to ensure the work is handled better	Try to find the most convincing evidence to local government. Writing a proposal, signed by villagers	2,200.00 €	Commune budget	01 July 2022	Tim, Villagers	no	0%
	J.	\$...?	...?
4	34.65	\$	Arrange trash-cans in the attractive places (easy to find out)	18	1. Figure out and decide on visible trash-can locations 2. Move the trash-cans from the current locations to the selected suitable locations	It's easier for people to find trash cans, to limit littering on the ground		5.00 €	Personal budget	01 June 2022	Tim, Mr. Ty	yes	100%
6	23.1	\$	Arrange trash-can in the crowded places	19	1. Figure out and decide on crowded locations 2. Move the trash-cans from the current locations to the selected suitable locations	More people throw garbage in the trash-can, garbage collection is more efficient	Add crowded areas if these locations are found to be missing	5.00 €	Personal budget	03 June 2022	Tim, Mr. Ty	yes	100%
1	23.1	\$	Post signs to the nearest trash-can	20	1. Move out trash-cans to the locations which need signage 2. Design a signpost for the location of the trash-cans 3. Print out the color printing to make the signboard 4. Post instructions in places near trash-cans that can be hidden from view	People can easily find the location of the trash-can near them	Go to distric or city center to print the signs with better quality color printers	4.00 €	Personal budget	01 June 2022	Tim, M. Quan	yes	100%
19	57.75	\$	Select and replace with the right size trash-cans	21	1. Select the size of the trash-cans according to the area to be dumped 2. Replace trash-cans that are too small with a more suitable one	Optimizing garbage storage, limiting the fact that the trash-can is often full due to its small size	Buy used large trash-cans to increase the number of trash-cans from the government's additional budget	40.00 €	Village budget	01 July 2022	Tim, Mrs. Thay	yes	50%
	J.	\$...?	...?

Interpretation and implication

- In order for the solutions to be highly effective, the sequence of my actions will be as follows:
 - First, focus on propagandizing, mobilizing, and raising the villagers' awareness of environmental protection
 - Followed by convincing local government about the importance of removal teams, proposing more budgets for environmental issues
 - Finally, specific environmental protection actions to develop sustainable solutions, maximizing efficiency

Results

- All 21 solutions are decided to implement
- Measures that rely heavily on individuals are 100% implemented
- Budget-related measures often take time for local government to approve
- Increase manpower was rejected

... More detail in Measure, Result, cost, time, responsibility, decision & status

FMEA (Failure Mode and Effects Analysis) of measure 1 to measure 6 ...

FMEA (Failure Mode and Effects Analysis)		Risk-Analysis								Improvement	new Risk-Analysis			
Measure-No.	Measure (What has to be done?)	potential Failures/ Problems	actual controls to detect the Failures/ Problems	Detection of the Problem	potential Effects of the Failures/ Problems	Severity of the Effect	potential Causes of the Failure/ Problem	Probability of Cause	RPN	Countermeasures (integrated in Action-Plan)	Severity of the Effect	Probability of Cause	Detection of the Problem	RPN
		Which Failures/ Problems can result from the Measures?	By which existing Controls can the Failure/ Problem be detected, before it occurs?	Rating: 1= each time - 10= never	Which Effect results from the Failure/ Problem?	Rating: 1= minimal - 10= disastrous	Which Influence triggers the Failure/ Problem?	Rating: 1= never - 10= always	Risk-Priority-Number	How could the trigger of the Failure/ Problem, i.e. their Root-Causes be eliminated?	Rating: 1= minimal - 10= disastrous	Rating: 1= never - 10= always	Rating: 1= each time - 10= never	Risk-Priority-Number
1	1. Collect current shortage of cleaning equipment from removal team members (Gloves, masks, brooms, dustpans) 2. On behalf of removal team members communicate with removal team leader 3. Proposing removal team leader to provide adequate equipment for removal team members	Lacking cleaning equipment problem is not completely solved	Inform to the removal team members directly about cleaning equipment increased planning	5	The removal team leader lacks the quantity compared to the actual demand	8	Presenting lacking trash-can problems to removal leader is not clear	3	120	Communicate clearly with removal members to understand what type and quantity they needed equipment. Communicate with management based on clear numbers, unified information	8	2	4	64
2	1. Collect the current and desired salary of removal team members 2. Collect data to show that current income level is not enough for removal team members's life 3. Convince the local government of the importance of garbage collectors 4. Proposal to raise removal team members salary from 72.45 EUR to 100.62 EUR (write a proposal, signed by villagers)	Salary increase proposal not accepted	Feedback from local government	10	Removal temembers feel uncomfortable	9	The persuasion for local government is not enough reasonable	6	540	Try to find the most convincing evidence to local government. Persuading removal team members to accept the offer to increase some, but not all exactly like their expectation. Writing a proposal, signed by villagers	9	2	5	90
3	1. Gather about the current local trash-can shortage 2. Convince local government that the lacking trash-cans is one of the main causes of littering 3. Proposing the local government to provide a budget to buy more trash cans 4. Discuss with people about the option of making their own trash cans for temporary	Trash-can increase proposal not accepted	Feedback from local government	5	Regular garbage does not have enough storage space	9	The persuasion for local government is not enough reasonable	5	225	Try to find the most convincing evidence to local government. Persuading villager make their own trash-can for temporary	9	3	3	81
4	1. Gather about the current serious pollution situation in the village 1. Gather about the current local trash-can shortage 3. Convince local governments that the lacking trash-cans is one of the main causes of littering 4. Outlining the effectiveness of having enough trash cans to convince local local government	Can not get the consent of local government	Feedback from local government	6	Difficulty in asking for more budget to buy additional trash-cans	6	The persuasion for local government is not enough reasonable	5	180	Try to find the most convincing evidence to local government	6	4	3	72
5	1. Gather about the current local trash-can shortage in Trunghung village 3. Convince removal team leader that the lacking trash-cans is one of the main causes of littering 4. Find consensus from removal team leader on the request with the government for the lacking trash-cans	Removal team leader doesn't have the same opinion	Feedback from removal team leader	6	Difficult to convince local government	6	The persuasion of removal is not enough reasonable	4	144	Try to find the most convincing evidence to removal team leader	6	4	4	96
6	1. Assess the frequency of garbage disposal of the areas 2. Arrange large trash-cans in large areas 3. Arrange small trash-cans and homemade trash-cans in residential areas to reduce the amount of garbage for large trash-cans	Improperly sized trash-cans	Villagers's reflection and actual effect of the change	5	Trash-cans are often full	5	Misjudged the area of the area	5	125	Assess the area thoroughly with local people to understand the level of littering of each area	5	4	4	80

... All Risk-Priority-Number (RPN) > 100 and need to has countermeasures to reduce these RPN

FMEA (Failure Mode and Effects Analysis) of measure 7 to measure 14 ...

7	1. Collect data on how often people eat and drink in public in the current locality 2. Collect data on current local environmental pollution 3. Collect data to share with villagers about the harmful effects of environmental pollution 4. Prepare content to propagate to people to limit consumption of food and drink in public 5. Broadcast on local radio station weekly	People still don't change their public consume food and drink habits	Actual observation after conducting propaganda action	8	There is still a lot of domestic waste discharged into the public environment	5	The argument is not convincing enough	6	240	Request local government to propagate more propaganda at all-villagers meetings, together with broadcast on local radio station weekly	5	4	5	100
8	1. Collecting data on Villagers has littered medical waste in concealed way 2. Collect data on current local environmental pollution 3. Collect data to share with villagers about the harmful effects of environmental pollution 4. Prepare content to propagate to people not to dump medical waste into the environment 5. Broadcast on local radio station weekly	People still don't change their public consume food and drink habits	Actual observation after conducting propaganda action	8	There is still a lot of medical waste discharged into the public environment	5	The argument is not convincing enough	4	160	Request local government to propagate more propaganda at all-villagers meetings, together with broadcast on local radio station weekly	5	4	3	60
9	1. Prepare content to guide villagers to classify garbage, not to throw garbage indiscriminately 2. Broadcast on local radio station weekly 3. Posting instructions for garbage classification in crowded areas 4. Distributing instruction leaflets and mobilizing villagers do not to litter	People still don't classify their garbage before throwing it into the environment	Actual observation after conducting propaganda action	8	The removal team still takes a long time to calssify the garbage	6	Villagers do not want to change their habit or do not understand clearly how to separate garbage types	5	240	Spread the usefulness of garbage classify to the entire villagers and visualize the garbage classify instructions	6	5	3	90
10	1. Mobilize and set up a local volunteer team 2. Disseminate the plan of volunteering to clean up with removal team once a month 3. Carry out the implementation according to the plan	Volunteer team does not have many people	Number of volunteer members	6	The removal team is always overloaded with daily garbage cleaning work	5	Villagers don't want to do extra work, they feel that garbage collection is not attractive to them	6	180	Propaganda and campaign widely to all villagers, all ages. Upholding the spirit of environmental protection of outstanding individuals weekly	5	3	4	60
11	1. Collaborate with the local government to gather a group of villagers willing to participate in environmental protection 2. Motivating and encouraging the spirit of all villagers to participate in environmental protection 3. Plan to clean up local hotspot contaminated areas 2 times a month 4. Carry out the implementation according to the plan	Can't summon many people	Number of garbage collection team	7	The removal team is unable to clean up a large amount of accumulated waste on their own	5	Many villagers do not want to participate in garbage collection, they assume that it is the job of the removal team	4	140	Propaganda and campaign widely to all villagers, all ages. Upholding the spirit of environmental protection of outstanding individuals monthly	5	5	3	75
12	1. Collecting data on general environmental pollution in Vietnam recently 2. Collecting data on general environmental pollution in Trunghung recently 3. Collect data to share with villagers about the harmful effects of environmental pollution 4. Propagating and persuading people about urgent issues that need environmental protection	Villagers are still not clear about the current urgency of the Environmental pollution	Actual observation after conducting propaganda action	6	The villagers still do not limit their actions indiscriminately dumping garbage	5	the explanation is not clear and the argument is not convincing enough for the villagers	4	120	Give a clear explanation the current urgency of the Environmental pollution in Trunghung village. Request local authorities to jointly propagate to the people and broadcast on local radio station weekly	5	4	4	80
13	1. Figure out how to properly classify garbage 2. Design some signboards guiding how to classify garbage 3 Color print out to make a signboard 4. Posting instruction signs in crowded places and some areas where littering often occurs	The color of the print is not clear, the ink is smudged	Reflections of the villagers	5	Villagers do not see the instructions on the signboard clearly	4	Color printers in the countryside are of poor quality	3	60	Go to distric or city center to print the signs with better quality color printers	4	3	2	24
14	1. Discuss with the local government about orientation for environmental protection in Trunghung village 2. Sort out the current villagers of Trunghung village in some common groups 3. Clearly define the roles and tasks of each population group 4. Propaganda on local loudspeakers about the role and responsibility of individuals in environmental protection so that everyone can understand clearly what they need to do	Villagers are still not clear about their roles and responsibilities	Actual observation after conducting propaganda action	6	Villagers still cannot promote their strengths in environmental protection	6	the explanation is not clear and the argument is not convincing enough for the villagers	5	180	Give a clear explanation of the villager's role and duties based on the actual situation of the current village. Request local authorities to jointly propagate to the people in collective activities. broadcast on local radio station weekly	6	4	4	96

... 7 Risk-Priority-Number (RPN) > 100, 1 RPN < 100, need focus on countermeasures to reduce these 7 RPN

FMEA (Failure Mode and Effects Analysis) of measure 15 to measure 21 ...

15	1. Propaganda to mobilize all villagers to participate in to protect the environment, inform once a week at the local radio program 2. Commendation of individuals and organizations for good observance of the environmental protection action 3. Distributing leaflets, spreading the spirit of environmental protection to everyone	Villagers still don't change their mindset about environmental protection movement	Actual observation after conducting propaganda action	7	Villagers are still on the sidelines, not joining hands to protect the environment	5	The argument is not convincing enough	5	175	Request local government to propagate more propaganda at all-villagers meetings, together with broadcast on local radio station weekly	5	4	4	80
16	1. Analyze the unreasonable points of the current garbage removal plan 2. Discuss with the removal team to have a suitable garbage removal plan 3. Make a plan based on consensus 4. Request the removal members to follow the plan and perform the checklist after clearing the ground and trash-can	The new garbage removal plan is not really reasonable	Feedback from removal team	8	The situation that many trash-cans are full and the ground has a lot of garbage still happens	4	Requires the removal plan to reach the consensus of the entire garbage removal team	4	128	Planning based on the consensus of the majority of participants	4	5	3	60
17	1. Collect the daily workload of the garbage removal members 2. Analysis with local governments on the current shortage of human resources 3. Convince local government that the lack of human resources to clean up garbage can lead to negative impacts on environmental protection 4. Proposed increase from 13 people to 16 people in the current situation	Manpower increase proposal not accepted	Feedback from local government	9	Removal team has have to work too hard	9	The persuasion for local government is not enough reasonable	6	486	Try to find the most convincing evidence to local government. Writing a proposal, signed by villagers	9	2	5	90
18	1. Figure out and decide on visible trash-can locations 2. Move the trash-cans from the current locations to the selected suitable locations	Misjudged the visible trash-can locations	Actual observation after conducting improved action	3	It increases the amount of garbage people throw garbage on the ground	4	This assessment is ualitative classification	3	36		4	...?	...?	
19	1. Figure out and decide on crowded locations 2. Move the trash-cans from the current locations to the selected suitable locations	Underestimating the number of crowded areas	Actual observation after conducting improved action	4	It increases the amount of garbage people throw garbage on the ground	4	This assessment is ualitative classification	4	64	Add crowded areas if these locations are found to be missing	4	3	3	36
20	1. Move out trash-cans to the locations which need signage 2. Design a signpost for the location of the trash-cans 3. Print out the color printing to make the signboard 4. Post instructions in places near trash-cans that can be hidden from view	The color of the print is not clear, the ink is smudged	Reflections of the villagers	5	Villagers do not see the instructions on the signboard clearly	4	Color printers in the countryside are of poor quality	4	80	Go to distric or city center to print the signs with better quality color printers	4	3	3	36
21	1. Select the size of the trash-cans according to the area to be dumped 2. Replace trash-cans that are too small with a more suitable one	All non-conforming trash-cans can not be replaced	Actual observation after conducting improved action	7	Garbage is easily thrown indiscriminately on the ground	6	There are not enough large trash-cans to replace the small trash-cans	5	210	Buy used large trash-cans to increase the number of trash-cans from the government's additional budget	6	4	4	96

Interpretation and implication

- The top RPN are 540 and 486, they are related to increasing removal team members' salary and manpower. it really makes sense because these are also the 2 methods that require the most effort
- These depend a lot on changing local government’s views on the importance of protecting the environment and the role of the removal team

Results

- All 21 measures have own Failures/Problems can result from itself
- 17 measures have Risk-Priority-Number (RPN) > 100 and these measures require countermeasures to reduce RPN < 100
- 4 measures have RPN < 100, but we still develop 3 measure of them to get smaller RPN
- Highest RPN is 540 and lowest RPN is 36

Summarize the results and the financial and other benefits of the project ...

Summary and benefits					Financial Benefits
Problems	Root Causes	Implemented Measures	Financial Benefits	Other Benefits	
Y_03 ground(cleaned) ground not completely cleaned	x1.1.1.1) Villagers consume food or drink in public x1.1.2.1) Villager has littered medical waste in concealed way x1.2.1) Villagers do not classified garbage before littering x1.3.1.1) The removal team has too much work x1.3.2.1.1) Garbage accumulated for a long time	1. Collect data on how often people eat and drink in public in the current locality 2. Collect data on current local environmental pollution 3. Collect data to share with villagers about the harmful effects of environmental pollution 4. Collecting data on Villagers has littered medical waste in concealed way 5. Prepare content to propagate to people to limit consumption of food and drink in public 6. Prepare content to propagate to people not to dump medical waste into the environment 7. Prepare content to guide villagers to classify garbage, not to throw garbage indiscriminately 8. Posting instructions for garbage classification in crowded areas 9. Distributing instruction leaflets and mobilizing villagers do not to litter 10. Motivating and encouraging the spirit of all villagers to participate in environmental protection 11. Collaborate with the local government to gather a group of villagers willing to participate in environmental protection 12. Broadcast on local radio station weekly 13. Mobilize and set up a local volunteer team 14. Disseminate the plan of volunteering to clean up with removal team once a month 15. Plan to clean up local hotspot/contaminated areas 2 times a month 16. Carry out the implementation according to the plan	720 EUR (Estimated)	- Ensure a clean living environment for villagers to have more health and a happy life - Ensure aesthetics for residential areas - Maintain clean water sources in rural areas - Reducing the amount of plastic bags buried in the soil, limiting soil erosion - Reducing the cause of disease outbreaks - Protect the living environment for living things: fish, birds, ... - Eliminate unpleasant odors caused by garbage in heavily polluted areas - Mitigating climate change in rural areas	720 EUR (Estimated)
Y_06 decision(garbage) garbage mixture harmful	x1.1.1) Trash-cans are arranged in the out of sight places x1.1.2) Trash-cans are arranged in the solitude places x1.2.1.1) Never had near trash-cans signposts idea before x1.3.2.1) inappropriate Trash-can selection	1. Figure out and decide on visible trash-can locations 2. Figure out and decide on crowded locations 3. Move the trash-cans from the current locations to the selected suitable locations 4. Move the trash-cans from the current locations to the selected suitable locations 5. Move out trash-cans to the locations which need signage 6. Design a signpost for the location of the trash-cans 7. Print out the color printing to make the signboard 8. Post instructions in places near trash-cans that can be hidden from view 9. Select the size of the trash-cans according to the area to be dumped 10. Replace trash-cans that are too small with a more suitable one	360 EUR (Estimated)	- Ensure a clean living environment for villagers to have more health and a happy life - Reducing the amount of plastic bags buried in the soil, limiting soil erosion - Reducing the cause of disease outbreaks - Protect the living environment for living things: fish, birds, ... - Eliminate unpleasant odors caused by garbage in heavily polluted areas	360 EUR (Estimated)
Y_04 garbage(disposed) thrown on the ground	x1.2.1.1.1) Not yet propaganda about the current urgency of the Environmental pollution x1.2.2.1.1) Properly garbage dispose is not visual x1.3.1.1) Responsibilities have not been clarified x1.3.2.1) Not encouraged the spirit of the villager yet	1. Collecting data on general environmental pollution in Vietnam recently 2. Collecting data on general environmental pollution in TruongHung recently 3. Collect data to share with villagers about the harmful effects of environmental pollution 4. Propagating and persuading people about urgent issues that need environmental protection 5. Commendation of individuals and organizations for good observance of the environmental protection action 6. Distributing leaflets, spreading the spirit of environmental protection to everyone 7. Figure out how to properly classify garbage 8. Design some signboards guiding how to classify garbage 9. Color print out to make a signboard 10. Posting instruction signs in crowded places and some areas where littering often occurs 11. Discuss with the local government about orientation for environmental protection in Trung Hung village 12. Sort out the current villagers of TrungHung village in some common groups 13. Clearly define the roles and tasks of each population group 14. Propaganda on local loudspeakers about the role and responsibility of individuals in environmental protection so that everyone can understand clearly what they need to do 15. Propaganda to mobilize all villagers to participate in to protect the environment, inform once a week at the local radio program	330 EUR (Estimated)	- Ensure aesthetics for residential areas - Maintain clean water sources in rural areas - Reducing the amount of plastic bags buried in the soil, limiting soil erosion - Protect the living environment for living things: fish, birds, ...	330 EUR (Estimated)
Y_02 trash-can(empty) out of sight	x1.1.1.1.1) Lack of investment funds to buy trash-cans x1.1.1.1.2) The local government doesn't really care x1.1.1.1.3) Removal team Leader doesn't know obvious situation x1.1.2.1.1) Do not divide the garbage disposal location	1. Gather about the current local trash-can shortage 2. Gather about the current serious pollution situation in the village 3. Outlining the effectiveness of having enough trash cans to convince local local government 4. Convince removal team leader that the lacking trash-cans is one of the main causes of littering 5. Find consensus from removal team leader on the request with the government for the lacking trash-cans 6. Convince local government that the lacking trash-cans is one of the main causes of littering 7. Proposing the local government to provide a budget to buy more trash cans 8. Discuss with people about the option of making their own trash cans for temporary 9. Assess the frequency of garbage disposal of the areas 10. Arrange large trash-cans in large areas 11. Arrange small trash-cans and homemade trash-cans in residential areas to reduce the amount of garbage for large trash-cans	180 EUR (Estimated)	- Ensure aesthetics for residential areas - Reducing the amount of plastic bags buried in the soil, limiting soil erosion - Reducing the cause of disease outbreaks - Eliminate unpleasant odors caused by garbage in heavily polluted areas	180 EUR (Estimated)
Y_05 removal(schedule) trash-can fullness	x1.3.1.1.1) inappropriate garbage removal time x1.3.1.1.2) inappropriate garbage removal manpower	1. Analyze the unreasonable points of the current garbage removal plan 2. Collect the daily workload of the garbage removal members 3. Discuss with the removal team to have a suitable garbage removal plan 4. Make a plan based on consensus 5. Request the removal members to follow the plan and perform the check-sheet after clearing the ground and trash-can 6. Analysis with local governments on the current shortage of human resources 7. Convince local government that the lack of human resources to clean up garbage can lead to negative impacts on environmental protection 8. Proposed increase from 13 people to 16 people in the current situation	110 EUR (Estimated)	- Ensure a clean living environment for villagers to have more health and a happy life - Ensure aesthetics for residential areas - Reducing the cause of disease outbreaks	110 EUR (Estimated)
Y_01 ground(cleaned) removal requires a great deal of effort	x1.1.1.1) Removal member raised before but lack cleaning equipments not resolved x1.1.1.1.1) Underestimate the importance of cleaning up	1. Collect current shortage of cleaning equipment from removal team members (Gloves, masks, brooms, dustpans) 2. Collect the current and desired salary of removal team members 3. Collect data to show that current income level is not enough for removal team members' life 4. On behalf of removal team members communicate with removal team leader x1.1.1.1) Underestimate the importance of cleaning up 5. Proposing removal team leader to provide adequate equipment for removal team members 6. Convince the local government of the importance of garbage collectors 7. Proposal to raise removal team member's salary from 72.45 EUR to 100.62 EUR (write a proposal, signed by villagers)	90 EUR (Estimated)	- Increase the happiness and enthusiasm at work for removal team	90 EUR (Estimated)
Y_07 ground(cleaned) hear the flying insect noise	/	/	/	/	/

Results

- The financial benefit are difficult to calculate exactly, estimated number is very precious (*Sponsor suggested the confirmed number should be in Control phase, he need to check with local accountant*)
- Totally, we get the benefit around 1,790 EUR / year
- The benefit come from measures of 6 problems (from Y_01 to Y_06, without Y_07)

Interpretation and implication

- The measures is not only bring financial benefits, but also other benefits are significant such as:
- Ensure a clean living environment for villagers to have more health and a happy life
 - Ensure aesthetics for residential areas
 - Maintain clean water sources in rural areas
 - Reducing the amount of plastic bags buried in the soil, limiting soil erosion
 - Reducing the cause of disease outbreaks
 - Protect the living environment for living things: fish, birds, ...
 - Eliminate unpleasant odors caused by garbage in heavily polluted areas
 - Mitigating climate change in rural areas

... The financial benefits are not easy to calculate exactly, estimated number is also very precious

Local authorities propagate to the villagers about environmental protection ...



Image captions:

- Request support from local government leaders to propagate and mobilize people about environmental protection movement
- In Vietnamese countryside, local government leaders’s voice often very meaning and convince



Image captions:

- Image of the volunteer team of TrungHung village before preparing to carry out the task of environmental protection
- This is a team of young villagers who are enthusiastic and proactive



Image captions:

- The image of going to each villager's houses to mobilize and propagate the importance of environmental protection
- Instructing villagers on how to classify their garbage and request the people do not litter



... Volunteer team mobilize villagers to raise awareness of environmental protection ✓

Broadcast on TrungHung village's radio station weekly, ...

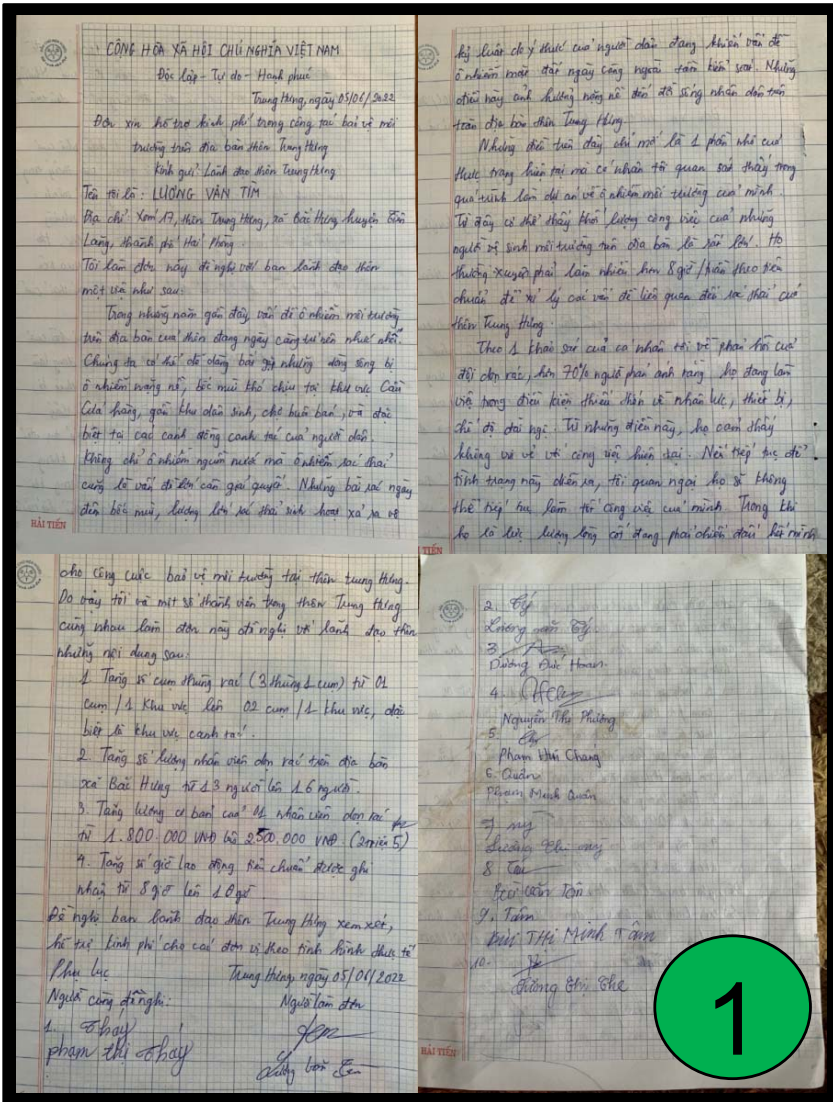


Image captions:

- Broadcast on local radio station weekly, loudspeakers broadcast news about:
 - Propagate villagers to limit eating and drinking in public harvest areas, ...
 - Organize propaganda for villagers about the current urgency of the Environmental pollution, ...
 - Encourage and motivate people to participate in environmental protection movements, ...

... The most effective method that affects to entire villagers ✓

Request to local government about finance support for ...



REQUEST TO FINANCE SUPPORT FOR PROTECT ENVIRONMENT ACTIVITIES
IN TRUNG HUNG VILLAGE

I want to show off my request as below:

Recently, the pollution in TrungHung village is getting worse. It is easy to catch up the polluted river in the area of CuaHang bridge, near residential area, local market and specialized at farming harvest area. Not only polluted water source but also rubbish are big problems need to be solved. These rubbish areas are smelled disgusting day by day, a big amount of rubbish are littered in the environment due to villagers' lack of awareness. It causes the pollution is getting uncontrolled. These things have affected to villager's life in Trung Hung village.

Above information is a small part of reality which I have researched during my environment project. This lead to acknowledge about the amount of job which be handled by cleaners in my Trung Hung village is huge. They have to work over 8h/day (standard working hour) to clean rubbish in all area of Trung Hung village.

According to a survey which I had conducted from cleaning team, more than 70% cleaners implied that they are working under short of manpower condition, equipment. Moreover, the benefit for them is not sufficient. As the result, they feel unhappy with current job. If this is continued, I am worry about that they will quit their job. Meanwhile, they are the key persons who clean the pollution, contribute to protect environment in Trung Hung village.

As a result, I and some villagers want to request the authority with below contents:

1. Increase group of rubbish bin (3 bins) from 1 group/ area to 2 group/ area, specialized at farming harvest area.
2. Increase cleanera in Bac Hung commune from 13 persons to 16 persons.
3. Increase basic salary for cleaner from 1.800.000VND to 2.500.000VND
4. Allow to work OT with 2 hours more than standard (10 hours/day).

Request to Trung Hung village 's authority to consider and support finance according to these requests above.

10 Villagers signed

1

2

- Image captions:
- Photo #1 is a photo of Tim's handwritten application to the local authority. This document is **signed by 10 villagers** who proposed together. In Vietnam, handwritten forms signed by many proponents together are often very effective to the government
 - Photo #2 is an English translation of the main content of photo #1. In Vietnam, most authorities do not use foreign languages, so all documents must be in Vietnamese
 - The proposal consists of four main contents: increasing the number of trash cans, increasing the staff of the garbage collection team, increasing the salary of the garbage collectors and increasing the basic working hours from 8 hours/week to 10 hours/week

Add more & Arrange trash-cans in the recognizable places ...



Image captions:

- Use the local government budget which has been approved to purchase secondhand trash-cans with the aim of increasing the number of existing trash-cans
- Trash-cans are arranged in recognizable places such as: farming areas, riverside, harvest area and shaded area (The place of farmers to rest for food), ...
- The increase in the amount of trash-cans at these locations has significantly improved the current littering situation in TrungHung village
- This action has been highly appreciated by the local government because it significantly reduces the time of the removal team must collect garbage on the ground

... Arrange trash-can in the crowded places ✓

Arrange small trash-cans & homemade trash-cans in residential areas ...



Image captions:

- Add some small and homemade trash-cans in residential areas where there were no trash cans before
- This arrangement of this small trash-can significantly reduced the amount of garbage which was thrown to the big trash-cans, limited the situation that the centralized trash-cans are often overfilled

... To reduce the amount of garbage for large trash-cans ✓

Villager made their own trash-can for temporary ...



Image captions:

Raw materials include: iron wire, excess plastic canvas, bamboo branches, large garbage bags



Image captions:

The villagers make handmade trash-cans: they tie the bamboo slats together with iron wire, then cover them with canvas



Image captions:

After complete the trash-can frame, they used large plastic bag to put inside of the garbage to sort compartments



Image captions:

Once completed, the villagers' homemade trash-cans are used. The trash-can has 3 compartments to classify garbage: recyclable, organic and hazardous garbage

... During the period when the local budget is not enough for the required number of trash-can

Visualize environmental protection signs in the crowded areas ...



Image captions:

- Post signs directing villagers to the nearest trash can
- Post signs to instruct villager know how to classify the garbage
- Post signs encouraging villagers to join hands to protect the environment
- Post signs asking people do not litter
- The volunteer team hangs the signs of a ban on dumping garbage in polluted areas

... Volunteer teams focus on setting up warning signs in polluted areas

Young volunteer team organize a campaign to pick up trash ...



Image captions:

- Young volunteer team organize a campaign to pick up garbage on village roads, pruning roadside trees
- They are students, this is their summer vacation, so they are very enthusiastic to participate in the environmental protection program launched by me
- After the campaign, we collected a lot of garbage on the ground
- Through this useful activity, the young people spread the spirit of environmental protection to many villagers

... on village roads, pruning roadside trees ✓

Mobilize some villagers to participate in to protect the environment ...



Image captions:

- Some villagers are cleaning up an area with a lot of garbage which has accumulated for a long time, it is very difficult to clean in a short period of time, they have to put a lot of effort into this activity
- Photo compares before (a lot of polluted garbage) and after (the garbage is cleaned up and the ground is planted with more plant)

... Spreading the spirit of environmental protection to everyone ✓

We not only just clean up garbage in polluted areas in the village ...



Image captions:

- Gathering young people in the village into a volunteer team with the main purpose of improving the quality of the environment in TrungHung village
- Convey the message of needing to protect the local living environment, say no to littering
- Make a detailed plan on the idea of planting trees to expand forests in VinhQuang sea area with the main purpose of improving the quality of the recent polluted environment
- Propose to the local government to obtain funds for the program
- Mobilize everyone to participate in planting trees on VinhQuang beach. It had been such of beautiful memory for all of us

... But also plant trees to improve a cleaner environment ✓

Results of the IMPROVE-Steering

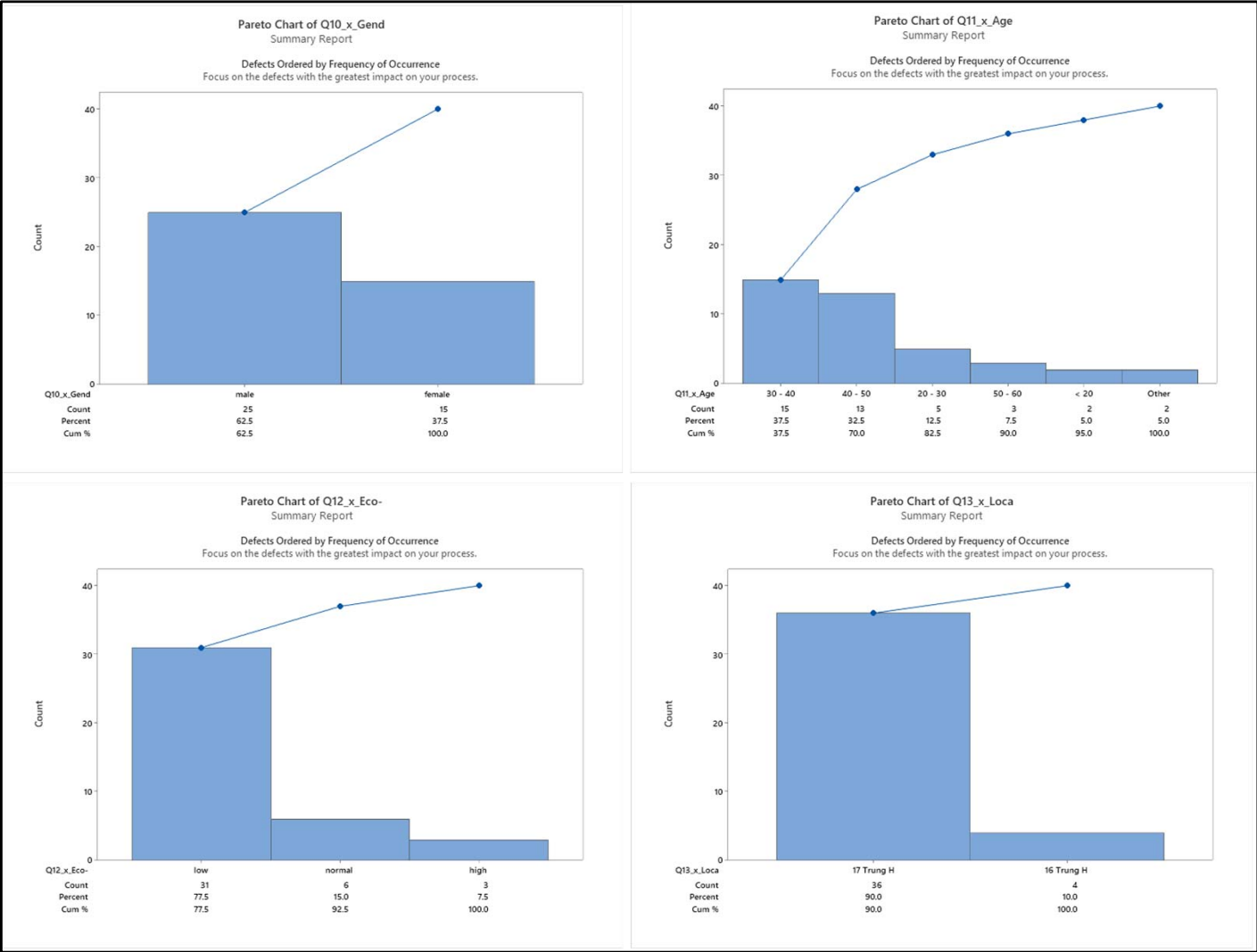
Improve-Steering				
Tool	Application	Documentation	Comment	Decision
Solution-Ideas	ok	ok		Master-Black-Belt
DoE (optional)	ok	ok		Dr. Reiner Hutwelker reiner.hutwelker@tum.de
Action-List	ok	ok		20-Jun-2022
FMEA	ok	ok		passed
				Sponsor
				Pham Van Quang Phamvanquang.trunghung@gmail.com
				22-Jun-2022
Additional Notes			Dear Tim, no other Environment Green Belt project has touched, fascinated and impressed me more than yours. What you and the wonderful people around you have achieved is simply excellent, in terms of methodology and great in terms of content. I wish you and your team very much that your enormous efforts will also be reflected in the data of the CONTROL phase! - Reiner	passed
Sponsor Notes			Hi Tim, I am very impressed by you and your team's improvement actions. Not only you proposed budget-related improvements (which needs time to approve) but you are also trying to take advantage of all the improvements that can be implemented quickly with great efficiency. On behalf of the entire TrungHung's villagers, I really want to give you a big thanks. I believe the good result will be show by quantitative evidence in the last phase _ Pham Van Quang	

Only proceed to the next phase after a positive decision of MBB and Sponsor

CONTROL

Data-Evaluation, Process-Performance, Improvements & Benefits, Process-Management-Plan & Finalisation

Data & Graphical evaluation of personal answer from 40 interviewees ...



Results

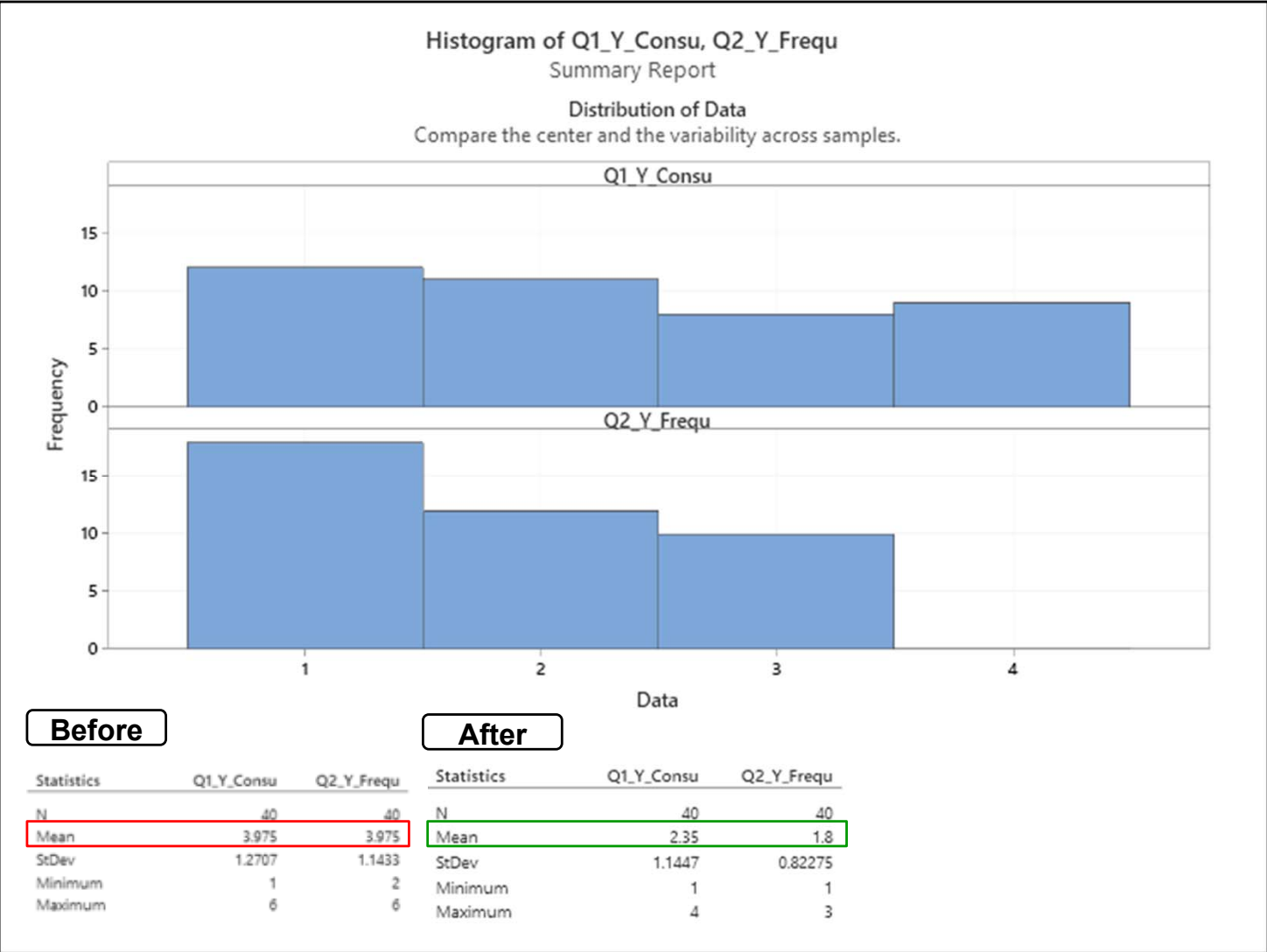
- 40 villagers (answered the interview) made new collected data, 25 males and 15 females.
- TrungHung village is divided into 2 parts: 16th and 17th areas. 90% interviewees from 17th and 10% from 16th area.
- The major age ranges are 30 – 40 & 40 – 50 years old, it counted 70 % of all the interviewees
- The result shows important information that 77.5% (31 people) are in low economic status. This result reflects the truth, because most of the TrungHung villagers are farmers

Interpretation and Implication

- The people are between 30 – 50 years old, They are of labor age, so it is very easy to meet them at harvest areas. < 20 years old, they focus on studying, older than 50 they are retired. From 20 to 30, they are interested in factory work
- The main economic status is low, because the people who live in the countryside (village), their income is very low. So low economic status is very suitable situation in TrungHung village

... In their location, age, economic status and gender ✓

Graphical evaluation of littering behaviour of participants ...



Results

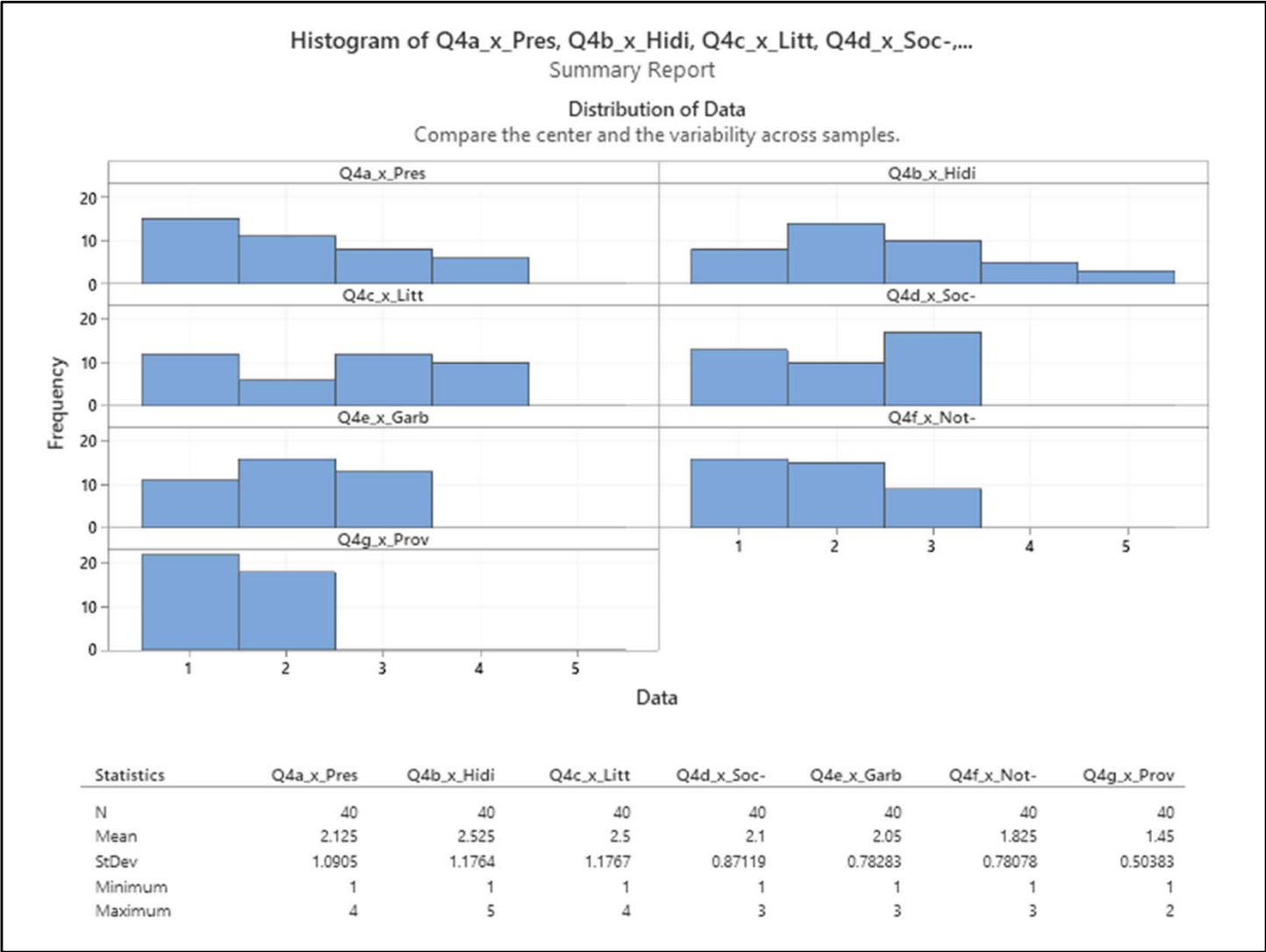
- Both Q1_public consumption frequency and Q2_public littering frequency are fairly even results among the options
- Q2 does not have any answers larger than 3rd, the rest is equal or smaller than 3rd
- Q1 does not have any answers larger than 4th, the rest is equal or smaller than 4th

Interpretation and Implication

- The interviewee's answer showed that their frequency of consumption and littering are much improved than before. Proof by numbers of Before Mean (3.975 & 3.975) much larger than After Mean (2.35 & 1.8)
- Some answers show that the villagers already changed their mindset about consuming food and litter garbage in public, that can be the big positive impact to Limit littering
- The main 1st to 3rd & 4th options maybe are not totally correct because people usually want to show their better version, this result can be increased. But through this result, we can also see that people's consciousness has been significantly improved after the improvements

... Part 1 about Q1 & Q2 by histogram

Graphical evaluation of littering behaviour of participants ...

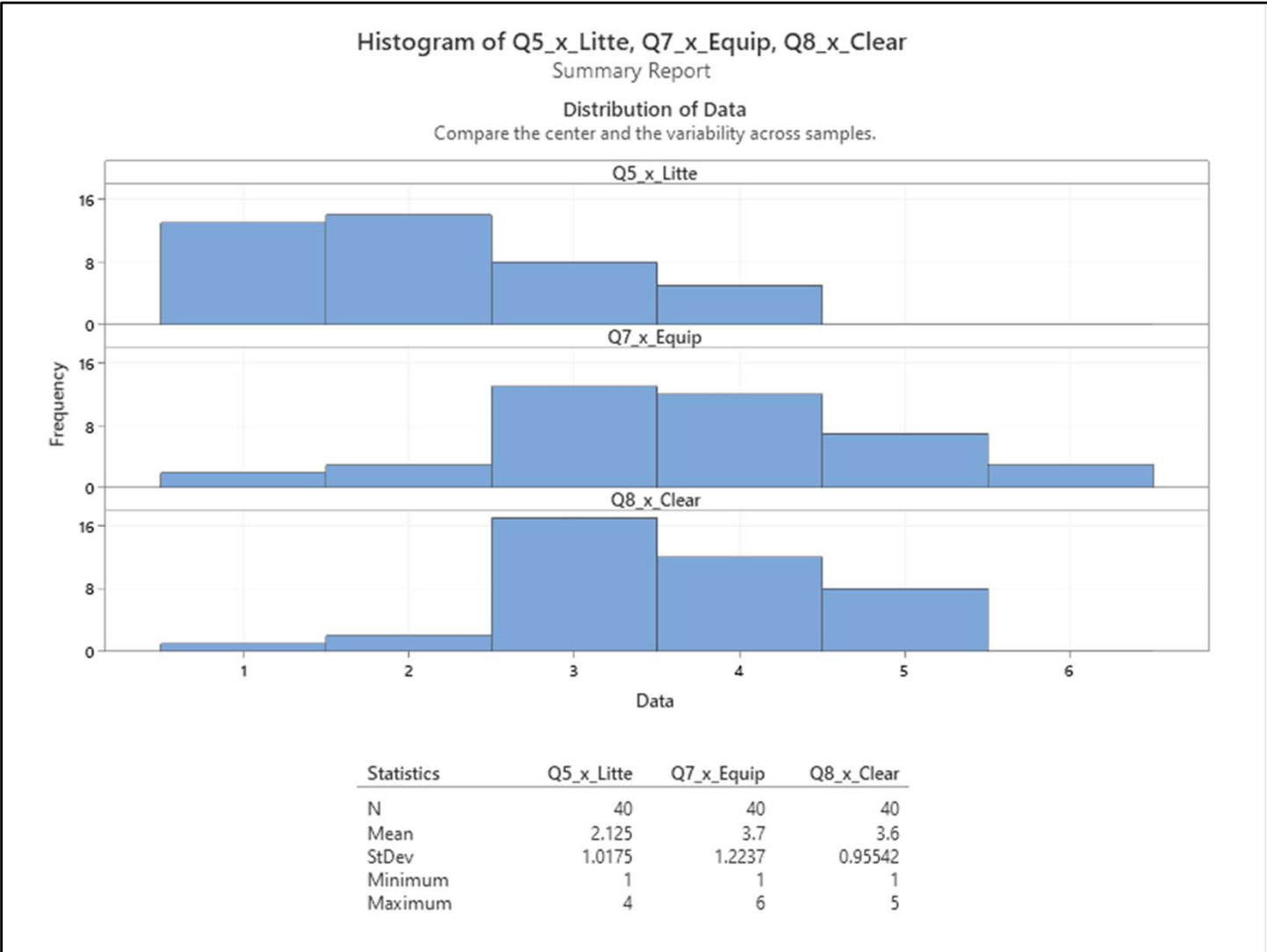


- Results**
- The collected data has a range with a minimum of 1 and maximum of 6 (1 = almost never ... 6 = very often)
 - When people is pressed for time, most of them didn't totally agree that sometimes they throw garbage away
 - Q4f (Ignoring) and Q4g (provoke) have many answers of option 1st, it is much better than before data interview
 - About Q4e, opinions are approximately equally distributed from option 1st to 4th

- Interpretation and Implication**
- The villagers have a better sense of correcting garbage dispose when they are pressed for time
 - When people throw trash, they don't want to public that
 - Villager's awareness of environmental protection is much improved than before
 - Has number of people do not agree that sometimes they put garbage in a place where it can not be seen
 - Almost the number of answers about provoking other people by throwing garbage on the ground is disagree (1st & 2nd options) , that shows they want to follow the right garbage disposal

... Part 2 about Q4a & Q4b & Q4c & Q4d & Q4e & Q4f & Q4g by histogram ✓

Graphical evaluation of littering behaviour of participants ...



Results

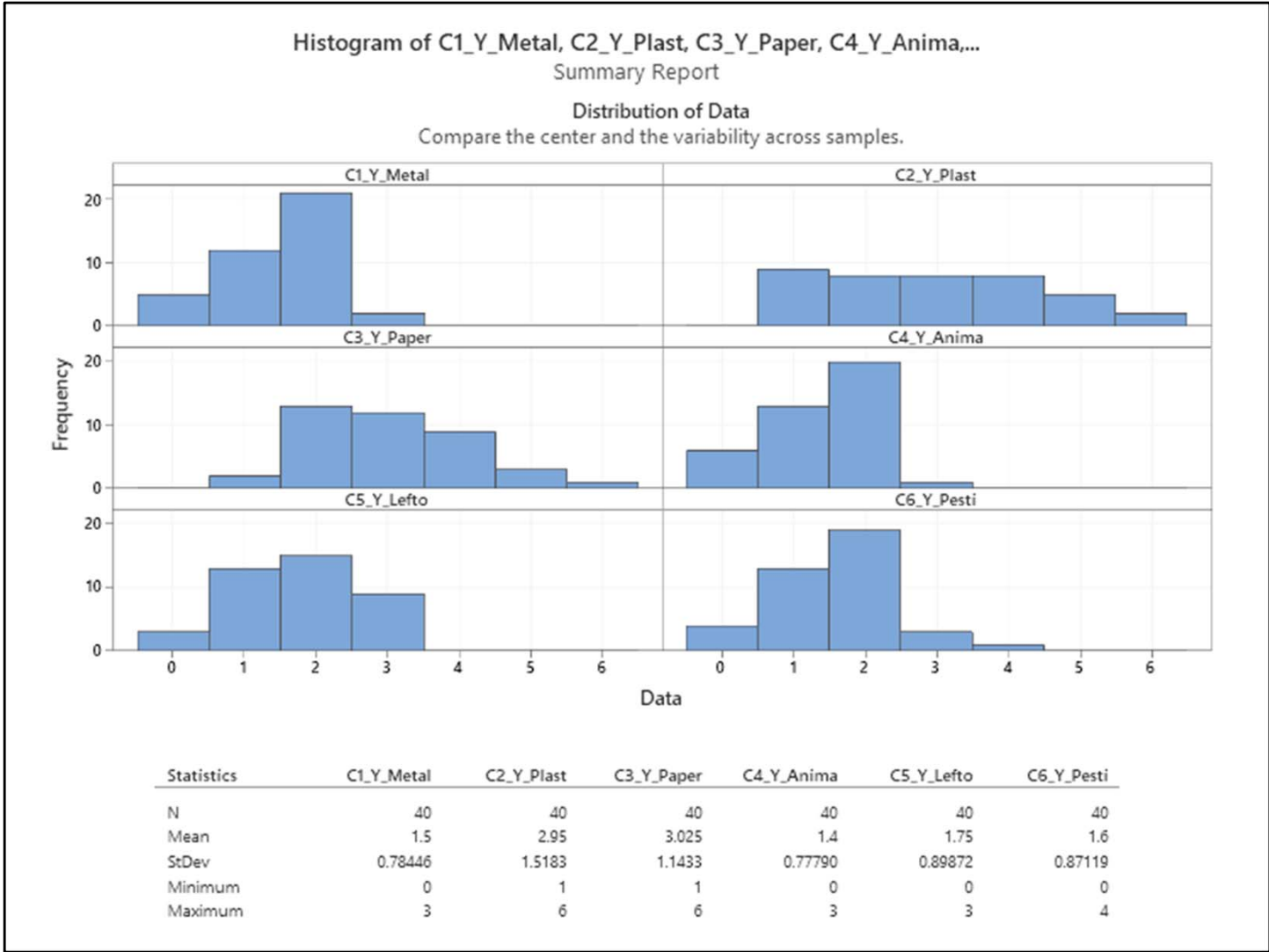
- The collected data is in the valid range with a minimum of 1 (extremely decreased, very bad/dirty) and a maximum of 6 (extremely increased, very good/clean)
- Q7 & Q8 Concentration at level 3 & 4 and descending at level 5 & 6 and 1 & 2
- Q1 concentration at level 1 & 2
- The people mostly believe that the quality of environment has been improved, need to maintain it

Interpretation and Implication

- The interviewees want to show they changed the extent of littering recently by decreasing the trend. The reason may be due to the positive effects of campaigns and propaganda
- The equipped trash-cans and the area cleanness have similar trend, may confirm again to consumption about a positive relationship: Lacking trash-can is a reason of ground littering
- Villager's evaluations of equipped trash-cans and cleanliness level of the area have been more positive than before
- Many villagers appreciate the addition of the trash-can solution recently

... Part 3 about Q5 & Q7 & Q8 by histogram

Graphical evaluation summary of 6 collected garbage types ...



Results

- The data table shows that N=40 which corresponds to the 40 different places near trash-cans
- The collected data is in inside of the range with number of garbage pieces from 0 to 6, narrow than before 0 - 7
- The number of metal pieces is from 0 to 3
- The number of plastic pieces is from 1 to 6
- The number of paper pieces is from 0 to 4
- The number of animal carcasses is from 0 to 4
- The number of leftover is from 0 to 3
- The number of pesticide shells is from 0 to 4

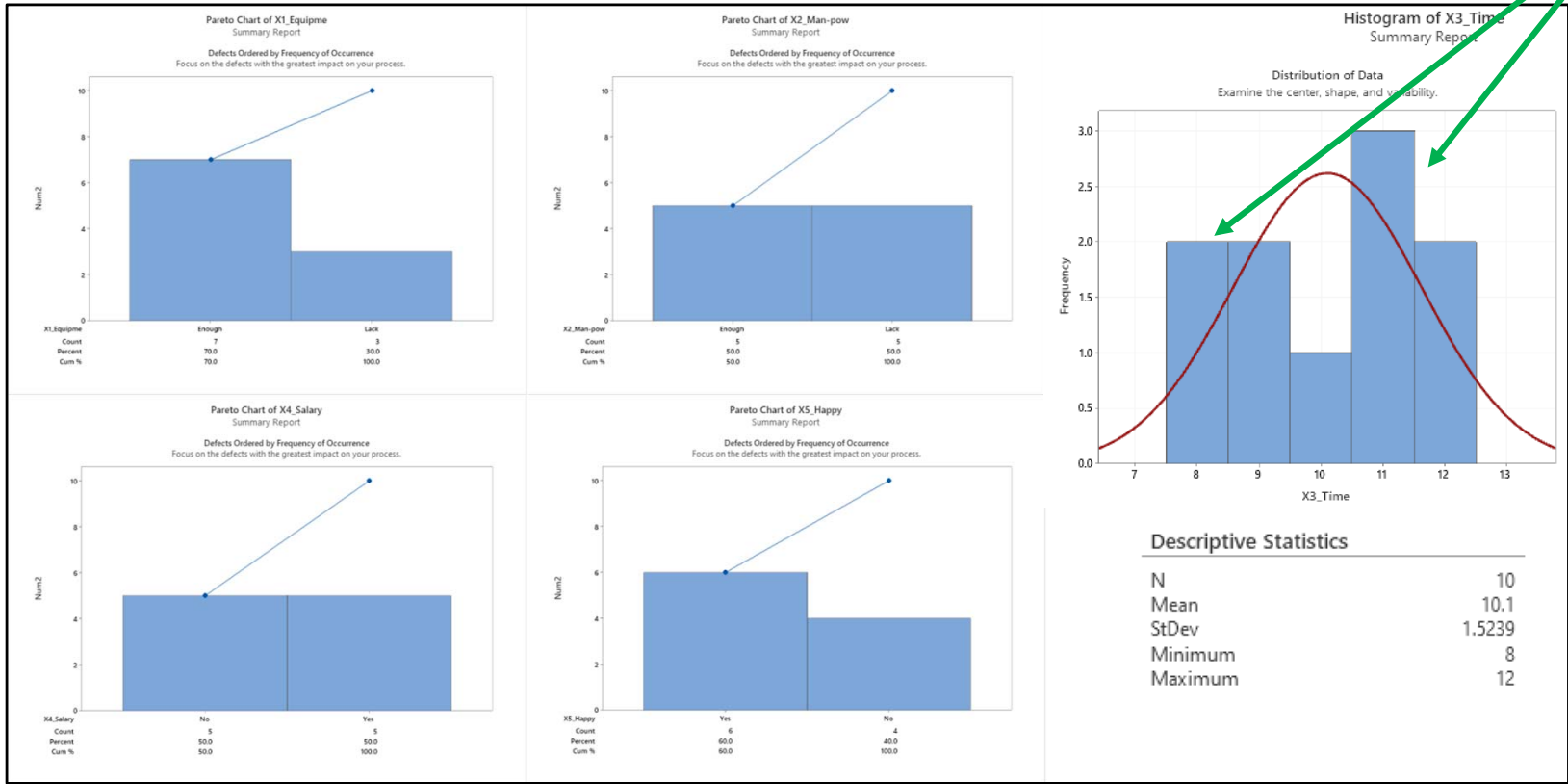
Interpretation and Implication

- The largest range is plastic, its min is 1 and max is 6, and 6 pieces it just appeared 2 times. With these results, we can see that the problem of plastic garbage around the trash-cans has been significantly improved
- Not only plastic, the rest of the garbage types have also improved. Evidenced by the lower Means than before
- The minimum mean is Animal carcasses (1.4), that shows us people generally dispose animal carcasses into the environment in lowest number

... collecting data about the actual littering at 40 different places near trash-cans

Might there be 2 subgroups enclosed in this histogram?
You could check this if you could divide the garbage collectors sample by an influence (x), e.g region where they work
This could be also be formulated as a difference-hypothesis and tested accordingly

Graphical evaluation of collected data from garbage collector’s interview ...



Results

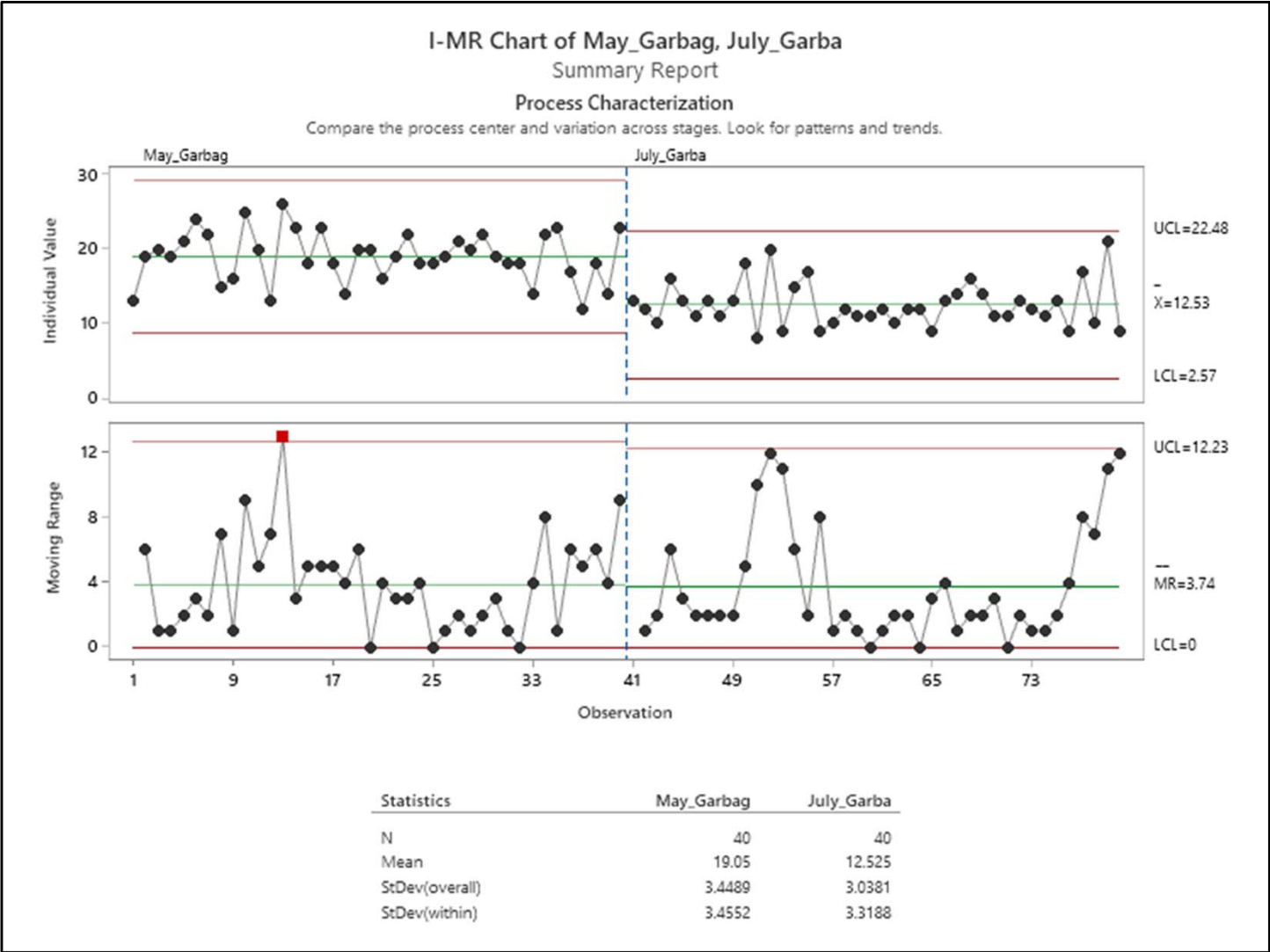
- 70% of garbage collectors answer that the cleaning equipment is enough, for example: Trash-bin, gloves, masks, brooms, dustpans
- 50% members are satisfied with their current salary and their team is not lack manpower, so they do not have to do much job liked before, it could be a reason make they feel better about hard work
- The before working hour is 13.1 hours, recently actually the mean of histogram real collected time is 10.1 hours, shorten the distance to 8 standard hours
- 60% members feel happy about their work, it may be because the local government values what they do, villagers appreciate their work more than before

Interpretation and Implication

- Some reasons could lead garbage collectors to feel better at work, such as: campaigns for the entire villagers to participate in environmental protection, the local government and villagers really appreciate their work more than before.... The mood of collectors is very important, it directly impacts garbage removing results. This was actually improved a lot in the Improve Phase

... Additional question modified to suitable with TrungHung village

I-MR Charts of field study about total garbage pieces around trash-cans ...



Results

- The MR Charts of May had 1 outlier, July shows no outlier. Therefore July is in under control
- The upper and lower control limit of Moving Range Charts are approximately equal, but very different in the Individual Value chart
- The I Chart range of May is (8.68 , 29.42) higher than range of July (2.57 , 22.48)
- The garbage mean of May (19.05) > the mean of July (12.53)

Interpretation and Implication

- The data index for the amount of trash on the ground around the trash-cans in July is much less than in May.
- All July data are within control limits as depicted on the I-MR chart
- Improved results can be obtained from the villagers who are well aware of the necessity of environmental protection, taking action to protect the environment, Limit indiscriminate littering
- The actions of the volunteer cleaning team also contributed to this positive result

... Use old collected data (in May) and new collected data (in July) ✓

Data evaluati

Please adapt your header/ footer: Before-After Comparision of ... led to a sigificant and practically relevant difference
Please also adapt the results according to my suggestion. We always have this two pieces of informaiton in statistical tests:

- statistical significance and
- practical relevance (e.g. the difference in a Difference-Hypothesis and the R-sq in a Relationship-Hypothesis)

Practical Relevance is always subject to your interpretation, as you might get significant results, with an (extremely) small or big effect size. Then you should discuss this effect size shortly in your interpretation, e.g. why this is (not) practically relevant, and what this means, what you achieved. This would lead to a better understanding, especially for your sponsors.

Method

μ₁: population mean of May_Pres
μ₂: population mean of July_Pres
Difference: μ₁ - μ₂

Equal variances are not assumed

Descriptive Statistics

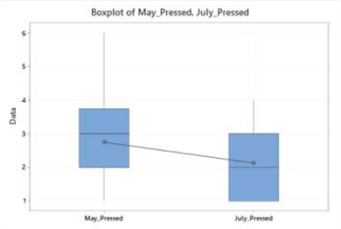
Sample	N	Mean	StDev	SE Mean
May_Pressed	40	2.75	1.30	0.20
July_Pressed	40	2.13	1.09	0.17

Estimation for Difference

Difference	95% CI for Difference
0.625	(0.092, 1.158)

Test

Null hypothesis	$H_0: \mu_1 - \mu_2 = 0$		
Alternative hypothesis	$H_1: \mu_1 - \mu_2 \neq 0$		
T-Value	DF	P-Value	
2.33	75	0.022	



Descriptive Statistics

Sample	N	Mean	StDev	SE Mean
May_Hiding	40	3.45	1.71	0.27
July_Hiding	40	2.52	1.18	0.19

Estimation for Difference

Difference	95% CI for Difference
0.925	(0.271, 1.579)

Test

Null hypothesis	$H_0: \mu_1 - \mu_2 = 0$		
Alternative hypothesis	$H_1: \mu_1 - \mu_2 \neq 0$		
T-Value	DF	P-Value	
2.82	69	0.006	



- The p-value of the 2-sample T-test (May / July Time pressed) is 0.022 < 0.05, therefore the test show there is difference between May and July Time pressed
- The p-value of the 2-sample T-test (May / July Garbage hiding) is 0.006 < 0.05, therefore the test show there is difference between May and July about Time Garbage hiding
- The Mean of July Time pressed (2.125) < May Time pressed (2.75)
- The Mean of July Garbage hiding(2.525) < May Garbage hiding(3.45)
- The minimum of all Categories is 1, but the maximum of May data (6 for both Time pressed & Garbage hiding) larger than July data (4 for Time pressed & 5 for Garbage

Statistics	May_Presse	May_Hiding
N	40	40
Mean	2.75	3.45
StDev	1.2960	1.7090
Minimum	1	1
Maximum	6	6

Statistics	July_Press	July_Hidin
N	40	40
Mean	2.125	2.525
StDev	1.0905	1.1764
Minimum	1	1
Maximum	4	5

Interpretation and Implication

- The results of a 2-sample T-test indicated that there is a difference between factorials
- The degree of the difference is ... , meaning ... and from our perspective this difference ivr
- In July, villagers are more inclined to disagree with the actions of hiding garbage and throwing garbage in a hurry situation. This once again proves that the villagers' views on environmental

protection have improved, from that they adjust their actions to conform to local regulations

... Use old collected data (in May) and new collected data (in July)

Please see my notes on page 100

Data evaluation of trash-can’s distance to carry a piece of trash ...

Method

μ_1 : population mean of May_TrashCan-Supply

μ_2 : population mean of July_TrashCan-Supply

Difference: $\mu_1 - \mu_2$

Equal variances are not assumed for this analysis.

Descriptive Statistics

Sample	N	Mean	StDev	SE Mean
May_TrashCan-Supply	40	68.0	28.6	4.5
July_TrashCan-Supply	40	70.5	30.7	4.9

Estimation for Difference

Difference	95% CI for Difference
-2.50	(-15.71, 10.71)

Test

Null hypothesis $H_0: \mu_1 - \mu_2 = 0$

Alternative hypothesis $H_1: \mu_1 - \mu_2 \neq 0$

T-Value	DF	P-Value
-0.38	77	0.707

Results

- The July collected data is in the valid range with a minimum of 0 (m) and maximum of 120 (m), 120 m means that people carry their garbage infinitely to an available trash-can
- The p-value of the 2-sample T-test (May / July TrashCan-Supply) is $0.707 > 0.05$, therefore the test shows there is not difference between May and July result of distance would villagers carry a piece of trash if a trash can isn't right next to them
- The Mean of May_TrashCan-Supply (68.0) < Mean of July_TrashCan-Supply (70.5)
- May collected data just had 1 participant accept the distance 120 meters, beside that July collected data had 5 participants accept the distance 120 meters

Boxplot of May_TrashCan-Supply, July_TrashCan-Supply

Interpretation and Implication

- Although test result shows there is not difference, but when we look at Boxplots, we can see that in July collected data, the villagers accepted more than 2 meters compared to May data (from 68.0 to 70.5)
- The distance would villagers carry a piece of trash (if a trash can isn't right next to them) directly related to their daily routine, this really takes a long time to improve effectively

... Show small improved but not a statistically significant difference in the means

Please see my notes on page 100

Data evaluation of total garbage pieces around the trash-cans ...

Method

μ_1 : population mean of May_Garbage
 μ_2 : population mean of July_Garbage
Difference: $\mu_1 - \mu_2$

Equal variances are not assumed for this analysis.

Descriptive Statistics

Sample	N	Mean	StDev	SE Mean
May_Garbage	40	19.05	3.45	0.55
July_Garbage	40	12.53	3.04	0.48

Estimation for Difference

95% CI for	
Difference	Difference
6.525	(5.078, 7.972)

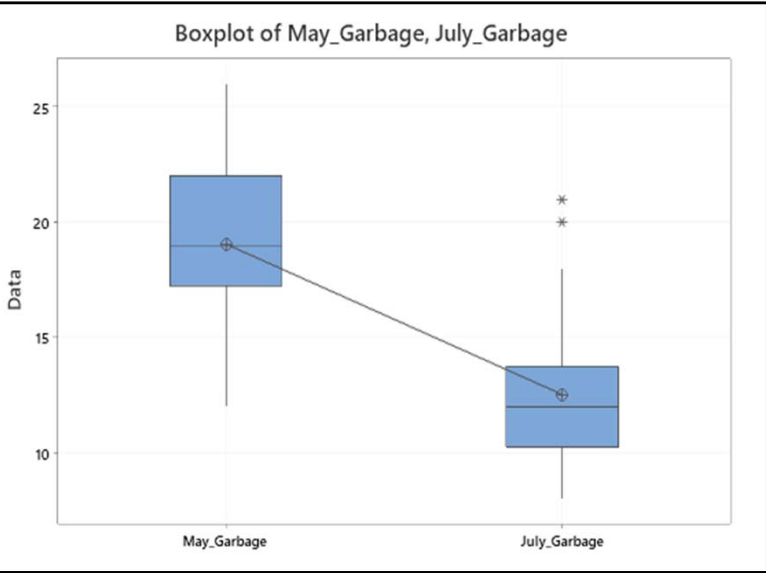
Test

Null hypothesis $H_0: \mu_1 - \mu_2 = 0$
Alternative hypothesis $H_1: \mu_1 - \mu_2 \neq 0$

T-Value	DF	P-Value
8.98	76	0.000

Results

- The p-value of Two-Sample T-Test and CI (May_Garbage, July_Garbage) is $0.000 < 0.05$, therefore the test show there is difference between total garbage pieces around the trash-cans in May and July
- The Mean of May_Garbage (19.05) > Mean of July_Garbage (12.53), This may indicate that the average amount of trash around the trash-can in July is almost 7 pieces less than in May
- The biggest number trash around the trash-can of 1 count time in May is 26 while in July it's just 21
- The smallest number trash around the trash-can of 1 count time in May is 12 while in July it's just 8
- The total amount of trash around the trash-cans in May is 762 trash pieces, much larger than the total in July which is 501 trash pieces, reduce more than 34% of total trash in May



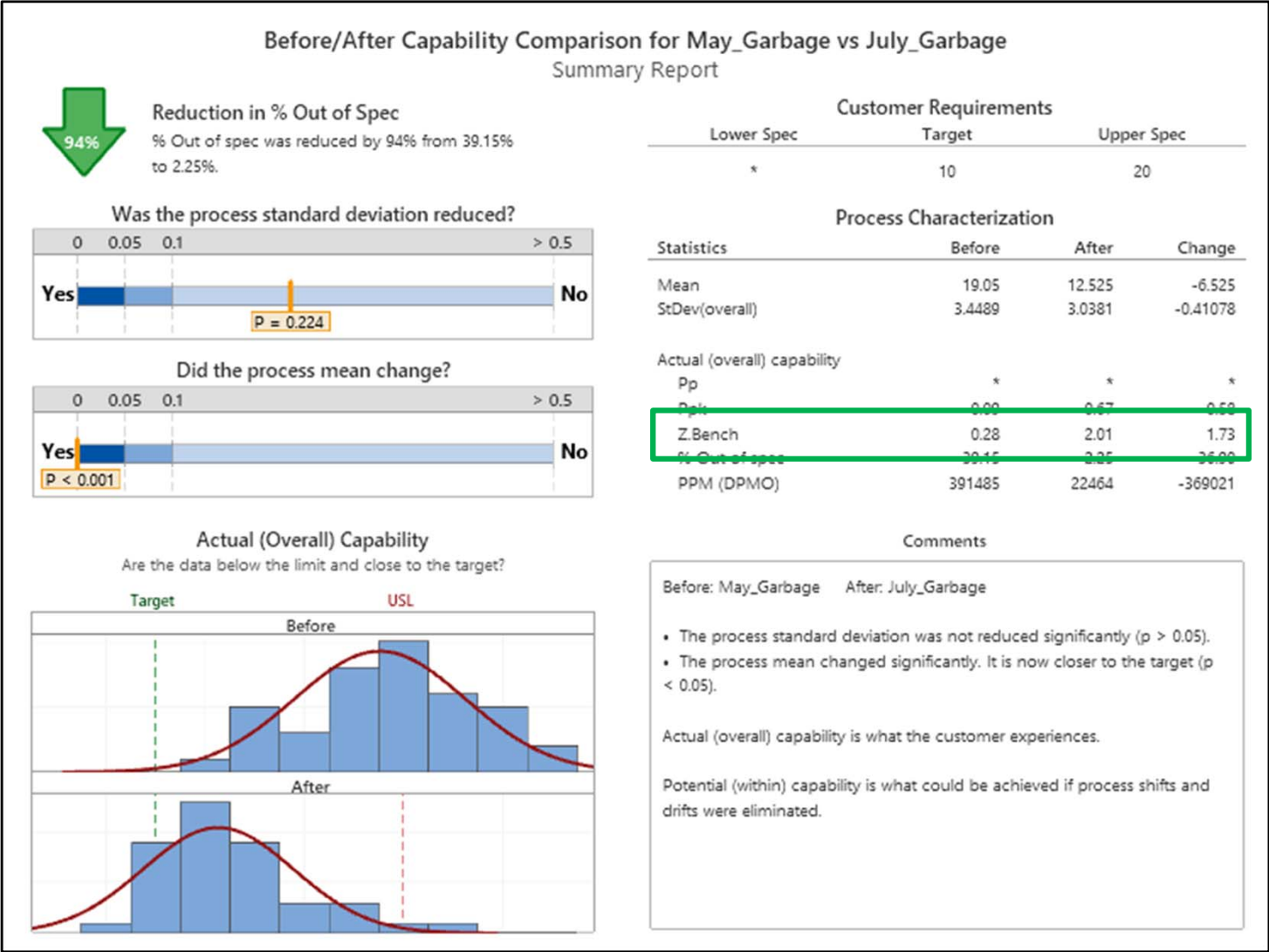
Interpretation and Implication

- The total amount of trash around the trash-cans is a very important indicator, it directly affects the most influential issue which is **Y_03 | problem: ground(cleaned) pieces left > 20**
- Clear and positive improvement results show that the effectiveness of the implemented measures is really working well and needs to be maintained
- The difference is very clearly indicated on the Boxplot charts
- Villager's awareness and responsibility greatly influence the improvement results

... Show the improvement after implementation actions

Please also mention the before after sigma-level comparison (Z.Bench in Minitab)

Before/After Process Capability Analysis for May and July collected data ...



Results

- The process Mean changed significantly. It is now closer to the target ($p < 0.05$)
- The process standard deviation was not reduced significantly ($p > 0.05$)
- Potential (within) capability is what could be achieved if process shifts and drifts was eliminated
- Histogram charts indicate July_Garbage process shifted to the left side, so out of spec was reduce by 94% from 39.15% to 2.25 %, it has improved a lot compared to the May data

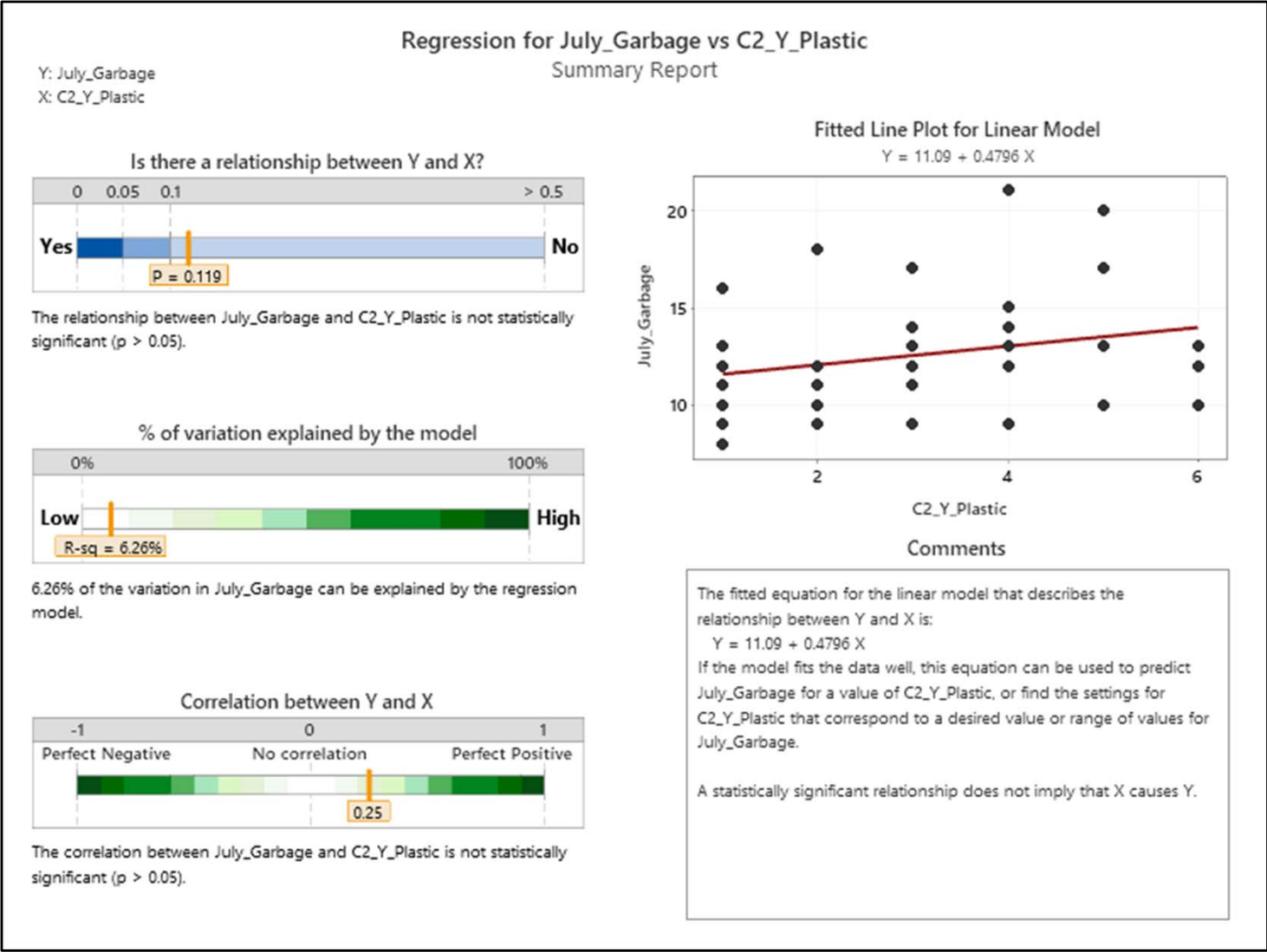
Interpretation and Implication

- After data centered around the number 12, compared to before data around 20, in the case our target should be 10, we already got the positive result, but we still need a lot of effort to achieve 10 targets. Because improving numbers close to the target in terms of desired value is always a challenge
- We also need to improve the process standard deviation in the near future to make the process capable. Effective improvement measures need to be more focus on implementation

... Show a positive statistically difference in the means of trash next to trash-cans

This is an interesting idea/ hypothesis, and you should express this idea already in the header and footer, as in this cas you did not want a significant result, as far as I understand
Think of headers and footer as being a headline the news

Regression analysis for July_Gargbage vs C2_Y_Plastic pieces ...



Results

- With a p-value > 0.05, the relationship between C2_Y_plastic (food packaged, bottles/ cups/bags) and July_garbage is not statistically significant
- 6.26% of the variation in July_Garbage can be explain by the regression model (very weak relationship)
- A statistically significant relationship does not imply that X causes Y
- Fitted Line Plot for Linear Model:
 $Y = 11.09 + 0.4796 * X$
Y is July_Garbage, X is C2_Y_Plastic

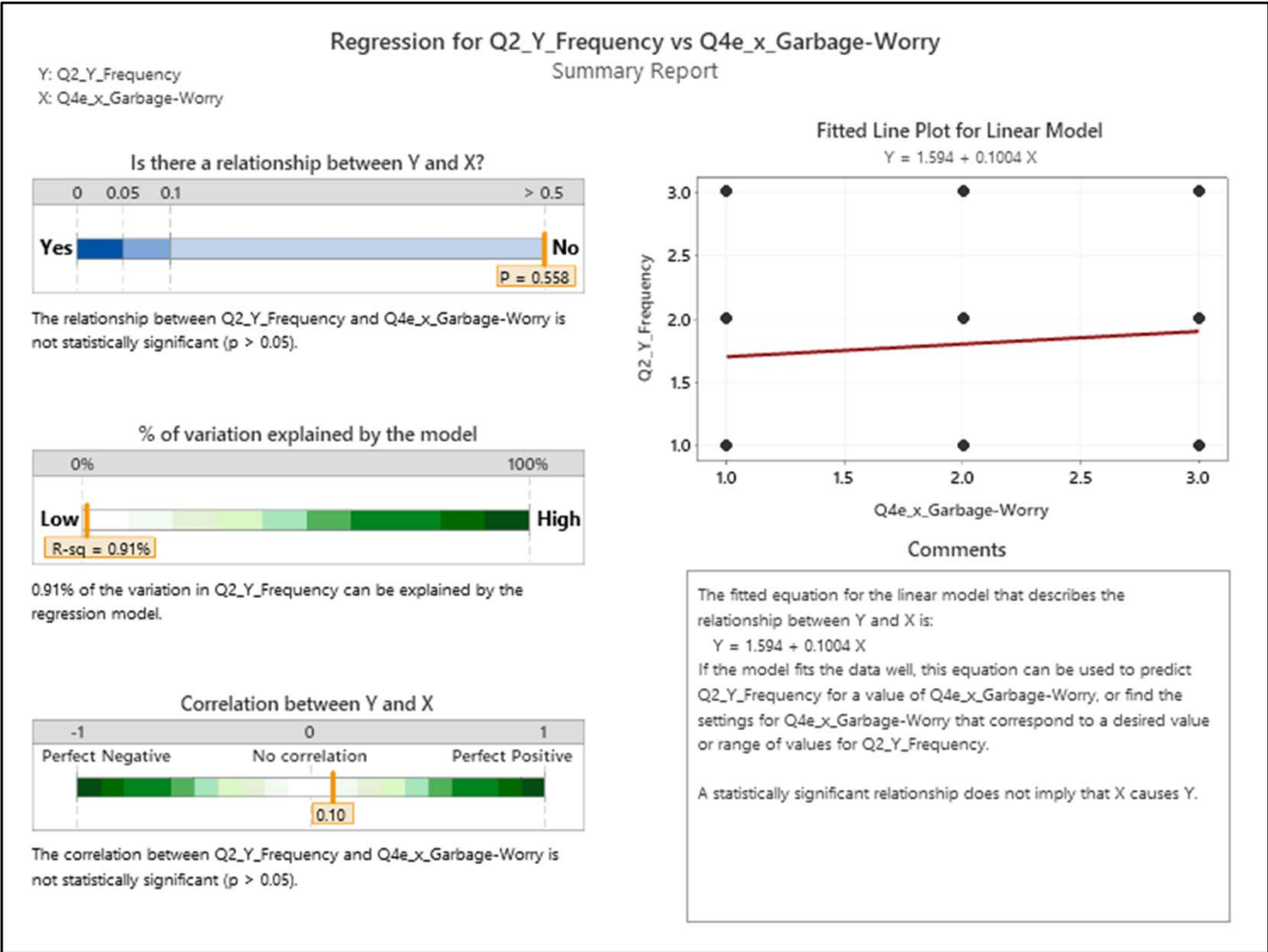
Interpretation and Implication

- There is not correlation between (X) plastic pieces and (Y) general garbage. The correlation (r=0.25) indicates that when the number of plastic pieces (X) changes, we do not know how total general garbage (Y - include all 6 types of garbage) significantly changes
- In the result, plastic pieces are not significant in the count for general garbage, so the improvement measures had the effect of changing the strong positive correlation of May data to no correlation of July

... Shows the relationship is not statistically significant (p > 0.05)

Headline! – Please tell us in a more comprehensible way, what we can see here
The result of your slide should be easily understandable by sponsors

Regression analysis for Q2_Y_Frequency vs Q4e_x_Garbage-Worry...



Results

- With a p-value > 0.05 , the relationship between Q2_Y_Frequency and Q4e_x_Garbage-Worry is not statistically significant
- 0.91% of the variation in Q2_Y_Frequency can be explained by the regression model (very weak relationship)
- A statistically significant relationship does not imply that X causes Y
- Fitted Line Plot for Linear Model:
 $Y = 1.504 + 0.1004 * X$
Y is Q2_Y_Frequency
X is Q4e_x_Garbage-Worry

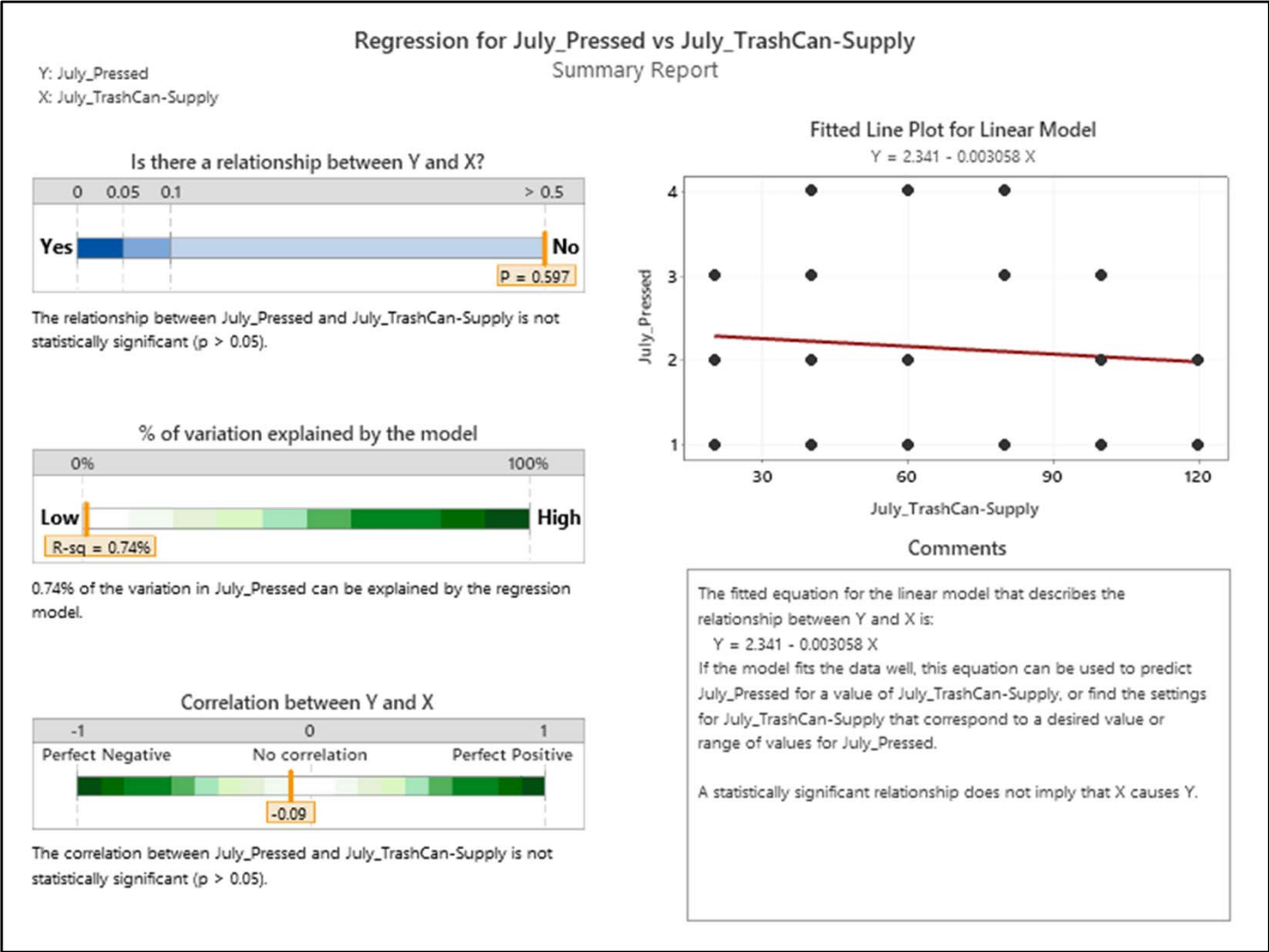
Interpretation and Implication

- There is no correlation between (X) Garbage-Worry and (Y) Frequency. The correlation ($r=0.21$) indicates that when the Garbage-Worry (X) changes, we do not know how Garbage frequency (Y) significantly changes
- In the result, Garbage-Worry is not significant to the Garbage frequency, so the improvement measures had the effect of changing the positive correlation of May data to no correlation of July

... Shows the relationship is not statistically significant ($p > 0.05$)

Headline! – Please tell us in a more comprehensible way, what we can see here
The result of your slide should be easily understandable by sponsors

Regression analysis for July_Pressed vs July_TrashCan-Supply ...



Results

- With a p-value > 0.05 , the relationship between July_TrashCan-Supply and July_Pressed is not statistically significant
- 0.74% of the variation in July_Pressed can be explain by the regression model (very weak relationship)
- A statistically significant relationship does not imply that X causes Y
- Fitted Line Plot for Linear Model:
 $Y = 2.341 + 0.003058 * X$
Y is July_Pressed
X July_TrashCan-Supply

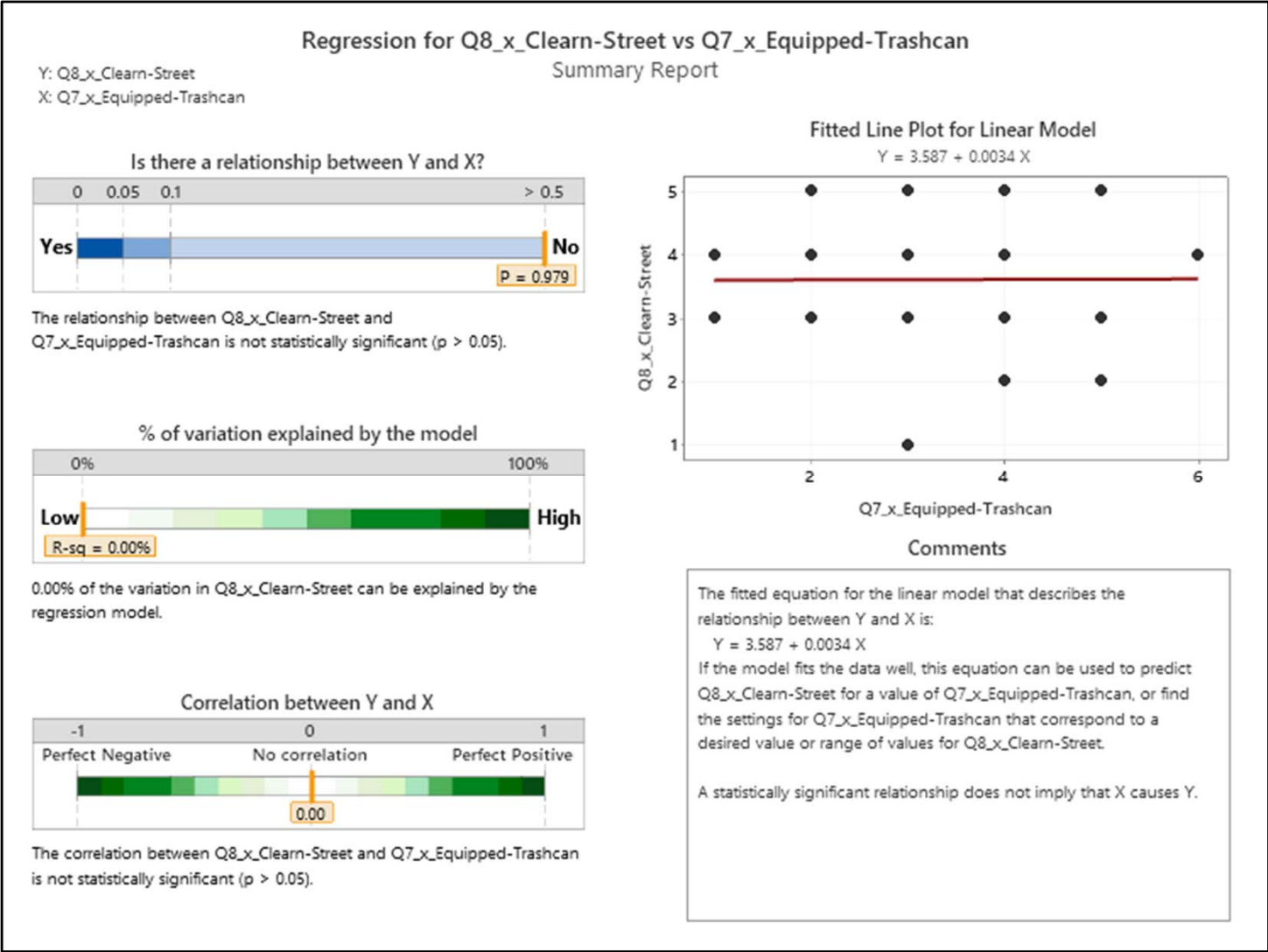
Interpretation and Implication

- There is no correlation between (X) TrashCan-Supply and (Y) Pressed-Time. The correlation ($r=-0.09$) indicates that when the TrashCan-Supply (X) changes, we do not know how Pressed-Time behavior (Y) significantly changes
- In the result, TrashCan-Supply is not significant to the Pressed-Time behavior, so the improvement measures had the effect of changing the positive correlation of May data to no correlation of July

... Shows the relationship is not statistically significant ($p > 0.05$)

Headline! – Please tell us in a more comprehensible way, what we can see here
The result of your slide should be easily understandable by sponsors

Regression analysis for Q8_x_Clean vs Q7_x_Equipped-Trashcan ...



Results

- With a p-value > 0.05, the relationship between Q8_x_Clean and Q7_x_Equipped-Trashcan is not statistically significant
- 0.00% of the variation in Q8_x_Clean can be explain by the regression model (very weak relationship)
- A statistically significant relationship does not imply that X causes Y
- Fitted Line Plot for Linear Model:
 $Y = 3.587 + 0.0034 * X$
Y is Q8_x_Clean (Level of cleanliness)
X is Q7_x_Equipped-Trashcan

Interpretation and Implication

- There is no correlation between (X) Equipped-Trashcan and (Y) Level of cleanliness (Q8_x_Clean). The correlation (r=0.00) indicates that when the Equipped-Trashcan (X) changes, we do not know how Level of cleanliness (Y) significantly changes
- In the result, Equipped-Trashcan is not significant to the Level of cleanliness , so the improvement measures had the effect of changing the positive correlation of May data to no correlation of July

... Shows the relationship is not statistically significant (p > 0.05)

Process Management Plan (PMP) supports responsible removal team members ...

Process-Management-Plan																	
Define measures to sustainably maintain the process-improvements																	
Ranking of Outputs (Y)	Outputs (Y)	Measurand	Unit	Target and specification limits (USL; LSL)	Scale-Level	In which time intervals will the control chart be actualized?	How large will the sample size be in each time interval?	How many data points should the control chart represent?	I-MR Chart (if N <= 100)	xbar-R Chart (if N > 100 and if subgroup size <= 8)	xbar-S Chart (if N > 100 and if subgroup size > 8)	p-Chart (if ok vs. ko is discriminated)	u-Chart (if ok vs. different defect opportunities are discriminated)	Which control limits should be used? (LCL; Center-Line; UCL)	Who is responsible for creating the control charts?	In which document is the reaction plan specified?	Who is responsible for maintaining the reaction plan?
Output (Y)		Data from Data-Collection-Plan															
6	Y_01 Problem: GROUND(CLEANED) CLEANING-EFFORT > 8 WORKING HOURS PER WEEK	Time	working hours	Target: 6 USL: 8 LSL: 4	Data discrete or continuous (Cardinal-Scale)	monthly	20	20	20 data points; no subgrouping				20 data points; (for discrete values: treated as number of defects per output)	LCL : 4 CL: 6 UCL: 8	Removal team members	TrungHung_litering_control.xls x	Removal Leader
4	Y_02 Problem: TRASH-CAN(EMPTY) VISIBILITY/ ATTRACTION TOO LOW	6 level rating scale	Grade 1...6	Target: 5 LSL: 3	Data Rank Ordered (Ordinal-Scale)	biweekly	20	20	20 data points; no subgrouping					LCL : 3 CL: 5 UCL: 6	Removal team members	TrungHung_litering_control.xls x	Removal Leader
1	Y_03 Problem: GROUND(CLEANED) PIECES LEFT > 20	Amount	Number of pieces within a radius of 5 meters around a trash-can	Target: 10 USL: 20	Data discrete or continuous (Cardinal-Scale)	weekly	20	20	20 data points; no subgrouping				20 data points; (for discrete values: treated as number of defects per output)	LCL : 0 CL: 10 UCL: 20	Removal team members	TrungHung_litering_control.xls x	Removal Leader
3	Y_04 Problem: GARBAGE(DISPOSED) LOCATION WRONG	Amount	Number of wrong pieces's location in trash-cans and on the ground	Target: 6 USL: 14	Data discrete or continuous (Cardinal-Scale)	biweekly	20	20	20 data points; no subgrouping				20 data points; (for discrete values: treated as number of defects per output)	LCL : 0 CL: 6 UCL: 12	Removal team members	TrungHung_litering_control.xls x	Removal Leader
5	Y_05 Problem: REMOVAL(SCHEDULE) GARBAGE IN TRASH-CAN FULL	6 level rating scale	Grade 1...6	Target: 4 LSL: 2	Data Rank Ordered (Ordinal-Scale)	monthly	20	20	20 data points; no subgrouping					LCL : 2 CL: 4 UCL: 6	Removal team members	TrungHung_litering_control.xls x	Removal Leader
2	Y_06 Problem: DECISION(GARBAGE) HARMFULNESS WRONG	6 level rating scale	Grade 1...6	Target: 5 LSL: 2	Data Rank Ordered (Ordinal-Scale)	weekly	20	20	20 data points; no subgrouping					LCL : 2 CL: 5 UCL: 6	Removal team members	TrungHung_litering_control.xls x	Removal Leader
7	Y_07 Problem: GROUND(CLEANED) FLYING INSECT SOUND NOISE	6 level rating scale	Grade 1...6	Target: 5 LSL: 3	Data Rank Ordered (Ordinal-Scale)	quarterly	20	20	20 data points; no subgrouping					LCL : 3 CL: 5 UCL: 6	Removal team members	TrungHung_litering_control.xls x	Removal Leader

Interpretation and implication


■ To implement the Process Management Plan, it requests a strong commitment of the local removal team

Results

■ PMP determine a priori in a reaction plan what to do, if certain signals occur in the control chart, eg: Outlier, Trends, Cycles, Oscillation, Drift and Shifts

wonderful!

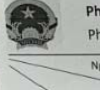
Daily check-sheet template for status of 7 output problems ...



Phiếu kiểm tra dọn vệ sinh môi trường khu vực cạnh tác của thôn Trung Hưng, xã Bắc Hưng

Phiên bản số 1

Ngày	Tháng Năm 2022																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Trạng thái																															
Hạng mục																															
Rác bừa bãi dưới đất																															
Rác không phân loại																															
Thùng rác quá đầy																															
Rác phân loại sai																															
Khu vực có mùi hôi thối																															
Người kiểm tra																															
Chú thích	<p>Hướng dẫn:</p> <p>I. Cách điền biểu: 1. Ưu tiên điền những giá trị thống số cụ thể trước; 2. Trạng thái bình thường thì tích "✓"; 3. Có sự cố hoặc không thể sử dụng tích "x", báo lại ban quản lý</p> <p>II. Hoàn thành vệ sinh khu vực cạnh tác định kì và ghi chép lại lịch sử dọn vệ sinh. Sau khi kiểm tra kết quả, bạn cần ký xác nhận.</p> <p>III. Gửi biểu mẫu này cho trưởng ban dọn vệ sinh vào ngày cuối cùng của mỗi tháng và nhận được một biểu mẫu mới để điền.</p>																														



Phiếu kiểm tra dọn vệ sinh môi trường khu vực cạnh tác của thôn Trung Hưng, xã Bắc Hưng

Phiên bản số 1

Ngày	Tháng Tháng Năm 2022																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Trạng thái																															
Hạng mục																															
Rác bừa bãi dưới đất	✓		✓						✓		✓																				
Rác không phân loại	✓		✓						✓		✓																				
Thùng rác quá đầy	✓		✓						✓		✓																				
Rác phân loại sai	✓		✓						✓		✓																				
Khu vực có mùi hôi thối	✓		✓						✓		✓																				
Người kiểm tra	Thị		Thị						Thị		Thị																				
Chú thích	<p>Hướng dẫn:</p> <p>I. Cách điền biểu: 1. Ưu tiên điền những giá trị thống số cụ thể trước; 2. Trạng thái bình thường thì tích "✓"; 3. Có sự cố hoặc không thể sử dụng tích "x", báo lại ban quản lý</p> <p>II. Hoàn thành vệ sinh khu vực cạnh tác định kì và ghi chép lại lịch sử dọn vệ sinh. Sau khi kiểm tra kết quả, bạn cần ký xác nhận.</p> <p>III. Gửi biểu mẫu này cho trưởng ban dọn vệ sinh vào ngày cuối cùng của mỗi tháng và nhận được một biểu mẫu mới để điền.</p>																														

Ngày 1-6 tháng 5 qua đây (cạnh miếu vọng cảnh)

Ngày 13-6 Khu vực đầu sông rất ô nhiễm (rác của người dân)

Ngày 22-6 Khu vực cạnh tác bị rác dưới đất (Khu vực cần đầu sông)

Ngày 25-6 rất nhiều rác vật rơi ra vì chỉ (có một họ gia đình đã dọn sạch)

Interpretation and implication

- Daily check-sheet can help removal team members & leader maintain the quality of their garbage collecting service better. Often checking the sheet can remind them what is important and have better control the output

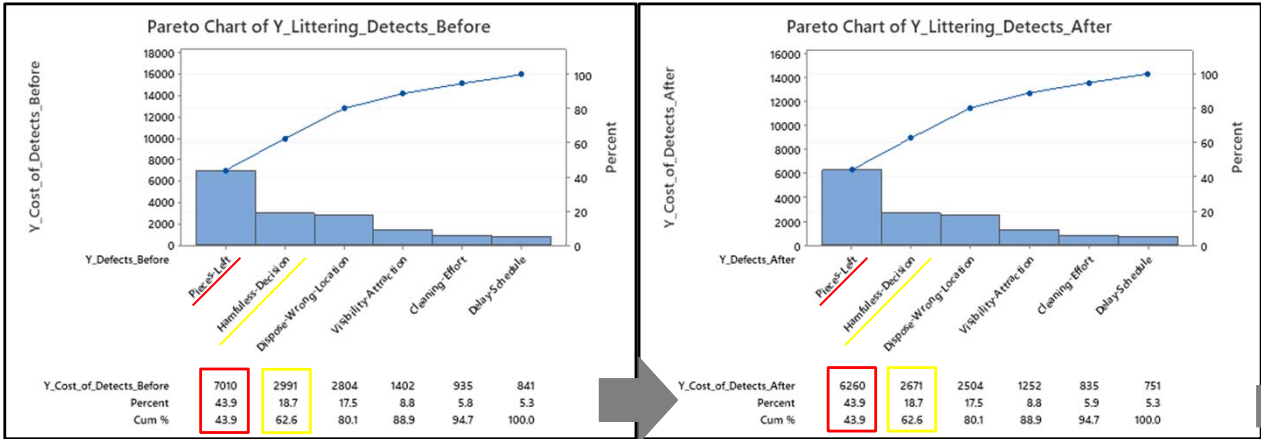
Results

- Build Daily check-sheet template to maintain output quality control of 7 predefined key problems
- Left picture is template, right picture is result check-sheet of June. Removal team member noted on unusual day

... Picture shows result of June with note, performed by removal team member

Summarize the results and the financial and other benefits of the project ...

Problems	Root Causes	Implemented Measures	Financial Benefits	Other Benefits
Y_03 ground(cleaned) ground not completely cleaned	e1.1.1.1) Villagers consume food or drink in public e1.1.2.1) Villagers has littered medical waste in concealed way e1.2.1) Villagers do not classified garbage before littering e1.3.1.1) The removal team has too much work e1.3.2.1.1) Garbage accumulated for a long time	1. Collect data on how often people eat and drink in public in the current locality 2. Collect data on current local environmental pollution 3. Collect data to share with villagers about the harmful effects of environmental pollution 4. Collecting data on Villagers has littered medical waste in concealed way 5. Prepare content to persuade people to limit consumption of food and drink in public 6. Prepare content to persuade people not to dump medical waste into the environment 7. Prepare content to guide villagers to classify garbage, not to throw garbage indiscriminately 8. Prepare instructions for garbage classification in crowded areas 9. Distributing instruction leaflets and mobilizing villagers do not to litter 10. Mobilizing and encouraging the spirit of all villagers to participate in environmental protection 11. Collaborate with the local government to gather a group of villagers willing to participate in environmental protection 12. Broadcast on local radio station weekly 13. Mobilize and set up a local volunteer team 14. Disseminate the plan of collaborating to clean up with removal team once a month 15. Plan to clean up local hotspot contaminated areas 2 times a month 16. Carry out the implementation according to the plan	720 EUR (Estimated) 750 EUR (Confirmed)	- Improve a clean living environment for villagers to have health and a happy life - Improve aesthetics for residential areas - Maintain clean water sources in rural areas - Reduce the amount of plastic bags buried in the soil, preventing soil erosion - Prevent the cause of disease outbreaks - Protect the living environment for living things: fish, birds, ... - Reduce unpleasant odors caused by garbage in heavily polluted areas - Bring climate change in rural areas
Y_06 decision(garbage) garbage mixture harmful	e1.1.1) Trash-cans are arranged in the out of sight places e1.1.2) Trash-cans are arranged in the out of sight places e1.2.1.1) Never had near trash-can signposts idea before e1.3.2.1.1) Inappropriate Trash-can selection	1. Figure out and decide on visible trash-can locations 2. Move the trash-cans from the current locations to the selected suitable locations 3. Move the trash-cans from the current locations to the selected suitable locations 4. Design a signpost for the location of the trash-cans 5. Print out the color printing to make the signpost 6. Post instructions in places near trash-cans that can be hidden from view 7. Select the size of the trash-cans according to the area to be dumped 8. Replace trash-cans that are too small with a more suitable one	360 EUR (Estimated) 320 EUR (Confirmed)	- Improve a clean living environment for villagers to have health and a happy life - Improve aesthetics for residential areas - Maintain clean water sources in rural areas - Reduce the amount of plastic bags buried in the soil, preventing soil erosion - Prevent the cause of disease outbreaks - Protect the living environment for living things: fish, birds, ... - Reduce unpleasant odors caused by garbage in heavily polluted areas
Y_04 garbage(disposed) thrown on the ground	e1.2.1.1.1) Not yet propaganda about the current urgency of the Environmental pollution e1.2.2.1.1) Properly garbage dispose is not usual e1.3.1.1.1) Responsibilities have not been clarified e1.3.2.1.1) Not encouraged the spirit of the village yet	1. Collecting data on general environmental pollution in Vietnam recently 2. Collecting data on general environmental pollution in Truong Hung recently 3. Collect data to share with villagers about the harmful effects of environmental pollution 4. Propagating and persuading people about urgent issues that need environmental protection 5. Collaboration of individuals and organizations for good observance of the environmental protection action 6. Distributing leaflets, spreading the spirit of environmental protection to everyone 7. Figure out how to properly classify garbage 8. Color print out to make a signpost 9. Posting instruction signs in crowded places and some areas where littering often occurs 10. Discuss with the local government about orientation for environmental protection in Truong Hung village 11. Clearly define the roles and tasks of each population group 12. Sort out the current villagers of Truong Hung village in some common groups 13. Propaganda on local loudspeakers about the role and responsibility of individuals in environmental protection so that everyone can understand clearly what they need to do 14. Propaganda to mobilize all villagers to participate in to protect the environment, inform once a week at the local radio program	330 EUR (Estimated) 300 EUR (Confirmed)	- Improve aesthetics for residential areas - Maintain clean water sources in rural areas - Reduce the amount of plastic bags buried in the soil, preventing soil erosion - Protect the living environment for living things: fish, birds, ...
Y_02 trash-can(empty) out of sight	e1.1.1.1.1) Lack of investment funds to buy trash-cans e1.1.1.1.2) The local government doesn't really care e1.1.1.1.3) Removal team Leader doesn't know about situation e1.2.1.1) Do not divide the garbage disposal location	1. Gather about the current local trash-can shortage 2. Gather about the current serious pollution situation in the village 3. Cutting the effectiveness of having enough trash cans to convince local local government 4. Convince removal team leader that the lacking trash-can is one of the main causes of littering 5. Find consensus from removal team leader on the request with the government for the lacking trash-cans 6. Convince local government that the lacking trash-can is one of the main causes of littering 7. Proposing the local government to provide a budget to buy more trash cans 8. Discuss with people about the option of making their own trash cans for temporary 9. Assess the frequency of garbage disposal of the areas 10. Arrange large trash-cans in large areas 11. Arrange small trash-cans and homemade trash-cans in residential areas to reduce the amount of garbage for large trash-cans	180 EUR (Estimated) 150 EUR (Confirmed)	- Improve aesthetics for residential areas - Reduce the amount of plastic bags buried in the soil, preventing soil erosion - Protect the living environment for living things: fish, birds, ...
Y_05 removal(schedule) trash-can fullness	e1.3.1.1.1) Inappropriate garbage removal time e1.3.1.1.2) Inappropriate garbage removal manpower	1. Analyze the unreasonable points of the current garbage removal plan 2. Collect the daily workload of the garbage removal members 3. Discuss with the removal team to have a suitable garbage removal plan 4. Make a plan based on consensus 5. Request the removal team to follow the plan and perform the check-sheet after clearing the ground and trash-can 6. Analyze with local governments on the current shortage of human resources 7. Convince local government that the lack of human resources to clean up garbage can lead to negative impacts on environmental protection 8. Proposed increase from 13 people to 16 people in the current situation	110 EUR (Estimated) 90 EUR (Confirmed)	- Improve a clean living environment for villagers to have health and a happy life - Improve aesthetics for residential areas - Reduce the amount of plastic bags buried in the soil, preventing soil erosion
Y_01 ground(cleaned) removal requires a great deal of effort	e1.1.1.1.1) Removal member raised before making cleaning equipment not received e1.1.1.1.2) Underestimate the importance of cleaning up	1. Collect current shortage of cleaning equipment from removal team members (Gloves, masks, brooms, dustpans) 2. Collect the current and desired salary of removal team members 3. Collect the current and desired salary of removal team members 4. On behalf of removal team members communicate with removal team leader 5. Proposing removal team leader to provide adequate equipment for removal team members 6. Convince the local government of the importance of garbage collectors 7. Propose to raise removal team member's salary from 72.45 EUR to 100.02 EUR (write a proposal, signed by villagers)	90 EUR (Estimated) 100 EUR (Confirmed)	- Increase the happiness and enthusiasm at work for removal team



Financial Benefits
720 EUR (Estimated) 750 EUR (Confirmed)
360 EUR (Estimated) 320 EUR (Confirmed)
330 EUR (Estimated) 300 EUR (Confirmed)
180 EUR (Estimated) 150 EUR (Confirmed)
110 EUR (Estimated) 90 EUR (Confirmed)
90 EUR (Estimated) 100 EUR (Confirmed)

	Cost (before)	Cost (after)	Savings
Ground(cleaned) cleaning-effort > 8 working hours per week	€ 935	€ 835	€ 100.00
Trash-can(empty) visibility/attraction too low	€ 1,402	€ 1,252	€ 150.00
Ground(cleaned) pieces left > 20	€ 7,010	€ 6,260	€ 750.00
Garbage(disposed) location wrong	€ 2,804	€ 2,504	€ 300.00
Removal(schedule) garbage in trash-can full	€ 841	€ 751	€ 90.00
Decision(garbage) harmfulness wrong	€ 2,991	€ 2,671	€ 320.00
	expected	€ 1,710.00	
	worst case	€ 1,400.00	
	best case	€ 2,000.00	

... Shows confirmed number, validated by Sponsor & Local accountant

Lessons learned 😊

Summarize lessons learned and identify topics for future projects
What I learned in the course of the project, concerning:
1. Subject matter/ Product:
Improve public Garbage Littering situation in Trung Hung village harvest area
2. Process:
Clean up the trash on the ground and empty the trash-cans in Trunghung village harvest area
3. Methods/ Tools:
Method;: Statistic methods like ANOVA, T-test, Regression, Pareto analysis, FMEA Software: Minitab, Excel, Sigma-guide
4. People/ Teams:
Sponsor, Removal team, Local authority, Villagers
5. Management:
Secretary of the Communist Party of TrungHung Village (Sponsor), Local authority, Removal leader
6. Finance:
Financial estimation by local accountant, Review by Secretary of the Communist Party of TrungHung Village (Sponsor)
7. Company:
TrungHung village government
Potentials/ topics for further improvements:
1. Request to invest in renting an excavator to clean all the garbage that has been accumulated for many years in the riverbed of CuaHang Bridge
2. Building and perfecting the sanction system to handle village environmental laws about environmental pollution problems
3. To complete the wastewater treatment system in residential areas and even industrial and agricultural zones in TrungHung village
4. Need to raise people's awareness of using and handling garbage more

Interpretation and implication

Through Public Garbage Littering in TrungHung village harvest area project,

1. I have learned a lot of useful things:

- Already know how to implement a real project according to the DMAIC method, under the guidance of MBB Dr. Reiner
- Learnt how to persuade, communicate and negotiate with people in the process of mastering a project
- Understand the knowledge of Lean 6 Sigma and successfully apply it to the project
- learn how to study online effectively and feel good about the multinational learning environment

2. Contribute a part to building a better life for the TrungHung villagers:

- improve environmental pollution in the harvest are
- All people have a better sense of environmental protection, more respect garbage removal team’s activities

Potentials for further improvements

Certificate to recognize Luong Van Tim's contribution in local environmental protection ...



Image captions:

- After all the efforts, the best thing is to be recognized by the local government for making many effective contributions to environmental protection in the locality
- Certificate confirmed Luong Van Tim's contribution, issued by TrungHung village government (Secretary of the Communist signed)

... awarded by TrungHung village government (Secretary of the Communist signed)

Tim, what a great, and from our point of view understandable recognition for your excellent work

Sponsor representatives share messages after the project ...

Video Sponsor's Thank You message



The content of the Thank You message

Translate content into English:

- The project to improve the polluted environment in TrungHung village has come to the end
- First of all, I would like to acknowledge and thanks Mr. Luong Van Tim for his great contributions to local environmental protection
- Personally, I highly appreciate his methods and approaches to the current polluted environment in the locality
- I hope that there will be more young generations around the world enthusiastic about environmental protection
- Thanks for your creative ideas, which have helped villagers to change their consciousness and behavior in environmental protection
- This takes a crucial part in making the village greener, cleaner and more beautiful, thank you very much!

... and thanks for the achievements that the project brings to the villagers

Results of the CONTROL-Steering

Control-Steering				
Tool	Application	Documentation	Comment	Decision
Graphical Analysis	ok	ok		Master-Black-Belt
Process-Capability	ok	ok		Dr. Reiner Hutwelker reiner.hutwelker@tum.de
Control-Charts	ok	ok		11-Jul-2022
Statistical Test of Improvement	ok	ok	Of course, I would accept this in a normal story-book – However in your case I would recommend, to make your results even more comprehensible, directed at managers, so that they immediately understand, what you did in this chapter	passed
Project-Management-Plan	ok	ok		Sponsor
Summary & Benefits	ok	ok		Pham Van Quang Phamvanquang.trunghung@gmail.com
Lessons Learned	ok	ok		Date
Additonal Notes			Dear Tim, this is excellent work - I personally think it is the best project ever in this course. You are my #1 candidate for our Environment Green Belt Award in October and it would be great if you could still implement my notes. Of course you have already earned the certificate - congratulations, great achievement, Reiner.	passed/ failed
Sponsor Notes				

Only proceed to the next phase after a positive decision of MBB and Sponsor

End of this Project-Story-Book

Six Sigma process improvement methods and tools