CHAPTER V

CONCLUSION AND SUGGESTION

5.1. Conclusion

According to the data analysis and discussion in the chapter IV, finally the research are explained below:

5.1.1 Evaluate current application of unmanned aerial systems (UAV) in the construction project

1. The aim of this case study was to identify potential applications of visual assets from UASs for construction tasks and to identify other construction-related tasks that deserve further study. The first objectives the writer identify current application of unmanned aerial systems (*UASs*) in the construction project. From the observation, the writer found that the number of respondents who implement the application of unmanned aerial systems *(UASs)* supervisory is a half from the total respondent (50%) and the rest is still with the conventional supervisory. The most application of UASs respondent applied are aerial photography to track job progress, safety monitoring and support (K3) in construction industry in Yogyakarta and Jakarta. Also, it can be concluded usefulness of visual assets of UASs application that most respondents response high impact is safety monitoring, aerial photography to track job progress and inspection of difficult areas or impossible access contractor have a high degree of advantage with unamanned aerial systems in construction project. Base

from the survey result of UASs application from 2016 - 2017 for safety monitoring, aerial photography to track job progress have an increasing 40% of the application usage and inspection of difficult areas or impossible access have an increasing 20% application usage along with a good report supervisory in their business. The findings of this study indicate that there are several potential applications of UAS-based visual assets for construction management applications including the monitoring of project progress, evaluation of job site logistics plans, monitoring of safety conditions, and quality inspections of work performed among other secondary management tasks.

5.1.2 Analysis the Factor Influencing Supervisory and Monitoring of the Project Using Conventional and Unmaned Aerial Systems (UASs)

1. The second research objectives is to identify and compare the factor influencing supervisory and monitoring of the project using conventional (traditional) and unmaned aerial systems (UASs) tools. From the observation and data analysis, based from data, quality and cost factors the writer found that UASs respondents are emphasized more in applied supervisory provide a new perspective on real time progress with the *mean value* 4,40 rather than conventional respondents are more emphasized in unique perspective (area hard to see) with the *mean value* 4,00. Then for management aspect factors, inspection in hard to reach places has proven invaluable for planning progress is the most important factor form UASs repondents have *mean value* 4,20, the other hand visual understanding of

the estimating cost requirements for construction is the most important management aspect factors from conventional respondents responses have *mean value* 4,40. Meanwhile, method consideration to obtaining the visual assests is must be match between system and the real world. This factors have a high degree of respons in terms of usage factors , this factor have *mean value* 3,80 both of supervisory. It can be conluded from all responses, the higher responses of management aspect factors is inspection in hard to reach places has proven invaluable planning progress with the *mean value* 4,20 for UASs supervisory. Then for data, quality and costs factors is areas hard to see (unique perspective of project) with the *mean value* 4,10.

2. The use of UASs would provide benefits to projects such as reduced time for aerial photos to be delivered to site, no limitations on the number of photos other than flight time and memory card capacity, no limitations on view angle sand elevation of photos and availability of videos from the same perspective and elevation as aerial photos. These benefits would need to be financially quantified for a more direct comparison to aerial and ground photography services to be possible. In addition, UASs can provide a flexibility that photography services may not be able to provide in terms of service timing. With a site-based UASs, project personnel can have real-time access to images and videos of the site from preferred angles.

5.1.2.1 Analysis T–Test Benefit and Outcomes Current Method Construction Project Supervisory

1. The responses of contractors and consultants on *data, quality and cost* factors are done by *independent samples t-test* was conducted to compare UASs and conventional supervisory. From the result of t test we get the result of T calculation is 1,084 which is less than T table 2,0860, and number of significant T calculation is 0.291 which is bigger than 0,05, so that Ho is accepted, it means partially there was *no significant difference* in the obtaining visual assets of current method applications, in terms on the data, quality and costs factors in project implementation construction. This test was found that UASs and conventional really does have an effect or impact benefit and outcomes on *data, quality and cost factors* due to obtaining visual assets. Specifically, the result means have high mean (big). It was found that high mean data, quality and costs is beneficially and high outcomes in terms of obtaining the visual assets. That factors have significant impacted to the project timeline as well as project receive a very high return on investment.
2. The responses of contractors and consultants on *management aspects* factors are done by *independent samples t-test* was conducted to compare UASs and conventional supervisory. From the result of t test we get the result of T calculation is -0,949 which is less than T table 2,3060, and number of significant T calculation is 0.371 which is bigger than 0,05, so that Ho is accepted, it means partially there was *no significant difference*

in the obtaining visual assets of current method applications, in terms of management aspect factors in project implementation construction. These results indicate that UASs and conventional supervisory really does have an effects benefits and outcomes on *management aspect factors* due to obtaining visual assets. Specifically, the result means have high mean (big). It was found that high mean management aspect is more beneficially and high outcomes in terms of obtaining the visual assets. Otherwise the result means that have low mean (small) it was found that management aspect is more less beneficially and less outcomes in terms of obtaining the visual assets.

3. The responses of contractors and consultants on *usage* factors are done by *independent samples t-test* was conducted to compare UASs and conventional supervisory. From the result of t test we get the result of T calculation is 1,152 which is less than T table 2,3060, and number of significant T calculation is 0.282 which is bigger than 0,05, so that Ho is accepted, it means partially there was *no significant difference* in the obtaining visual assets of current method application, in terms of usage factors in project implementation construction. These results indicate that UASs and conventional supervisory really does have an effects benefits and outcomes on usage factors due to obtaining visual assets. Specifically, the result means have high mean (big). It was found that high mean usage is represent beneficially and high outcomes in terms of obtaining the visual assets. These 5 statement factors from table 4.35

show that UASs is easy to use and responses positive impact usage due to the project. Otherwise the result means that have low mean (small) it was found that usage is more less beneficially and less outcomes in terms of obtaining the visual assets.

5.1.3 Analysis the Costs Supervisory and Monitoring of the Project Using Conventional and Unmaned Aerial Systems (UASs)

1. The third research objectives is to identify and compare the cost of monitoring and supervisory using unmanned aerial systems (*UASs*) and conventional (*traditional*) tool. The analysis of ten projects is showing the most of projects have the similar salary, both of respondent show the staff projects with salary 3 – 6 Million Rupiahs. From the interviews with some of the chief engineers said that, the UASs and conventional supervisory have the same duty. Therefore there is an additional in charge because the ability operator drone and obtain Remote Pilot Airman Certification from FAA (Federal Aviation Administration) in the worldwide but in Indonesia regulation is Peraturan Menteri Perhubungan Republik Indonesia No 180 Tahun 2015 that need to regulated and obey. The operator has to understand the regulations issued, if does not it will be harmful for the construction penalty due to the project. We can take the another information, the project applied UASs and Conventional method supervisory does not have a staff more than 5 - 7 people, mostly about 2 - 4 staff with this method. In the other hands, the project which applied conventional method usually has staff for supervisory more than 5 -7

people and could be 8 – 10 people for monitoring. It can be conclude project that already applied technology UASs – BIM much more less staff than project still applied conventional monitoring.

2. Based on the result obtained from the observation, the writer conclude that UASs (drone) is more cost-effective financing rather than conventional supervisory. From the calculation total supervisor every project needed, we can get the information total wage project supervisory UASs and conventional with the percent to total wage is Rp 2.229.600.000 (1,061 %) and average percent to total wage is Rp 445.920.000 (0,212%). The conventional supervisory more expensive considered financing expenses with the percent to total wage Rp 3.082.500.000 (2,248 %) and average percent to total wage Rp 616.500.000 (0,450%). So the diffrences between both method significant high competitive expenses, with the percent to total wage amount Rp852.900.000 (1,187%) and average percent to total wage amount Rp170.580.000 (0,24%).

3. From the analysis, the writer found that the available cost information project and workers wage related to UASs use on jobsites, it was determined that additional data from the project are needed to perform a more detailed analysis and comparison to current methods for imaging jobsites. Costs such as specific wage operators, obtaining authorization, permission from Direktorat Jenderal Perhubungan Udara (Dirjenhubud) to be able to fly and to meet regulatory requirements are the greatest

expenditures involved with the use of UASs on jobsites. However, these costs are expected to decrease when implemented this method. There are many benefits provided by the use of UASs for project management tasks that will need to be quantified to more clearly understand their impact on construction sites. As UASs use becomes more widespread, additional data will be available to study their financial implications. At this time, and with the data available, the authors can conclude that for many companies applied UASs could be a good investment. Finally by implementing UASs into construction projects, companies not only increase the effectiveness of the job they perform but also able to increase their return on investment for projects, all due to the innovation and usefulness od UASs.

5.1.3.1 Analysis T-Test Costs Supervisory and Monitoring of the Project Using Conventional and Unmaned Aerial Systems (UASs)

1. The responses of contractors and consultants on *total worker wage* are done by *independent samples t-test* was conducted to compare UASs and conventional total worker wage supervisory. From the result of ttest we get the result of T calculation is -1,774 which is more than T table -2,3060, and number of significant T calculation is 0.114 which is bigger than 0,05, so that Ho is accepted, it means partially there was *no significant difference* between total worker wage of UASs and conventional supervisory due to conventional supervisory. These result indicate that UASs and conventional supervisory really does have an effect on total worker wage supervisory. Specifically, these result means have high

means (big). It was found that high means is spend more total worker wage from the total amount of staff (expensive), meanwhile result means have low mean (small). It was found that small mean is spend more less total worker wage from the total amount of staff (more cost-effective financing).

5.2. Suggestions

According to the result from the observation about a study of application of unmanned aerial systems in construction project, there are some recommendations as consideration for the next observation, such as:

1. Future research the observer should evaluate the financial implications in detail to determine what project characteristics could affect financial feasibility of UASs use.
2. Observer will need to be researched further include the impact of the use of UASs, the impact of the learning curve in the use of UASs technology by construction personnel, privacy concerns, and safety issues that maybe related to the use of UASs technology on jobsites.
3. The use of UASs is not widespread in construction stages and can greatly vary from project to project. Future research the observer should be able to operate a drone in proper way and applied on assessing the performance of UASs for the tasks that may be considered feasible with UASs technology in the field. A longer duration of research is required, for example 1 month in the project or even to follow the entire construction process from start to finish.

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UNIVERSITAS ATMA JAYA YOGYAKARTA
Fakultas Teknik

Nomor : 3783/XI/U/2017
Hal : Ijin Penyebaran Kuesioner

Yogyakarta, 18 Desember 2017

Kepada
Yth.

Dengan hormat,

Dalam rangka menyelesaikan Pendidikan Tingkat Sarjana pada Program Studi Teknik Sipil Kelas Internasional, Fakultas Teknik, Universitas Atma Jaya Yogyakarta, setiap mahasiswa yang menempuh mata kuliah Final Project sangat membutuhkan data pendukung secara nyata dan lengkap.

Untuk itu kami mohon Bapak/Ibu berkenan memberikan ijin penyebaran kuesioner di instansi yang Bapak/Ibu pimpin, dengan judul "A STUDY OF APPLICATION OF UNMANNED AERIAL SYSTEMS IN CONSTRUCTION PROJECT" kepada :

Nama	: Gregorius Edwin Yonathan
NPM	: 131315057
Program Studi	: Teknik Sipil Kelas Internasional
Semester	: Gasal T.A. 2017/2018

Atas perhatian dan kerjasamanya, kami ucapkan terima kasih.

Dekan

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Attachment 2. Research Questionnaire

RESEARCH QUESTIONNAIRE

A CASE STUDY OF APPLICATION OF UNMANNED AERIAL SYSTEMS IN CONSTRUCTION PROJECT

The technical Marketing Manager of Autodesk. Inc., Anthony Governati (2012), express that BIM is not just a tool, but a process that support virtual designing construction methodology. Point all stakeholder together throughout entire design in construction process and beyond to the operation and maintenance of the building.

In today's twenty-first century world, technology has come to play an ever-increasing role in the daily lives of people across the globe. One of the ultimate goals of new technology is that it improves the experience of the user in some way. When applied to the commercial industry, by these principles technology should also work to make whatever process, task, or project it is working on more efficient. One example of such a technology currently making strides by streamlining commercial processes is unmanned aerial vehicles (UASs), more commonly referred to as drones.

One industry in specific that has utilized the various benefits of drones is the *construction sector*. The construction industry represents one of the largest commercial industries in the world. Fortunately, drones have the potential to cut down on *time* and *costs* in several areas of construction sites, as evidenced by *several case studies evaluating them*.

Drones have the potential to improve efficiency on a wide variety of construction site jobs, including *surveying, digital mapping, and volumetric analysis,* as shown in several separate case studies in the some journal. The use of drones on these projects have limitation, which to help *decrease costs*, *productivity efficiency* at inspection or monitoring in case (*live or report*), and would ultimately lead to a *higher return on investment* for construction firms.

This questionnaire research conducted as final project requirement, it will disturbed among contractors or consultants that been involved in construction project. Considering the importance of this research, it is expected to fill this questionnaire earnestly. Thank you for the attention.

Attachment 2. Research Questionnaire

RESEARCH QUESTIONNAIRE

A CASE STUDY OF APPLICATION OF UNMANNED AERIAL SYSTEMS IN CONSTRUCTION PROJECT

This 2nd secondary questionaire is made for the purpose of completion of Final Project in Faculty of Engineering, International Civil Engineering Program of Atma Jaya Yogyakarta University. This questionnaire contains questions information that has been done or on - going during construction project.

A. Respondent Project Information

1. Project Name :
2. Project Address :
3. Land Area :
4. Building Area :
5. Contract Value :
6. Number of Floors :
7. Duration of project work :
8. Project Owner :
9. Planning Consultant :
10. Supervising Consultant :
11. Contractor :
12. Supervisory Type (*) :
    - ☐ Unmanned Aerial Systems (*UASs*) or Drone Supervisory
    - ☐ Conventional (*Traditional*) Supervisory
    - ☐ Drone and Conventional Supervisory
13. How much the salary every month for worker drone supervisory monitoring from the company ?
    - a. Rp. < 3 million
    - b. Rp. 3 - 6 million
    - c. Rp. 7 – 10 million
    - d. Rp. > 11 million
14. How much the salary every month for worker *conventional* supervisory monitoring from the company ?
    - a. Rp. . < 3 million
    - b. Rp. 3 - 6 million
    - c. Rp. 7 – 10 million
    - d. Rp. > 11 million

***(*)** If select more than **one option**, no 14 and 15 must be fill*

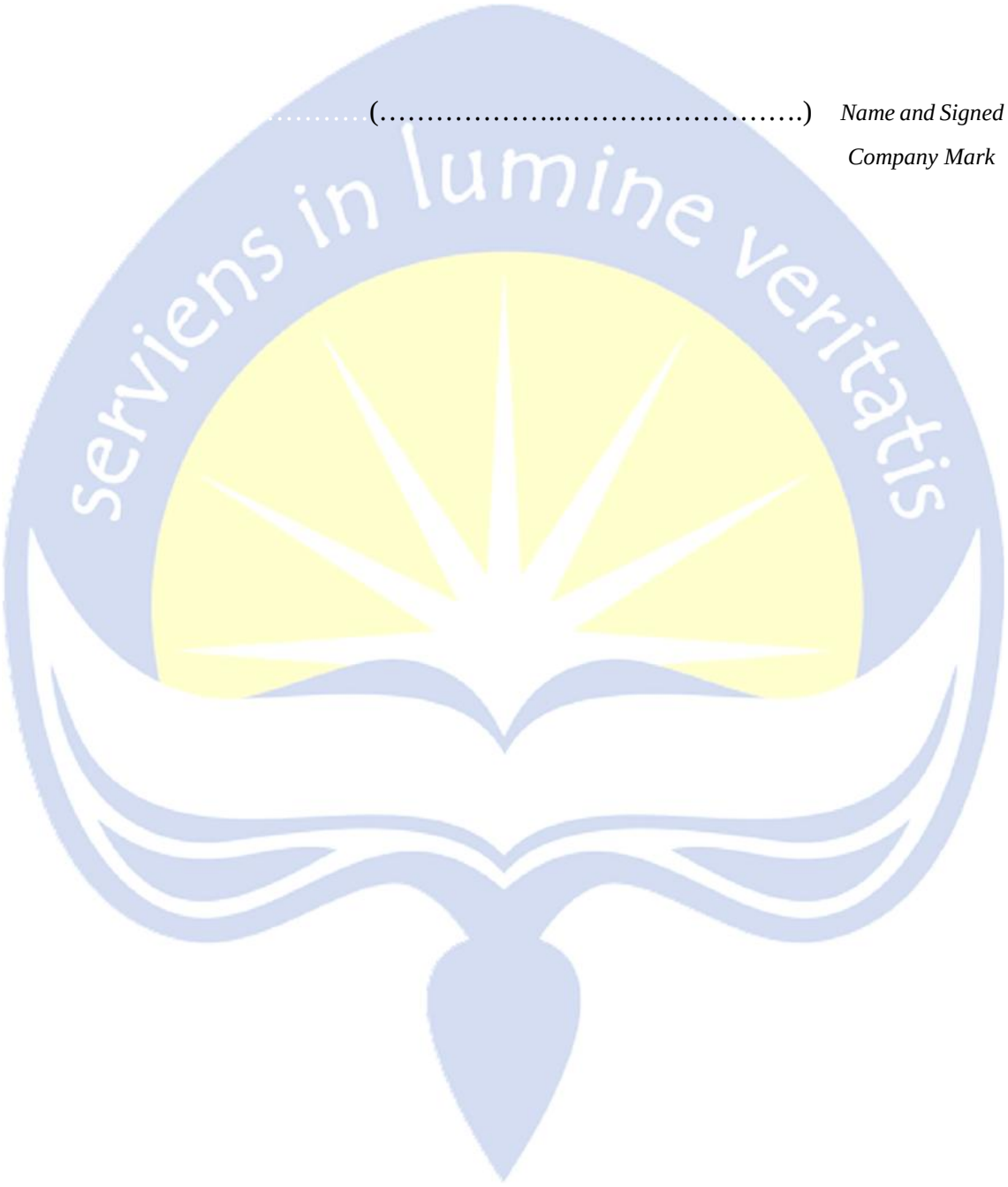
Attachment 2. Research Questionnaire

……, ……2018

Data Provided by

(……..…….……) *Name and Signed*

Company Mark



Attachment 2. Research Questionnaire

RESEARCH QUESTIONAIRE

A CASE STUDY OF APPLICATION OF UNMANNED AERIAL SYSTEMS IN CONSTRUCTION PROJECT

This 1st primary questionaire is made for the purpose of completion of Final Project in Faculty of Engineering, International Civil Engineering Program of Atma Jaya Yogyakarta University. This questionaire contains questions about the use of drones during construction work.

A. RESPONDENT INFORMATION

Give sign **(✓)** or **(✕)** in the box **(☐)** which has been provided below :

1. Company Name :
2. Company Address :
3. Position :
   - ☐ Project Manager
   - ☐ Site Manager
   - ☐ Site Engineer
   - ☐ Quality Controller
   - ☐ Others :……..
4. Respondent Type :
   - ☐ Consultant
   - ☐ Contractor
   - ☐ Others
5. Type of project (*) :
   - ☐ High Rise Building
   - ☐ Medium Building
   - ☐ Infrastructure
   - ☐ Industrial Building
   - ☐ Other Works, _____
6. Latest Education :
   - ☐ ≤ D3 *(Diploma)*
   - ☐ S1 *(Bachelor)*
   - ☐ ≥ S2 (*Master)*
7. Working experiance :
   - ☐ <5 Years
   - ☐ 5-10 Years
   - ☐ 10-15 Years
   - ☐ >15 Years

(*) Can select more than one option

Attachment 2. Research Questionnaire

CHARGING INSTRUCTION

- *Based on your knowledge and experience, put a mark (✗) or (✓) on the appropriate and / or appropriate box describing the frequency / frequency occurring and the degree of influence the contractor faces, and describes the type of response / action the contractor chooses in the intensity of use appeared during the execution of construction works.*

  - *Description of frequency rate of use of Unmanned Aerial Systems (UASs) for project construction*. The amount of scale expressed in the range 1 to 5 :

Agreement Scale	
Strongly Disagree	**1**
Disagree	**2**
Netral	**3**
Agree	**4**
Strongly Agree	**5**

  - *Description impact level / impact on construction project continuity.* The amount of scale expressed in the range 1 to 5 :

Impact or Effect Scale	
Not at all	**1**
Small	**2**
Medium	**3**
High	**4**
Extremely High	**5**

Attachment 2. Research Questionnaire

B. THE CURRENT AND FUTURE USAGE OF UNMANNED AERIAL SYSTEMS (UASs)

a. What is your knowledge and experience of UASs *(drone)*?

a. I know it very well and I have experience to use it.

b. I know it but do not have experience to use it.

c. I am interesting it and studying it now.

d. I only know the word UASs *(drone)*.

e. No, I do not know it all.

b. Company response toward UASs *(drone)*

1. Did your project use drone ?

a. Yes b. No

If the answer is **"No"**, please going to page **13 sub E.**

If the answer is **"Yes"**, what kind of drone brand do you use ? *(Respondent keep still fill until last page)*

☐ DJI P1, P2, P3,P4 ☐ Others,……

☐ YUNEEC Q500, H520

☐ DJI INSPIRE

☐ SYMA

2. How long your project has been implement drone in the construction project ?

a. < 1 year d. 3 year

b. 2 year e. > 4 year

3. From your experiance, how many employee required to ***implement*** *drone* supervisory in construction project ?

a. 1 staff c. 4 – 5 staff

b. 2 – 3 staff d. > 6 staff

4. From your experiance, how many ***additional*** employee required to implement *conventional* supervisory in construction project ?

a. 1 staff c. 4 – 5 staff

b. 2 – 3 staff d. > 6 staff

5. From your experiance, how many ***total*** employee required to implement *drone and conventional supervisory* in 1 construction project ?

a. 2 - 4 staff c. 8 – 10 staff

b. 5 – 7 staff d. > 11 staff

Attachment 2. Research Questionnaire

6. What application would you like to use drone for, in case on – going construction project ***(*)*** ?

   ☐ Aerial photography to track job progress

   ☐ Aerial photography for logistics and production planning

   ☐ Management Productivity

   ☐ Inspection of areas difficult or impossible to access

   ☐ Safety monitoring and support (K3)

   ☐ Land surveying, thermal imaging, laser scanning or other data collection

   ☐ Others,_____

   (*) *Select more than one option*

   According to the project experience, the implementation of UASs to the construction project is :

   a. Beneficial because of the potential profit

   b. Did not produce any benefit

7. How many times to do drone supervision in 1 day ?

   ☐ 1 time

   ☐ 2-3 time

   ☐ 4-5 time

   ☐ >6 time:……

8. How many day to do drone supervision in 1 week ?

   ☐ 1 day

   ☐ 2-3 day

   ☐ 4-5 day

   ☐ >6 day:……

9. According to your experiance, how much time you need to implement drone while on project constraction *(1 time implementation)* ?

   a. < 10 minutes b. 15 – 20 minutes c. 30 – 40 minutes d. > 1 hour

10. Do you think your company will use UASs *(drone)* for construction projects in the next 5 years?

    a. Yes b. No

Attachment 2. Research Questionnaire

c. Possible applications for UASs *(drone)* usage

1. Please indicate level of agreement usefulness of visual assets in various areas for drone applications – survey results *(agree and disagree)*

Application Would You Use A Drone For?	Strongly Disagree	Disagree	Netral	Agree	Strongly Agree
Project progress monitoring (Aerial)	1	2	3	4	5
Job site logistics and planning (Aerial)	1	2	3	4	5
Productivity management	1	2	3	4	5
Inspection of areas difficult or impossible to access (quality inspections)	1	2	3	4	5
Safety monitoring and support (K3)	1	2	3	4	5
Land surveying, thermal imaging, laser scanning	1	2	3	4	5
General managerial Issuess	1	2	3	4	5
Technical Issuess	1	2	3	4	5

2. Please indicate how long usage of UASs (drone) application – survey result (Years)

Application Would You Like To Use A Drone For?	2016	2017	CHANGE
Project progress monitoring (Aerial)			
Job site logistics and planning (Aerial)			
Productivity management			
Inspection of areas difficult or impossible to access (quality inspections)			
Safety monitoring and support (K3)			
Land surveying, thermal imaging, laser scanning			
General managerial Issuess			
Technical Issuess			

Attachment 2. Research Questionnaire

d. Type of view inspecting the visual data (Technical problems by inspecting the visual data)

1. Please indicate what kind of representation you need to see when monitoring / inspecting using an unmanned aircraft?

Type Of View	Not at all	Small	Medium	High	Extremely High
Closer View	1	2	3	4	5
Internal View	1	2	3	4	5
Higher Elevation	1	2	3	4	5
Specific Angle	1	2	3	4	5
Working Performing Tasks	1	2	3	4	5

e. Budget allocation in the future

1. Please indicate allocation for Unmanned Aerial Systems (UASs) or Drone

Type Of Allocation	Not at all	Small	Medium	High	Extremely High
Conduct a study of UASs implementation in the company	1	2	3	4	5
Purchase UASs and License	1	2	3	4	5
Conduct a UASs training for the staff	1	2	3	4	5
Invent the company's UASs procedures or manuals	1	2	3	4	5
Collaborate with other company regarding UASs effective procedure	1	2	3	4	5

C. UNMANNED AERIAL SYSTEMS (UASs) USE EXPERIENCE

a. Level of UASs - BIM significance in the construction stages

1. Please indicate respondent experience, level of UASs – BIM significance in the construction stages :

Stage Of Construction	Not at all	Small	Medium	High	Extremely High
Data Collection	1	2	3	4	5
Production Control	1	2	3	4	5
Procurement Scheduling	1	2	3	4	5
Site Layout and Handling	1	2	3	4	5
Safety (K3) and Motivation	1	2	3	4	5

Attachment 2. Research Questionnaire

b. Level of UASs (drone) impact due to implementation supervision on the construction project activities

1. Please indicate the respondent experience, about impact due to implementation of drone supervision on the construction project activities :

Respondent Experience	Not at all	Small	Medium	High	Extremely High
Replace the traditional method supervision	1	2	3	4	5
Reduce amount of worker to supervise	1	2	3	4	5
Reduce amount of total cost overall the project	1	2	3	4	5
Improve report status (Live)	1	2	3	4	5
Improve operation and decision making	1	2	3	4	5
Improve Safety of jobsite personel	1	2	3	4	5
Improve Safety of adjacent public	1	2	3	4	5
Reduce time observation	1	2	3	4	5
Minimize the risk of miscommnunication	1	2	3	4	5

c. Factors Implementation of UASs (drone) supervision on the construction project

1. Please indicate the factors implementation of UASs (drone) during the construction project :

Factor Of Implementation UASs	Not at all	Small	Medium	High	Extremely High
Efficient and effective	1	2	3	4	5
Reduce cost of employeement	1	2	3	4	5
Improve productivity	1	2	3	4	5
Reduce working hour	1	2	3	4	5
Improve communication (report)	1	2	3	4	5

Attachment 2. Research Questionnaire

D. COMPARE BENEFITS AND OUTCOMES OF CURRENT METHODS FOR OBTAINING VISUAL ASSETS *(Aerial Photography Monitoring)*

a) Please indicate comments on *data, quality and cost* factors according respondent experience in UASs usage :

Comments	Not at all	Small	Medium	High	Extremely High
Accurate land area surveys	1	2	3	4	5
Better quality photos and quicker turnaround	1	2	3	4	5
Unique perspective of project (area hard to see)	1	2	3	4	5
Clients love to see their project from the perspective	1	2	3	4	5
Improve relation with the client	1	2	3	4	5
Provides a new perspective on real time progress not attainable from the ground or conventional aircraft flyover	1	2	3	4	5
Cost savings and convenience	1	2	3	4	5
Images are fantastic from marketing point of view	1	2	3	4	5
Much quicker than using Conventional Monitoring	1	2	3	4	5
Provides long distance clients with up to date real-time footage of the current status of work	1	2	3	4	5
Easy operation	1	2	3	4	5

b) Please indicate comments on *management aspect* factors according respondent experience in UASs usage :

Comments	Not at all	Small	Medium	High	Extremely High
Construction Productivity Improvement (Full understanding of the workers project's and project management in improving productivity)	1	2	3	4	5
Construction Job Progress (Report footage to the general contrctors and owners)	1	2	3	4	5
Construction Site Security (Provides sharing of the information project team members)	1	2	3	4	5
Construction Inspection (Inspections in hard to reach places has proven invaluable for planning progress)	1	2	3	4	5
Construction Estimating Cost (Visual understanding of the estimating cost requirements for construction)	1	2	3	4	5

Attachment 2. Research Questionnaire

c) Please indicate comments on *usage* factor according respondent experience in UASs usage:

Comments	Not at all	Small	Medium	High	Extremely High
Flexibility and efficiency of use	1	2	3	4	5
Operation time and speed	1	2	3	4	5
Match between system and the real world (The use of waypoints and pre-programmed routes)	1	2	3	4	5
Recognize, diagnose and error prevention	1	2	3	4	5
Visibility of system status	1	2	3	4	5

d) Please show perception of visual video and photo asset use to monitoring according to your project?

USEFULNESS

Photo	**Video**
Project Progress	Project Progress
Job Progress	Job Progress
K3 (Safety, Health and Safety)	K3 (Safety, Health and Safety)
Monitoring of Logistics Works	Monitoring of Logistics Works
Marketing Needs	Marketing Needs
Material Monitoring	Material Monitoring
General Inspection	General Inspection

PROBLEM IDENTIFICATION

Photo	**Video**
K3 (Safety, Health and Safety)	K3 (Safety, Health and Safety)
Quality Issues	Quality Issues
Field Organization	Field Organization
Logistics Route	Logistics Route
Traffic Issues	Traffic Issues
Worker Behavior	Worker Behavior
Inventory Problem	Inventory Problem
Material Problem	Material Problem

Attachment 2. Research Questionnaire

E. COMPANY RESPONSE TOWARD TRADITIONAL *(CONVENTIONAL)* MONITORING

1. How many employee required to *monitoring / inspection* in construction project ?

   a. 1 staff
   b. 2 – 3 staff
   c. 4 – 5 staff
   d. > 6 staff,_____

2. How many *total employee* required to implement *conventional supervisory* in construction project ?

   a. 2 – 3 staff
   b. 4 – 6 staff
   c. 7 – 9 staff
   d. > 10 staff,_____

3. What application would you like to use supervisory for ***(*)*** ?

   ☐ Ground based photography to track job progress

   ☐ Ground based for logistics and production planning

   ☐ Management Productivity

   ☐ Inspection of areas difficult or impossible to access

   ☐ Safety monitoring and support (K3)

   ☐ Land surveying, thermal imaging, laser scanning or other data collection

   ☐ Other,_____ ***(*)****Could select more than one option*

4. How many times to do supervision in 1 day ?

   ☐ 1 time

   ☐ 2-3 time

   ☐ 4-5 time

   ☐ >6 time:……

5. How many times to do supervision in 1 week ?

   ☐ 1 day

   ☐ 2-3 day

   ☐ 4-5 time

   ☐ >6 day :…….

6. According to your experiance, how much time you need to implement drone while on project constraction *(1 time implementation)* ?

   a. < 10 minutes b. 15 – 20 minutes c. 30 – 40 minutes d. > 1 hour

7. Do you think your company will use UASs *(drone)* for next projects?

   a. Yes
   b. No

Attachment 2. Research Questionnaire

8. Please indicate areas of concern currently precluding drone usage :

Comments	Strongly Disagree	Disagree	Netral	Agree	Strongly Agree
Legal status to operate	1	2	3	4	5
Ability to learn how to operate one	1	2	3	4	5
Privacy	1	2	3	4	5
Safety of jobsite personnel	1	2	3	4	5
Cost to buy and operate	1	2	3	4	5

9. Please give rating to usefelness of conventional monitoring / inspection base on your experiance :

Usefulness of conventional monitoring / inspection	Strongly Disagree	Disagree	Netral	Agree	Strongly Agree
Project progress monitoring	1	2	3	4	5
Job site logistics	1	2	3	4	5
Productivity improvement	1	2	3	4	5
Quality Inspection	1	2	3	4	5
Safety monitoring and support (K3)	1	2	3	4	5
General managerial Issuess	1	2	3	4	5
Technical Issuess	1	2	3	4	5

10. The following question ask you to rate drone for their effectivenes across a range of attribute. If you have not used a drone before, please answer the question based on your perception of drone surveys :

Effectiveness	Not at all	Small	Medium	High	Extremely High
Monitoring or inspection in terms of their value for *money* ?	1	2	3	4	5
Monitoring or inspection in terms of their *safety* ?	1	2	3	4	5
Monitoring or inspection in therms of *accuracy* ?	1	2	3	4	5
Monitoring or inspection in terms of their *speed* ?	1	2	3	4	5
Monitoring or inspection in terms of their quality of *data* ?	1	2	3	4	5

Attachment 2. Research Questionnaire

F. COMPARE BENEFITS AND OUTCOMES OF CURRENT METHODS FOR OBTAINING VISUAL ASSETS *(Ground Based still photography monitoring)*

a) Please show comments on *data, quality and cost* factors according respondent experiences in conventional monitoring?

Comments	Not at all	Small	Medium	High	Extremely High
Accurate land area surveys	1	2	3	4	5
Better quality photos and quicker turnaround	1	2	3	4	5
Unique perspective of project (area hard to see)	1	2	3	4	5
Clients love to see their project from the perspective	1	2	3	4	5
Improve relation with the client	1	2	3	4	5
Provides a new perspective on real time progress	1	2	3	4	5
Cost savings and convenience	1	2	3	4	5
Images are fantastic from marketing point of view	1	2	3	4	5
Much slower than using drone monitoring	1	2	3	4	5
Provides long distance clients with up to date real-time footage of the current status of work	1	2	3	4	5
Easy operation	1	2	3	4	5

b) Please show comments on *management aspects* factors according respondent experiences in conventional monitoring?

Comments	Not at all	Small	Medium	High	Extremely High
Construction Productivity Improvement (Full understanding of the workers project's and project management in improving productivity)	1	2	3	4	5
Construction Job Progress (Report footage to the general contrctors and owners)	1	2	3	4	5
Construction Site Security (Provides sharing of the information project team members)	1	2	3	4	5
Construction Inspection (Inspections in hard to reach places has proven invaluable for planning progress)	1	2	3	4	5
Construction Estimating Cost (Visual understanding of the estimating cost requirements for construction)	1	2	3	4	5

Attachment 3. Research Questionnaire

KUISIONER PENELITIAN

STUDI KASUS APLIKASI SISTEM PESAWAT TAK BERAWAK *(DRONE)* PADA PROYEK KONSTRUKSI

Manajer Pemasaran Teknik Autodesk. Inc., Anthony Governati (2012), menyatakan bahwa BIM bukan sekedar alat, melainkan sebuah proses yang mendukung metodologi konstruksi perancangan virtual. Arahkan semua pemangku kepentingan ke seluruh keseluruhan desain dalam proses konstruksi dan seterusnya untuk operasi dan pemeliharaan bangunan.

Di dunia abad kedua puluh satu ini, teknologi telah datang untuk memainkan peran yang terus meningkat dalam kehidupan sehari-hari orang-orang di seluruh dunia. Salah satu tujuan akhir dari teknologi baru adalah meningkatkan pengalaman pengguna dengan cara tertentu. Bila diterapkan pada industri komersial, dengan prinsip-prinsip ini, teknologi juga harus bekerja untuk membuat proses, tugas, atau proyek apa pun yang bekerja dengan lebih efisien. Salah satu contoh teknologi seperti ini saat ini membuat langkah dengan merampingkan proses komersial adalah kendaraan udara tak berawak (UASs), yang lebih sering disebut sebagai pesawat tak berawak atau *drone*.

Salah satu industri yang spesifik yang telah memanfaatkan berbagai manfaat drone adalah *sektor konstruksi*. Industri konstruksi merupakan salah satu industri komersial terbesar di dunia. Untungnya, pesawat tak berawak berpotensi mengurangi waktu dan biaya di beberapa area lokasi konstruksi, sebagaimana dibuktikan oleh *beberapa studi kasus yang mengevaluasinya*.

Drone memiliki potensi untuk meningkatkan efisiensi pada beragam pekerjaan di bidang konstruksi, termasuk *survei, pemetaan digital, dan analisis volumetrik*, seperti yang ditunjukkan dalam beberapa studi kasus terpisah di beberapa jurnal. Penggunaan pesawat tak berawak pada proyek-proyek ini memiliki keterbatasan, yang dapat membantu *mengurangi biaya, efisiensi produktivitas* pada inspeksi atau pemantauan dalam kasus (*live atau laporan*), dan pada akhirnya akan *menghasilkan tingkat pengembalian investasi yang lebih tinggi* untuk perusahaan konstruksi.

Penelitian kuesioner ini dilakukan sebagai persyaratan tugas akhir, responden berasal dari kontraktor atau konsultan yang terlibat dalam proyek konstruksi. Mengingat pentingnya penelitian ini, diharapkan bisa mengisi kuesioner ini dengan sungguh-sungguh. Terimakasih atas perhatiannya.

Attachment 3. Research Questionnaire

KUISIONER PENELITIAN

STUDI KASUS APLIKASI SISTEM PESAWAT TAK BERAWAK *(DRONE)* PADA PROYEK KONSTRUKSI

Kuesioner sekunder 2nd dibuat bertujuan untuk penyelesaian Tugas Akhir di Fakultas Teknik, Program Teknik Sipil Internasional Universitas Atma Jaya Yogyakarta. Kuesioner ini berisi pertanyaan tentang informasi proyek yang sedang ataupun telah dilakukan selama pekerjaan konstruksi.

A. Informasi Proyek Responden

1. Nama Proyek :
2. Alamat Proyek :
3. Luas Lahan :
4. Luas Bangunan :
5. Nilai Kontrak :
6. Jumlah Lantai :
7. Durasi Kerja Proyek :
8. Project Owner :
9. Konsultant Pengawas :
10. Konsultan Perencana :
11. Kontraktor :
12. Jenis Pengawasan (*) :

    ☐ Unmanned Aerial Systems (*UASs*) atau Pengawasan dengan Drone

    ☐ Konvensional (*Traditional*) Pengawasan

    ☐ Pengawasan dengan Drone dan Konvensional (*Traditional*)

13. Berapa jumlah gaji yang di berikan setiap bulan kepada pekerja *pengawasan drone* dari perusahaan anda ?

    a. Rp. < 3 juta
    b. Rp. 3 - 6 juta
    c. Rp. 7 – 10 juta
    d. Rp. >11 juta

14. Berapa jumlah gaji yang di berikan setiap bulan kepada pekerja *pengawasan konvensional* dari perusahaan anda ?

    a. Rp. < 3 juta
    b. Rp. 3 - 6 juta
    c. Rp. 7 – 10 juta
    d. Rp. >11 juta

***(*)** Jika dipilih lebih dari **satu pilihan**, pertanyaan no 13 dan 14 diisi*

Attachment 3. Research Questionnaire

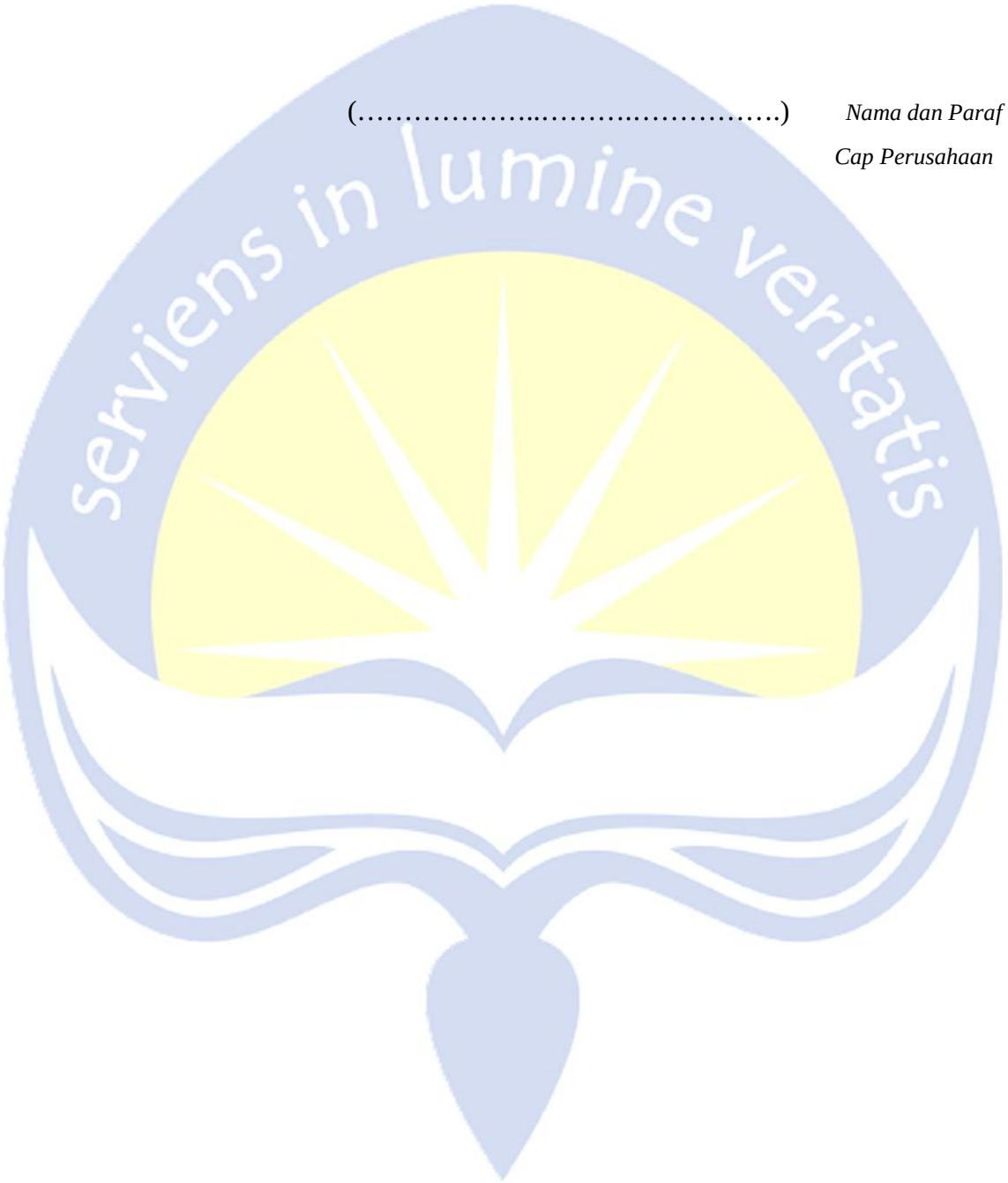
……, ……..2018

Data disediakan oleh

(Data provided by)

(……..…….……) *Nama dan Paraf*

Cap Perusahaan



Attachment 3. Research Questionnaire

KUISIONER PENELITIAN

STUDI KASUS APLIKASI SISTEM PESAWAT TAK BERAWAK *(DRONE)* PADA PROYEK KONSTRUKSI

Kuesioner primer 1st pertama dibuat untuk tujuan penyelesaian Tugas Akhir di Fakultas Teknik, Program Teknik Sipil Internasional Universitas Atma Jaya Yogyakarta. Kuesioner ini berisi pertanyaan tentang penggunaan pesawat tak berawak selama pekerjaan konstruksi.

A. INFORMASI RESPONDEN

Beri tanda **(**✓) atau (✕) didalam box **(☐)** yang sudah di berikan :

1. Nama Perusahaan :
2. Alamat Perusahaan :
3. Posisi :
   - ☐ Project Manager
   - ☐ Site Manager
   - ☐ Site Engineer
   - ☐ Quality Controller
   - ☐ Lainnya :……..
4. Tipe Responden :
   - ☐ Konsultant
   - ☐ Kontraktor
   - ☐ Lainnya :……..
5. Jenis Proyek (*) :
   - ☐ Bangunan tingkat tinggi
   - ☐ Bangunan tingkat rendah
   - ☐ Bangunan infrastruktur (jalan, jembatan, dll)
   - ☐ Bangunan industri
   - ☐ Lainnya , _____
6. Pendidikan Terakhir:
   - ☐ ≤ D3 *(Diploma)*
   - ☐ S1 *(Sarjana)*
   - ☐ ≥ S2 (*Master)*
7. Pengalaman Kerja :
   - ☐ ≤ 5 Tahun
   - ☐ 5 – 10 Tahun
   - ☐ 10 – 15 Tahun
   - ☐ > 15 Tahun

(*) Boleh dipilih lebih dari satu pilihan

Attachment 3. Research Questionnaire

PETUNJUK PENGISIAN

- Berdasarkan pengetahuan dan pengalaman anda, berilah tanda (✗) atau (✓) pada kotak yang sesuai dan atau tepat yang menggambarkan frekuensi/ seringnya terjadi dan tingkat/ besarnya pengaruh yang kontraktor hadapi, serta menggambarkan tipe respon/ tindakan yang dipilih kontraktor dalam intensitas penggunaan yang muncul selama pelaksanaan pekerjaan konstruksi.

  - Keterangan tingkat frekuensi setuju terhadap penggunaan Unmanned Aerial Systems (UASs) ataupun Konvensional Monitoring untuk proyek konstruksi.

Skala Frekuensi Setuju	
Sangat Tidak Setuju	**1**
Tidak Setuju	**2**
Netral	**3**
Setuju	**4**
Sangat Setuju	**5**

  - Keterangan tingkat dampak / pengaruh (*impact*) terhadap kontuinitas proyek konstruksi.

Skala Dampak / Pengaruh Penggunaan	
Tidak sama sekali	**1**
Kecil	**2**
Sedang	**3**
Tinggi	**4**
Sangat Tinggi	**5**

Attachment 3. Research Questionnaire

B. PENGGUNAAN SISTEM AERIAL UNMANNED (UASs) SAAT INI DAN MASA DEPAN

a. ***Pengetahuan dan pengalaman respondent terhadap UASs / Drone ?***

a. Saya tahu itu sangat baik dan saya memiliki pengalaman untuk menggunakannya.
b. Saya tahu itu cukup baik dan belum mempunyai pengalaman untuk menggunakannya.
c. Saya tertarik dengan hal itu dan sedang mempelajarinya.
d. Saya hanya mengetahu kalimat UASs *(drone)*
e. Saya tidak mengetahui sama sekali.

b. Respon perusahaan terhadap UAS *(drone)*

1. Apakah proyek Anda menggunakan pesawat tak berawak (drone)?

a. Iya b. Tidak

Jika respon adalah **"Tidak"**, silahkan langung ke ***halaman 13 sub E*.**

Jika respon adalah **"Iya"**, jenis merk drone apa yang anda gunakan? (*Responden mengisi sampai akhir halaman*)

☐ DJI P1, P2, P3,P4 ☐ Lainnya,……

☐ YUNEEC Q500, H520

☐ DJI INSPIRE

☐ SYMA

2. Berapa lama proyek Anda telah mengimplementasikan drone ke proyek konstruksi sebenarnya?

a. < 1 tahun c. 3 tahun
b. 2 tahun d. > 4 tahun

3. Dari pengalaman Anda, berapa banyak karyawan yang dibutuhkan untuk ***melaksanakan*** supervisor *pesawat tak berawak* dalam proyek konstruksi?

a. 1 staff c. 4 – 5 staff
b. 2 – 3 staff d. > 6 staff

4. Dari pengalaman Anda, berapa banyak karyawan ***tambahan*** yang dibutuhkan untuk menerapkan *supervisor konvensional* dalam proyek konstruksi?

a. 1 staff c. 4 – 5 staff
b. 2 – 3 staff d. > 6 staff

5. Dari pengalaman Anda, berapa jumlah ***total*** karyawan yang dibutuhkan untuk menerapkan *drone supervisor* dan *konvensional supervisor* dalam 1 proyek konstruksi?

a. 2 - 4 staff c. 8 – 10 staff
b. 5 – 7 staff d. > 11 staff

Attachment 3. Research Questionnaire

6. Jenis aplikasi apa yang ingin Anda gunakan untuk pesawat tak berawak, dalam hal proyek konstruksi yang sedang berjalan ***(*)*** ?

☐ Fotografi udara untuk memantau kemajuan pekerjaan proyek.

☐ Fotografi udara untuk pekerjaan logistik dan perencanaan produksi.

☐ Manajemen Produktivitas

☐ Inspeksi daerah ataupun titik yang sulit atau tidak mungkin untuk diakses.

☐ Pemantauan keamanan dan dukungan keselamatan kerja (K3)

☐ Survei tanah, thermal imaging, pemindai laser atau pengumpulan data lainnya.

☐ lain – lain, _____

(*) *Boleh dipilih lebih dari satu pilihan*

Berdasarkan pengalaman proyek konstruksi, penerapan UASs pada proyek konstruksi adalah :

a. Bermanfaat karena potensi keuntungan
b. Tidak menghasilkan manfaat apapun

7. Berapa kali melakukan pengawasan drone dalam 1 hari?

☐ 1 kali

☐ 2-3 kali

☐ 4-5 kali

☐ >6 kali :……

8. Berapa hari sekali melakukan pengawasan drone dalam 1 minggu? (Hari)

☐ 1 hari

☐ 2-3 hari

☐ 4-5 hari

☐ >6 hari :…….

9. Menurut pengalaman Anda, berapa banyak waktu yang Anda butuhkan untuk mengimplementasikan pesawat tak berawak saat berada di proyek konstruksi *(1 kali implementasi)*?

a. < 10 menit b. 15 – 20 menit c. 30 – 40 menit d. > 1 jam

10. Apakah perusahaan Anda akan menggunakan UAS (pesawat tak berawak) dalam proyek 5 tahun mendatang?

a. Iya b. Tidak

Attachment 3. Research Questionnaire

c. Potensi applikasi penggunaan UASs *(drone)*

1. Silahkan tunjukkan sejauh mana anda setuju kegunaan data visual di berbagai daerah dengan pengaplikasian pesawat tak berawak - hasil survei *(Setuju dan Tidak Setuju)*

Aplikasi yang Akan Anda Gunakan Untuk Drone?	Sangat Tidak Setuju	Tidak Setuju	Netral	Setuju	Sangat Setuju
Pemantauan udara untuk pemantauan kemajuan proyek	1	2	3	4	5
Pekerjaan Logistik dan Planning Produksi	1	2	3	4	5
Manajemen Produktivitas	1	2	3	4	5
Inspeksi daerah ataupun titik yang sulit atau tidak mungkin untuk diakses.	1	2	3	4	5
Pemantauan keamanan dan dukungan keselamatan kerja (K3) (Keamanan, Kesehatan dan Keselamatan Kerja)	1	2	3	4	5
Survey tanah, thermal imaging, pemindai laser atau pengumpulan data lainnya.	1	2	3	4	5
Hal / isu manajerial umum	1	2	3	4	5
Hal / isu teknis	1	2	3	4	5

2. Silahkan tunjukkan berapa lama penggunaan aplikasi UAS atau Drone – hasil survey berapa tahun penggunaan *(Tahun)*

Aplikasi yang telah Anda Gunakan Untuk Drone?	2016	2017	CHANGE
Pemantauan kemajuan proyek			
Pekerjaan Logistik			
Manajemen Produktivitas			
Inspeksi daerah ataupun titik yang sulit atau tidak mungkin untuk diakses.			
Pemantauan keamanan dan dukungan keselamatan kerja (K3) (Keamanan, Kesehatan dan Keselamatan Kerja)			
Survey tanah, thermal imaging, pemindai laser atau pengumpulan data lainnya.			
Hal / isu manajerial umum			
Hal / isu teknis			

d. Jenis tampilan untuk memeriksa data visual (Masalah teknis dengan memeriksa data visual)

1. Silahkan tunjukkan jenis representasi yang Anda perlu lihat saat melakukan pemantauan / inspeksi menggunakan pesawat tak berawak?

Jenis Tampilan	Tidak Sama Sekali	Kecil	Sedang	Tinggi	Sangat Tinggi
Melihat Lebih Dekat	1	2	3	4	5
Penglihatan atau Pandangan Internal	1	2	3	4	5
Elevasi Ketinggian	1	2	3	4	5
Sudut Spesifik Pengamatan	1	2	3	4	5
Kinerja Tugas Pekerjaan	1	2	3	4	5

e. Alokasi anggaran di masa depan

1. Silahkan tunjukkan Alokasi untuk penggunaan pesawat tak berawak UASs atau Drone :

Tipe Alokasi	Tidak Sama Sekali	Kecil	Sedang	Tinggi	Sangat Tinggi
Melakukan study implementasi UASs di perusahaan	1	2	3	4	5
Memiliki UASs dan Lisensi	1	2	3	4	5
Melakukan pelatihan UASs untuk staff	1	2	3	4	5
Menginventariskan UASs prosedur dan manual ke perusahaan	1	2	3	4	5
Bekerjasama dengan perusahaan lain mengenai prosedur efektif UASs	1	2	3	4	5

C. PENGALAMAN DARI PENGGUNAAN UNMANNED AERIAL SYSTEMS (UASs)

a. Tingkat signifikansi UASs - BIM dalam tahapan konstruksi

1. Tunjukkan pengalaman Anda, dalam drone – building information model dalam proyek konstruksi:

Tahap Konstruksi	Tidak Sama Sekali	Kecil	Sedang	Tinggi	Sangat Tinggi
Pengumpulan Data	1	2	3	4	5
Pengendalian Produksi	1	2	3	4	5
Penjadwalan Pengadaan	1	2	3	4	5
Tata Letak Lapangan dan Penanganan	1	2	3	4	5
Keamanan dan Motivasi	1	2	3	4	5

Attachment 3. Research Questionnaire

b. Tingkat dampak UAS (drone) terhadap pengawasan pelaksanaan pada kegiatan proyek konstruksi

1. Silahkan tunjukkan pengalaman Anda dalam penerapan pengawasan proyek konstruksi :

Pengalaman Responden	Tidak Sama Sekali	Kecil	Sedang	Tinggi	Sangat Tinggi
Mengganti dengan metode pengawasan tradisional	1	2	3	4	5
Mengurangi jumlah pekerja untuk supervisi	1	2	3	4	5
Mengurangi jumlah total biaya keseluruhan proyek	1	2	3	4	5
Laporan langsung *(live report)*	1	2	3	4	5
Keselamatan pada petugas lapangan kerja *(live report)*	1	2	3	4	5
Keselamatan masyarakat yang berdekatan *(live report)*	1	2	3	4	5
Tidak teraplikasi (karena sulit)	1	2	3	4	5
Tidak teraplikasi (karena mahal)	1	2	3	4	5
Tidak efisien di beberapa waktu dan tempat	1	2	3	4	5

c. Faktor pelaksanaan pengawasan UAS (drone) pada proyek konstruksi

1. Silahkan tunjukkan faktor implementasi UAS (drone) selama proyek konstruksi:

Faktor Penerapan UAS	Tidak Sama Sekali	Kecil	Sedang	Tinggi	Sangat Tinggi
Efisien dan efektif	1	2	3	4	5
Mengurangi biaya pekerja	1	2	3	4	5
Meningkatkan produktivitas	1	2	3	4	5
Mengurangi jam bekerja	1	2	3	4	5
Meningkatkan komunikasi (report)	1	2	3	4	5

Attachment 3. Research Questionnaire

D. MEMBANDINGKAN MANFAAT DAN HASIL YANG INGIN DI RAIH DARI METODE UASs / DRONE UNTUK MENDAPATKAN DATA VISUAL *(Monitoring Aerial Fotografi)*

a) Silahkan tunjukan komentar tentang *data, qualitas dan biaya* dalam penggunaan UASs :

Komentar	Tidak Sama Sekali	Kecil	Sedang	Tinggi	Sangat Tinggi
Survei tanah atau daerah yang akurat	1	2	3	4	5
Foto berkualitas lebih baik dan cepat berputar arah	1	2	3	4	5
Perspektif proyek yang beragam dan unik	1	2	3	4	5
Klien suka melihat proyek mereka dari data visual	1	2	3	4	5
Meningkatkan hubungan kepercayaan dengan owner	1	2	3	4	5
Menyediakan perspektif baru tentang kemajuan real time progress	1	2	3	4	5
Hemat biaya dan kemudahan	1	2	3	4	5
Gambar fantastis dari segi progress pemasaran	1	2	3	4	5
Jauh lebih cepat daripada menggunakan Konvensional Monitoring	1	2	3	4	5
Menyediakan rekaman real-time up to date dari status pekerjaan saat ini dengan klien jarak jauh	1	2	3	4	5
Mudah dioperasikan	1	2	3	4	5

b) Silahkan tunjukan komentar mengenai *aspek manajemen* menurut Anda dalam penggunaan UASs :

Komentar	Tidak Sama Sekali	Kecil	Sedang	Tinggi	Sangat Tinggi
Peningkatan Produktivitas Konstruksi (Pemahaman penuh tentang proyek pekerja dan manajemen proyek dalam meningkatkan produktivitas)	1	2	3	4	5
Pekerjaan Konstruksi Proyek (Laporkan rekaman kepada kontraktor umum dan pemilik)	1	2	3	4	5
Keamanan Situs Konstruksi (Menyediakan pembagian anggota tim proyek informasi)	1	2	3	4	5
Inspeksi Konstruksi (Inspeksi di tempat-tempat yang sulit dijangkau telah terbukti tak ternilai untuk perencanaan kemajuan)	1	2	3	4	5
Perkiraan Biaya Konstruksi (Pemahaman visual dari perkiraan kebutuhan biaya untuk konstruksi)	1	2	3	4	5

Attachment 3. Research Questionnaire

c) Silahkan tunjukan komentar mengenai *penggunaan* UASs menurut Anda :

Komentar	Tidak Sama Sekali	Kecil	Sedang	Tinggi	Sangat Tinggi
Fleksibilitas dan efisiensi penggunaan	1	2	3	4	5
Waktu operasi dan kecepatan	1	2	3	4	5
Kecocokan antara sistem dan dunia nyata (Penggunaan waypoint dan rute yang diprogram sebelumnya)	1	2	3	4	5
Kenali, diagnosa dan pencegahan kesalahan	1	2	3	4	5
Visibilitas status sistem	1	2	3	4	5

d) Silahkan tunjukan perspective asset video dan photo dalam monitoring proyek Anda? *(berikan tanda pada tabel)*

KEGUNAAN

Photo	**Video**
Progress Proyek	Progress Proyek
Progress Pekerjaan	Progress Pekerjaan
K3 (Keamanan, Kesehatan dan Keselamatan Kerja)	K3 (Keamanan, Kesehatan dan Keselamatan Kerja)
Pemantauan Pekerjaan Logistik	Pemantauan Pekerjaan Logistik
Kebutuhan Marketing	Kebutuhan Marketing
Pemantauan Material	Pemantauan Material
Inspeksi Umum (General)	Inspeksi Umum (General)

IDENTIFIKASI PROBLEM

Photo	**Video**
Problem K3 (Keamanan, Kesehatan dan Keselamatan Kerja)	Problem K3 (Keamanan, Kesehatan dan Keselamatan Kerja)
Isu Kualitas	Isu Kualitas
Organisasi Lapangan	Organisasi Lapangan
Rute Logistik	Rute Logistik
Isu Trafik	Isu Trafik
Perilaku Pekerja	Perilaku Pekerja
Problem Inventory	Problem Inventory
Problem Material	Problem Material

Attachment 3. Research Questionnaire

E. TANGGAPAN PERUSAHAAN TERHADAP PEMANTAUAN TRADISIONAL *(KONVENSIONAL)* MONITORING

1. Berapa banyak karyawan yang anda butuhkan untuk melakukan *pemantauan / inspeksi* dalam 1 kali implementasi dalam proyek konstruksi?

   a. 1 staff
   b. 2 – 3 staff
   c. 4 – 5 staff
   d. > 6 staff,_____

2. Berapa *jumlah total* karyawan yang dibutuhkan untuk melaksanakan pengawasan konvensional dalam proyek konstruksi Anda?

   a. 2 - 3 staff
   b. 4 – 6 staff
   c. 7 – 9 staff
   d. > 10 staff,_____

3. Jenis aplikasi apa yang anda gunakan untuk pengawasan proyek konstruksi ***(*)*** ?

   ☐ Fotografi berbasis lapangan untuk memantau kemajuan pekerjaan proyek
   ☐ Pengawasan darat berbasis logistik dan perencanaan produksi
   ☐ Management produktifitas
   ☐ Inspeksi daerah ataupun titik yang sulit atau tidak mungkin untuk diakses
   ☐ Pemantauan keamanan dan dukungan keselamatan kerja (K3)
   ☐ Survei tanah, thermal imaging, pemindai laser atau pengumpulan data lainnya.
   ☐ Lainnya,_____

   (*) *Boleh dipilih lebih dari satu pilihan (Select more than one option)*

4. Berapa kali melakukan pengawasan dalam 1 hari?

   ☐ 1 kali
   ☐ 2-3 kali
   ☐ 4-5 kali
   ☐ >6 kali :……

5. Berapa kali melakukan pengawasan dalam 1 minggu?

   ☐ 1 hari
   ☐ 2-3 hari
   ☐ 4-5 hari
   ☐ >6 hari :…….

6. Menurut pengalaman Anda, berapa banyak waktu yang Anda butuhkan untuk melaksanakan inspeksi saat memantau proyek konstruksi *(1 kali implementasi)*?

   b. < 10 menit b. 15 – 20 menit c. 30 – 40 menit d. > 1 jam

Attachment 3. Research Questionnaire

7. Apakah menurut Anda, perusahaan Anda akan menggunakan UASs (pesawat tak berawak) / Drone untuk proyek selanjutnya?

   a. Iya b. Tidak

8. Pertanyaan berikut meminta Anda menunjukkan masalah yang saat ini menghalangi penggunaan UASs (drone) ?

Tipe Tampilan	Sangat Tidak Setuju	Tidak Setuju	Netral	Setuju	Sangat Setuju
Status legal untuk beroperasi	1	2	3	4	5
Kemampuan untuk mengoperasikan	1	2	3	4	5
Privasi	1	2	3	4	5
Keamanan Personil	1	2	3	4	5
Biaya untuk membeli dan mengoperasikan	1	2	3	4	5

9. Tolong beri rating terhadap kegunaan pemantauan / inspeksi konvensional berdasarkan pengalaman Anda:

Kegunaan pemantauan / pemeriksaan konvensional	Sangat Tidak Setuju	Kurang Setuju	Netral	Setuju	Sangat Setuju
Pemantauan kemajuan proyek	1	2	3	4	5
Pekerjaan Logistik	1	2	3	4	5
Manajemen Produktivitas	1	2	3	4	5
Inspeksi Kualitas	1	2	3	4	5
K3 (Keamanan, Kesehatan dan Keselamatan Kerja)	1	2	3	4	5
Hal / isu manajerial umum	1	2	3	4	5
Hal / isu teknis	1	2	3	4	5

10. Pertanyaan berikut meminta Anda menilai UASs / Drone untuk efektifitasnya di berbagai pekerjaan. Jika Anda belum pernah menggunakan pesawat tak berawak sebelumnya, tolong jawab pertanyaan berdasarkan persepsi Anda tentang survei drone:

Persepsi efektifitas monitoring / inspeksi	Tidak Sama Sekali	Kecil	Sedang	Tinggi	Sangat Tinggi
Pemantauan / inspeksi dalam hal *nilai biaya* mereka?	1	2	3	4	5
Pemantauan / inspeksi dalam hal *keamanan* mereka?	1	2	3	4	5

Attachment 3. Research Questionnaire

Persepsi efektifitas monitoring / inspeksi	Tidak Sama Sekali	Kecil	Sedang	Tinggi	Sangat Tinggi
Pemantauan / inspeksi dalam hal *akurasi*?	1	2	3	4	5
Pemantauan / inspeksi dalam hal *kecepatan* mereka?	1	2	3	4	5
Pemantauan / inspeksi dalam hal *kualitas data* mereka?	1	2	3	4	5

F. MEMBANDINGKAN MANFAAT DAN HASIL YANG INGIN DI RAIH DARI METODE KONVENSIONAL TERHADAP UASs (Drone) UNTUK MENDAPATKAN DATA VISUAL *(Pemantauan fotografi berbasis lapangan)*

a) Silahkan tunjukan komentar tentang *data, kualitas dan biaya* menurut Anda dalam penggunaan konvensional monitoring menurut Anda? *(Terhadap Drone)*

Komentar	Tidak Sama Sekali	Kecil	Sedang	Tinggi	Sangat Tinggi
Survei tanah atau daerah yang akurat	1	2	3	4	5
Foto berkualitas lebih baik dan lebih cepat	1	2	3	4	5
Perspektif proyek yang beragam dan unik	1	2	3	4	5
Klien suka melihat proyek mereka dari data visual	1	2	3	4	5
Meningkatkan hubungan kepercayaan dengan owner	1	2	3	4	5
Menyediakan perspektif baru tentang kemajuan real time progress	1	2	3	4	5
Hemat biaya dan kemudahan	1	2	3	4	5
Gambar fantastis dari segi progress pemasaran	1	2	3	4	5
Jauh lebih cepat daripada menggunakan UASs (drone) monitoring	1	2	3	4	5
Menyediakan rekaman real-time up to date dari status pekerjaan saat ini dengan klien jarak jauh	1	2	3	4	5
Mudah dioperasikan	1	2	3	4	5

Attachment 3. Research Questionnaire

b) Silahkan tunjukan komentar seberapa penting *aspek manajemen* menurut Anda dalam penggunaan konvensional monitoring menurut Anda? *(Terhadap Drone)*

Komentar	Tidak Sama Sekali	Kecil	Sedang	Tinggi	Sangat Tinggi
Peningkatan Produktivitas Konstruksi (Pemahaman penuh tentang proyek pekerja dan manajemen proyek dalam meningkatkan produktivitas)	1	2	3	4	5
Pekerjaan Konstruksi Proyek (Laporkan rekaman kepada kontraktor umum dan pemilik)	1	2	3	4	5
Keamanan Situs Konstruksi (Menyediakan pembagian anggota tim proyek informasi)	1	2	3	4	5
Inspeksi Konstruksi (Inspeksi di tempat-tempat yang sulit dijangkau telah terbukti tak ternilai untuk perencanaan kemajuan)	1	2	3	4	5
Perkiraan Biaya Konstruksi (Pemahaman visual dari perkiraan kebutuhan biaya untuk konstruksi)	1	2	3	4	5

c) Silahkan tunjukan komentar mengenai kinerja penggunaan konvensional monitoring menurut Anda? *(Terhadap Drone)*

Komentar	Tidak Sama Sekali	Kecil	Sedang	Tinggi	Sangat Tinggi
Fleksibilitas dan efisiensi penggunaan	1	2	3	4	5
Waktu operasi dan kecepatan	1	2	3	4	5
Kecocokan antara sistem dan dunia nyata (Penggunaan waypoint dan rute yang diprogram sebelumnya)	1	2	3	4	5
Kenali, diagnosa dan pencegahan kesalahan	1	2	3	4	5
Visibilitas status sistem	1	2	3	4	5

d)* Silahkan tunjukan perspective asset video dan photo dalam penggunaan konvensional monitoring menurut Anda? *(Terhadap Drone)

KEGUNAAN

Photo	**Video**
Progress Proyek	Progress Proyek
Progress Pekerjaan	Progress Pekerjaan
K3 (Keamanan, Kesehatan dan Keselamatan Kerja)	K3 (Keamanan, Kesehatan dan Keselamatan Kerja)
Pemantauan Pekerjaan Logistik	Pemantauan Pekerjaan Logistik
Kebutuhan Marketing	Kebutuhan Marketing
Pemantauan Material	Pemantauan Material
Inspeksi Umum (General)	Inspeksi Umum (General)

Attachment 3. Research Questionnaire

PROBLEM IDENTIFIKASI

Photo	**Video**
Problem K3 (Keamanan, Kesehatan dan Keselamatan Kerja)	Problem K3 (Keamanan, Kesehatan dan Keselamatan Kerja)
Isu Kualitas	Isu Kualitas
Organisasi Lapangan	Organisasi Lapangan
Rute Logistik	Rute Logistik
Isu Trafik	Isu Trafik
Perilaku Pekerja	Perilaku Pekerja
Problem Inventory	Problem Inventory
Problem Material	Problem Material

RESPONDENT PROFILE

No	Company Name	Company Address	Position	Respondent Type	Supervisory Type	Type Of Project	Latest Education	Working Experience
1	PT. Tata Bumi Raya	Jl. Pandegiling No.223, DR. Soetomo, Tegalsari, Kota SBY, Jawa Timur 60264	Site Engineer	Contractor	Drone & Conventional	High Rise Building	Bachelor	10 - 15 Years
2	PT. Artha Beth Jaya Abadi	Jl. Kaliurang No.168, Caturtunggal, Kec. Depok, Kabupaten Sleman, Daerah Istimewa Yogyakarta 55281	Project Manager	Consultant	Conventional	High Rise Building	Bachelor	> 15 Years
3	PT. Wika Realty	Tamansari Hive Office, Lantai 12 . Jl. D.I Panjaitan Kav. 2, Cawang Jakarta Timur, 13340	Site Engineer	Contractor	Conventional	High Rise Building	Bachelor	5 - 10 Years
4	PT. Adhi Karya (Persero) Tbk	Jl. Raya Pasar Minggu Km 18, Jakarta Selatan	Other	Contractor	Drone & Conventional	High Rise Building	Bachelor	5 - 10 Years

No	Company Name	Company Address	Position	Respondent Type	Supervisory Type	Type Of Project	Latest Education	Working Experience
5	PT. Bumi Agung Semesta	Boulevard Gajah Mada No. 2017. Tangerang	Site Engineer	Contractor	Conventional	High Rise Building	Bachelor	< 5 Years
6	PT. Yasa Patria Perkasa	Gedung Granadi, Lt3, Jalan. KR Rasunasaid, Kau. 8-9, Block X-I Kuningan Timur, Jakarta Selatan	Site Manager	Contractor	Conventional	High Rise Building	Bachelor	5 - 10 Years
7	PT. PP (Persero) Tbk	Jl. Letjend. TB. Simatupang No. 57. Pasar Rebo, Jakarta	Site Engineer	Contractor	Drone & Conventional	Medium Building	Bachelor	< 5 Years
8	PT. Wijaya Karya Bangunan Gedung Tbk	Jl. D.I. Panjaitan Kav.9, Jakarta 13340	Site Engineer	Contractor	Drone & Conventional	Medium Building	Bachelor	< 5 Years
9	PT. Warna Bhuana Indonesia	Solo	Other	Contractor	Drone & Conventional	High Rise Building	Diploma	> 15 Years
10	PT. MultiBangun Adhitama Konstruksi (MULTIKON)	Graha Multi Building Lt. 3, Jalan Panjang Raya No.55, Kebon Jeruk, Jakarta Barat	Other	Contractor	Conventional	Medium Building	Bachelor	> 15 Years

PROJECT PROFILE

No	Project Name	Project Address	Land Area	Building Area	Duration (Days)	Number Of Floor
1	Proyek Malioboro Park View	Jl. Laksada Adisucipto km 7,5 Yogyakarta	6,048 m²	34,560 m²	450	12
2	Proyek Jogja Apartment	Jl. Lowanu No.69, Sorosutan, Umbulharjo , Yogyakarta.	4,689.68 m²	36,453.89 m²	730	14
3	Proyek Taman Sari Amarta	Jl. Palagan km 7,5 Yogyakarta	4,256 m²	25,000 m²	360	16
4	Proyek Apartment Taman Melati Yogyakarta	Jl. Inspeksi Selokan Mataram, Sinduadi, Sleman - Yogyakarta	-	37,000 m²	711	15 + 2 Basement
5	Proyek Green Park Jogja Apartment & Resort	Jl. Baladewa - Babarsari, Gledongan, Tambak bayan, Depok, Sleman, DIY	8,161 m²	26,000 m²	1095	10
6	Proyek Apartment Hadiningrat Terrace	Jl. Dr. Sardjito, no. 7B, Terban, DIY	3,226 m²	21,000 m²	365	11

No	Project Name	Project Address	Land Area	Building Area	Duration (Days)	Number Of Floor
7	Proyek Transmart Graha Bintaro	Jalan. Graha Raya Boulevard, Paku Jaya, Serpong Utara, Kota Tangerang Selatan, Banten	12,000 m²	8,000 m²	365	3 + 2 Basement
8	Proyek Transmart Bogor	Jl. KH. Abdullah bin Nuh kelurahan Cibadak Kecamatan Tanah Sareal Bogor	12,000 m²	37,500 m²	365	6 + 1 Mezzanine
9	Proyek The Bengawan Solo Hotel & Apartment	Jl. Ir Sutami No. 109, Jebres - Solo	10,200 m²	43,148 m²	1095	21 + 1 Basement
10	Proyek Gedung Instalasi Rawat Jalan Terpadu RS Panti Rapih Yogyakarta	Jalan Cik Di Tiro No.30, Caturtunggal, Kecamatan Depok, Terban, Gondok, DIY	-	25,000 m²	510	9

PROJECT PROFILE

No	Company Name	Position	Required UASs Staff	Required Conventional Staff	Total Staff	Type Of UASs	Supervisory in 1 Day	Supervisory in 1 Week	Time Supervisory	Implemented UASs	UASs next 5 years
1	PT. Tata Bumi Raya	Site Engineer	1	2- 3	2 - 4	DJI	1	4 - 5	15 - 20 minutes	< 1 Year	YES
2	PT. Artha Beth Jaya Abadi	Project Manager		4 - 5	8 - 10		2 - 3	4 - 5	30 - 40 minutes		YES
3	PT. Wika Realty	Site Engineer		4 - 5	5- 7		2 - 3	4 - 5	30 - 40 minutes		YES
4	PT. Adhi Karya (Persero) Tbk	Other	1	2- 3	2 - 4	DJI	2 - 3	2 - 3	15 - 20 minutes	2 Year	YES
5	PT. Bumi Agung Semesta	Site Engineer		4 - 5	5 - 7		2 - 3	4 - 5	30 - 40 minutes		NO
6	PT. Yasa Patria Perkasa	Site Manager		4 - 5	5 - 7		2 - 3	4 - 5	> 1 hour		NO

No	Company Name	Position	Required UASs Staff	Required Conventional Staff	Total Staff	Type Of UASs	Supervisory in 1 Day	Supervisory in 1 Week	Time Supervisory	Implemented UASs	UASs next 5 years
7	PT. PP (Persero) Tbk	Site Engineer	1	2- 3	2 - 4	DJI	1	2 - 3	15 - 20 minutes	2 Year	YES
8	PT. Wijaya Karya Bangunan Gedung Tbk	Site Engineer	1	4 - 5	5 - 7	DJI	1	2 - 3	30 - 40 minutes	2 Year	YES
9	PT. Warna Bhuana Indonesia	Other	1	4 - 5	5 - 7	DJI	2 - 3	4 - 5	30 - 40 minutes	3 Year	YES
10	PT. MultiBangun Adhitama Konstruksi (MULTIKON)	Other		4 - 5	5- 7		4 - 5	> 6	> 1 hour		YES

PROJECT PROFILE

No	Project Name	Project Address	Contract Value	Supervisor UASs Wage / Month	Supervisor Conventional Wage/ Month
1	Proyek Malioboro Park View	Jl. Laksada Adisucipto km 7,5 Yogyakarta	Rp172.288.210.000	3 - 6 Million	3 - 6 Million
2	Proyek Jogja Apartment	Jl. Lowanu No.69, Sorosutan, Umbulharjo , Yogyakarta.	Rp161.686.329.412		3 - 6 Million
3	Proyek Taman Sari Amarta	Jl. Palagan km 7,5 Yogyakarta	Rp165.000.000.000		3 - 6 Million
4	Proyek Apartment Taman Melati Yogyakarta	Jl. Inspeksi Selokan Mataram, Sinduadi, Sleman - Yogyakarta	Rp196.333.400.000	3 - 6 Million	3 - 6 Million
5	Proyek Green Park Jogja Apartment & Resort	Jl. Baladewa - Babarsari, Gledongan, Tambak bayan, Depok, Sleman, DIY	Rp115.490.235.294		3 - 6 Million

No	Project Name	Project Address	Contract Value	Supervisor UASs Wage / Month	Supervisor Conventional Wage/ Month
6	Proyek Apartment Hadiningrat Terrace	Jl. Dr. Sardjito, no. 7B, Terban, DIY	Rp140.000.000.000		3 - 6 Million
7	Proyek Transmart Graha Bintaro	Jalan. Graha Raya Boulevard, Paku Jaya, Serpong Utara, Kota Tangerang Selatan, Banten	Rp251.462.371.000	3 - 6 Million	3 - 6 Million
8	Proyek Transmart Bogor	Jl. KH. Abdullah bin Nuh kelurahan Cibadak Kecamatan Tanah Sareal Bogor	Rp160.000.000.000	3 - 6 Million	3 - 6 Million
9	Proyek The Bengawan Solo Hotel & Apartment	Jl. Ir Sutami No. 109, Jebres - Solo	Rp250.000.000.000	3 - 6 Million	3 - 6 Million
10	Proyek Gedung Baru RS Panti Rapih Yogyakarta	Jalan Cik Di Tiro No.30, Caturtunggal, Kecamatan Depok, Terban, Gondok, DIY	Rp129.700.000.000		3 - 6 Million

UASs WORKER WAGE (1 STAFF)

No	Project Name	RKS (Days)	Total Cost Supervisory (UASs) Percent Min	Total Cost Supervisory (UASs) Percent Max	Total Cost Supervisory (UASs) Percent Mean
1	Proyek Malioboro Park View	450	Rp45.000.000	Rp90.000.000	Rp67.500.000
2	Proyek Jogja Apartment	730			
3	Proyek Taman Sari Amarta	360			
4	Proyek Apartment Taman Melati Yogyakarta	711	Rp71.100.000	Rp142.200.000	Rp106.650.000
5	Proyek Green Park Jogja Apartment & Resort	1095			

No	Project Name	RKS (Days)	Total Cost Supervisory (UASs) Percent Min	Total Cost Supervisory (UASs) Percent Max	Total Cost Supervisory (UASs) Percent Mean
6	Proyek Apartment Hadiningrat Terrace	365			
7	Proyek Transmart Graha Bintaro	365	Rp36.500.000	Rp73.000.000	Rp54.750.000
8	Proyek Transmart Bogor	365	Rp36.500.000	Rp73.000.000	Rp54.750.000
9	Proyek The Bengawan Solo Hotel & Apartment	1095	Rp109.500.000	Rp219.000.000	Rp164.250.000
10	Proyek Gedung Baru RS Panti Rapih Yogyakarta	510			

CONVENTIONAL WORKER WAGE (1 STAFF)

No	Project Name	RKS (Days)	Total Cost Supervisory (Conventional) Percent Min	Total Cost Supervisory (Conventional) Percent Max	Total Cost Supervisory (Conventional) Percent Mean
1	Proyek Malioboro Park View	450	Rp45.000.000	Rp90.000.000	Rp67.500.000
2	Proyek Jogja Apartment	730	Rp73.000.000	Rp146.000.000	Rp109.500.000
3	Proyek Taman Sari Amarta	360	Rp36.000.000	Rp72.000.000	Rp54.000.000
4	Proyek Apartment Taman Melati Yogyakarta	711	Rp71.100.000	Rp142.200.000	Rp106.650.000
5	Proyek Green Park Jogja Apartment & Resort	1095	Rp109.500.000	Rp219.000.000	Rp164.250.000

No	Project Name	RKS (Days)	Total Cost Supervisory (Conventional) Percent Min	Total Cost Supervisory (Conventional) Percent Max	Total Cost Supervisory (Conventional) Percent Mean
6	Proyek Apartment Hadiningrat Terrace	365	Rp36.500.000	Rp73.000.000	Rp54.750.000
7	Proyek Transmart Graha Bintaro	365	Rp36.500.000	Rp73.000.000	Rp54.750.000
8	Proyek Transmart Bogor	365	Rp36.500.000	Rp73.000.000	Rp54.750.000
9	Proyek The Bengawan Solo Hotel & Apartment	1095	Rp109.500.000	Rp219.000.000	Rp164.250.000
10	Proyek Gedung Baru RS Panti Rapih Yogyakarta	510	Rp51.000.000	Rp102.000.000	Rp76.500.000

UASs WORKER WAGE (1 STAFF)

No	Project Name	RKS (Days)	Total Cost Supervisory (UASs) Percent Min	Total Cost Supervisory (UASs) Percent Max	Total Cost Supervisory (UASs) Percent Mean
1	Proyek Malioboro Park View	450	0,026%	0,052%	0 ,040%
2	Proyek Jogja Apartment	730			
3	Proyek Taman Sari Amarta	360			
4	Proyek Apartment Taman Melati Yogyakarta	711	0,036%	0,072%	0 ,054%
5	Proyek Green Park Jogja Apartment & Resort	1095			

No	Project Name	RKS (Days)	Total Cost Supervisory (UASs) Percent Min	Total Cost Supervisory (UASs) Percent Max	Total Cost Supervisory (UASs) Percent Mean
0	Proyek Apartment Hadiningrat Terrace	365			
7	Proyek Transmart Graha Bintaro	365	0,015%	0,029%	0 ,022%
8	Proyek Transmart Bogor	365	0,023%	0,046%	0 ,034%
9	Proyek The Bengawan Solo Hotel & Apartment	1095	0,044%	0,088%	0 ,066%
10	Proyek Gedung Baru RS Panti Rapih Yogyakarta	510			

CONVENTIONAL WORKER WAGE (1 STAFF)

No	Project Name	RKS (Days)	Total Cost Supervisory (Conventional) Percent Min	Total Cost Supervisory (Conventional) Percent Max	Total Cost Supervisory (Conventional) Percent Mean
1	Proyek Malioboro Park View	450	0,026%	0,052%	0 ,039%
2	Proyek Jogja Apartment	730	0,045%	0,090%	0 ,068%
3	Proyek Taman Sari Amarta	360	0,022%	0,044%	0 ,033%
4	Proyek Apartment Taman Melati Yogyakarta	711	0,036%	0,072%	0 ,054%
5	Proyek Green Park Jogja Apartment & Resort	1095	0,095%	0,190%	0 ,142%

No	Project Name	RKS (Days)	Total Cost Supervisory (Conventional) Percent Min	Total Cost Supervisory (Conventional) Percent Max	Total Cost Supervisory (Conventional) Percent Mean
6	Proyek Apartment Hadiningrat Terrace	365	0,026%	0,052%	0 ,039%
7	Proyek Transmart Graha Bintaro	365	0,015%	0,029%	0 ,022%
8	Proyek Transmart Bogor	365	0,023%	0,046%	0 ,034%
9	Proyek The Bengawan Solo Hotel & Apartment	1095	0,044%	0,088%	0 ,066%
10	Proyek Gedung Baru RS Panti Rapih Yogyakarta	510	0,039%	0,079%	0 ,059%

TOTAL AMOUNT SUPERVISOR

No	Project Name	Contract Value	Total Supervisor UASs	Total Supervisor Conventional	Total Supervisor
1	Proyek Malioboro Park View	Rp172.288.210.000	1	3	6
2	Proyek Jogja Apartment	Rp161.686.329.412		5	9
3	Proyek Taman Sari Amarta	Rp165.000.000.000		5	6
4	Proyek Apartment Taman Melati Yogyakarta	Rp196.333.400.000	1	3	4
5	Proyek Green Park Jogja Apartment & Resort	Rp115.490.235.294		5	6

No	Project Name	Contract Value	Total Supervisor UASs	Total Supervisor Conventional	Total Supervisor
6	Proyek Apartment Hadiningrat Terrace	Rp140.000.000.000		5	6
7	Proyek Transmart Graha Bintaro	Rp251.462.371.000	1	3	4
8	Proyek Transmart Bogor	Rp160.000.000.000	1	5	6
9	Proyek The Bengawan Solo Hotel & Apartment	Rp250.000.000.000	1	5	6
10	Proyek Gedung Baru RS Panti Rapih Yogyakarta	Rp129.700.000.000		5	6

UASs & CONVENTIONAL WORKER WAGE (ALL STAFF)

No	Project Name	RKS (Days)	Total Mean Cost Supervisory (UASs)	Total Mean Cost Supervisory (Conventional)	Total Mean Cost Supervisory
1	Proyek Malioboro Park View	450	Rp67.500.000	Rp67.500.000	Rp270.000.000
2	Proyek Jogja Apartment	730		Rp109.500.000	Rp985.500.000
3	Proyek Taman Sari Amarta	360		Rp54.000.000	Rp324.000.000
4	Proyek Apartment Taman Melati Yogyakarta	711	Rp106.650.000	Rp106.650.000	Rp426.600.000
5	Proyek Green Park Jogja Apartment & Resort	1095		Rp164.250.000	Rp985.500.000

No	Project Name	RKS (Days)	Total Mean Cost Supervisory (UASs)	Total Mean Cost Supervisory (Conventional)	Total Mean Cost Supervisory
6	Proyek Apartment Hadiningrat Terrace	365		Rp54.750.000	Rp328.500.000
7	Proyek Transmart Graha Bintaro	365	Rp54.750.000	Rp54.750.000	Rp219.000.000
8	Proyek Transmart Bogor	365	Rp54.750.000	Rp54.750.000	Rp328.500.000
9	Proyek The Bengawan Solo Hotel & Apartment	1095	Rp164.250.000	Rp164.250.000	Rp985.500.000
10	Proyek Gedung Baru RS Panti Rapih Yogyakarta	510		Rp76.500.000	Rp459.000.000

UASs & CONVENTIONAL WORKER WAGE (ALL STAFF)

No	Project Name	RKS (Days)	Total Percent Mean Cost Supervisory (UASs)	Total Percent Mean Cost Supervisory (Conventional)	Total Percent Mean Cost Supervisory
1	Proyek Malioboro Park View	450	0,039%	0,118%	0 ,157%
2	Proyek Jogja Apartment	730		0,339%	0 ,610%
3	Proyek Taman Sari Amarta	360		0,164%	0 ,196%
4	Proyek Apartment Taman Melati Yogyakarta	711	0,054%	0,163%	0 ,217%
5	Proyek Green Park Jogja Apartment & Resort	1095		0,711%	0 ,853%

No	Project Name	RKS (Days)	Total Percent Mean Cost Supervisory (UASs)	Total Percent Mean Cost Supervisory (Conventional)	Total Percent Mean Cost Supervisory
6	Proyek Apartment Hadiningrat Terrace	365		0,196%	0,235%
7	Proyek Transmart Graha Bintaro	365	0,022%	0,065%	0,087%
8	Proyek Transmart Bogor	365	0,034%	0,171%	0,205%
9	Proyek The Bengawan Solo Hotel & Apartment	1095	0,066%	0,329%	0,394%
10	Proyek Gedung Baru RS Panti Rapih Yogyakarta	510		0,295%	0,354%

SUMMARY RESPONDENT'S ANSWER UASs

QUESTION		RESPONDENT 1	2	3	4	5	6	7	8	9	10	TOTAL SCORE	RESP	MEAN Var.	MEAN Group.	SD	SD TOTAL	RANK Group.
Supervisory Application Use On-Going Construction	1	1			1			1	1	1		5	5	1,00	0,57	-		1
	2	1						1		1		3	5	0,60		-		4
	3	1			1			1		1		4	5	0,80		-		3
	4	1			1					1		3	5	0,60		-		4
	5	1			1			1	1	1		5	5	1,00		-		1
	6											-	5	-		-		-
	7											-	5	-		-		-
Usefulness of Visual Assets in Various Areas (UASs)	1	5			5			4	4	5		23	5	4,60	3,80	0,5477	0,6414	2
	2	3			4			4	4	3		18	5	3,60		0,5477		5
	3	3			4			4	1	3		15	5	3,00		1,2247		8
	4	4			5			3	4	4		20	5	4,00		0,7071		3
	5	5			5			5	5	4		24	5	4,80		0,4472		1
	6	1			4			4	4	3		16	5	3,20		1,3038		7
	7	4			5			4	2	4		19	5	3,80		1,0954		4
	8	4			4			4	1	4		17	5	3,40		1,3416		6
Type of View Inspecting The Visual Data (UASs)	1	5			5			4	4	5		23	5	4,60	4,32	0,5477	0,4147	2
	2	3			5			4	4	3		19	5	3,80		0,8367		5
	3	4			5			5	4	4		22	5	4,40		0,5477		3
	4	5			5			5	4	5		24	5	4,80		0,4472		1
	5	3			5			4	4	4		20	5	4,00		0,7071		4
UASs Budget Allocation in The Future	1	3			3			4	3	3		16	5	3,20	3,00	0,4472	0,3162	2
	2	3			3			4	3	2		15	5	3,00		0,7071		3
	3	3			3			5	2	4		17	5	3,40		1,1402		1
	4	2			3			4	3	2		14	5	2,80		0,8367		4
	5	3			3			3	2	2		13	5	2,60		0,5477		5

Level of UASs Significance in The Construction Stages	**1**	5			4			3	4	4		20	5	4,00	3,24	0,7071	0,7925	1
	2	3			3			2	2	3		13	5	2,60		0,5477		4
	3	4			4			4	3	3		18	5	3,60		0,5477		3
	4	4			4			5	2	4		19	5	3,80		1,0954		2
	5	2			3			1	2	3		11	5	2,20		0,8367		5
UASs Impact due to Implementation Supervision on The Construction Project Activities	**1**	3			2			3	2	3		13	5	2,60	2,67	0,5477	0,9381	4
	2	4			1			3	1	2		11	5	2,20		1,3038		6
	3	3			2			1	1	1		8	5	1,60		0,8944		9
	4	5			3			5	4	5		22	5	4,40		0,8944		1
	5	4			3			5	2	4		18	5	3,60		1,1402		2
	6	4			3			5	2	3		17	5	3,40		1,1402		3
	7	3			3			1	3	2		12	5	2,40		0,8944		5
	8	2			3			1	3	1		10	5	2,00		1,0000		7
	9	2			2			1	2	2		9	5	1,80		0,4472		8
Factors Implementation of UASs (drone)	**1**	4			3			5	4	3		19	5	3,80	2,96	0,8367	0,6693	1
	2	2			3			3	1	2		11	5	2,20		0,8367		5
	3	5			3			3	1	3		15	5	3,00		1,4142		3
	4	5			3			1	1	2		12	5	2,40		1,6733		4
	5	4			4			3	3	3		17	5	3,40		0,5477		2
Data, Quality and Cost	**1**	2			3			2	2	2		11	5	2,20	3,33	0,4472	0,7498	11
	2	3			4			4	4	3		18	5	3,60		0,5477		5
	3	4			4			5	4	4		21	5	4,20		0,4472		2
	4	4			4			5	4	3		20	5	4,00		0,7071		3
	5	3			3			3	2	3		14	5	2,80		0,4472		8
	6	4			4			5	4	5		22	5	4,40		0,5477		1
	7	3			4			3	3	4		17	5	3,40		0,5477		6
	8	3			3			4	3	3		16	5	3,20		0,4472		7
	9	2			3			3	3	2		13	5	2,60		0,5477		9
	10	3			4			5	4	3		19	5	3,80		0,8367		4
	11	2			3			2	3	2		12	5	2,40		0,5477		10

Management Aspects	**1**	3			4			5	3	2		17	5	3,40	3,64	1,1402	0,3847	4
	2	3			4			4	4	3		18	5	3,60		0,5477		3
	3	4			4			4	3	4		19	5	3,80		0,4472		2
	4	5			4			5	4	3		21	5	4,20		0,8367		1
	5	3			3			5	3	2		16	5	3,20		1,0954		5
Usage Performance	**1**	4			4			4	3	3		18	5	3,60	3,36	0,5477	0,3847	2
	2	4			3			3	3	4		17	5	3,40		0,5477		3
	3	5			4			3	3	4		19	5	3,80		0,8367		1
	4	3			4			3	3	3		16	5	3,20		0,4472		4
	5	2			3			3	3	3		14	5	2,80		0,4472		5

SUMMARY RESPONDENT'S ANSWER CONVENTIONAL

QUESTION		RESPONDENT 1	2	3	4	5	6	7	8	9	10	TOTAL SCORE	RESP	MEAN Var.	MEAN Group.	SD	SD TOTAL	RANK Group.
Supervisory Application Use On-Going Construction	1		1			1	1				1	4	5	0,80		-		1
	2		1			1						2	5	0,40		-		3
	3			1		1						2	5	0,40		-		3
	4			1		1					1	3	5	0,60	0,37	-		2
	5			1		1						2	5	0,40		-		3
	6											-	5	-		-		-
	7											-	5	-		-		-
Areas of Concern Currently Preculding UASs Usage	1		3	5		3	4				5	20	5	4,00		1,0000		3
	2		4	4		4	4				5	21	5	4,20		0,4472		2
	3		4	5		3	2				5	19	5	3,80	4,00	1,3038	0,3162	4
	4		3	4		4	4				3	18	5	3,60		0,5477		5
	5		4	5		4	5				4	22	5	4,40		0,5477		1
Usefulness of Conventional Monitoring (Inspection)	1		4	5		5	5				5	24	5	4,80		0,4472		1
	2		4	5		5	3				3	20	5	4,00		1,0000		4
	3		3	5		5	3				3	19	5	3,80		1,0954		5
	4		4	4		5	3				5	21	5	4,20	4,03	0,8367	0,4821	3
	5		4	5		5	4				4	22	5	4,40		0,5477		2
	6		4	3		5	2				3	17	5	3,40		1,1402		7
	7		4	5		4	2				3	18	5	3,60		1,1402		6
Effectivenes Perception of UASs Monitoring (Inspection)	1		3	1		3	3				3	13	5	2,60		0,8944		4
	2		3	1		4	3				4	15	5	3,00		1,2247		2
	3		3	1		3	4				3	14	5	2,80	2,84	1,0954	0,3847	3
	4		3	2		2	2				3	12	5	2,40		0,5477		5
	5		3	2		4	4				4	17	5	3,40		0,8944		1
	1		4	2		3	3				4	16	5	3,20		0,8367		5
	2		4	2		4	3				5	18	5	3,60		1,1402		3
	3		4	2		5	4				5	20	5	4,00		1,2247		1

Data, Quality and Cost	**4**		2	1		2	3				2	10	5	2,00	3,00	0,7071	0,6633	11
	5		4	1		5	4				5	19	5	3,80		1,6432		2
	6		3	1		4	4				5	17	5	3,40		1,5166		4
	7		2	2		2	3				4	13	5	2,60		0,8944		8
	8		2	2		3	2				3	12	5	2,40		0,5477		9
	9		3	2		3	3				4	15	5	3,00		0,7071		6
	10		2	2		2	3				2	11	5	2,20		0,4472		10
	11		2	3		3	3				3	14	5	2,80		0,4472		7
Management Aspects	**1**		4	4		4	3				3	18	5	3,60	3,88	0,5477	0,4147	4
	2		4	4		3	4				4	19	5	3,80		0,4472		3
	3		3	3		4	4				3	17	5	3,40		0,5477		5
	4		4	3		5	4				5	21	5	4,20		0,8367		2
	5		4	4		5	4				5	22	5	4,40		0,5477		1
Usage Performance	**1**		3	3		4	2				3	15	5	3,00	3,00	0,7071	0,5831	3
	2		2	3		3	3				3	14	5	2,80		0,4472		4
	3		3	4		4	4				4	19	5	3,80		0,4472		1
	4		2	3		4	3				4	16	5	3,20		0,8367		2
	5		2	2		3	2				2	11	5	2,20		0,4472		5

SUMMARY RESPONDENT'S ANSWER UASs & CONVENTIONAL

RESPONDENT												TOTAL		MEAN		SD	SD TOTAL	RANK
QUESTION		1	2	3	4	5	6	7	8	9	10	SCORE	RESP	Var.	Group.			Group.
Supervisory Application Use On-Going Construction	1	1	1		1	1	1	1	1	1	1	9	10	0,90		-		1
	2	1	1			1		1		1		5	10	0,50		-		4
	3	1		1	1	1		1		1		6	10	0,60		-		3
	4			1	1	1				1	1	5	10	0,50	0,46	-		4
	5	1		1	1	1		1	1	1		7	10	0,70		-		2
	6											-	10	-		-		-
	7											-	10	-		-		-
Usefulness of Visual Assets in Various Areas (UASs)	1	5			5			4	4	5		23	5	4,60		0,5477		2
	2	3			4			4	4	3		18	5	3,60		0,5477		5
	3	3			4			4	1	3		15	5	3,00		1,2247		8
	4	4			5			3	4	4		20	5	4,00		0,7071		3
	5	5			5			5	5	4		24	5	4,80	3,80	0,4472	0,6414	1
	6	1			4			4	4	3		16	5	3,20		1,3038		7
	7	4			5			4	2	4		19	5	3,80		1,0954		4
	8	4			4			4	1	4		17	5	3,40		1,3416		6
Type of View Inspecting The Visual Data (UASs)	1	5			5			4	4	5		23	5	4,60		0,5477		2
	2	3			5			4	4	3		19	5	3,80		0,8367		5
	3	4			5			5	4	4		22	5	4,40	4,32	0,5477	0,4147	3
	4	5			5			5	4	5		24	5	4,80		0,4472		1
	5	3			5			4	4	4		20	5	4,00		0,7071		4
UASs Budget Allocation in The Future	1	3			3			4	3	3		16	5	3,20		0,4472		2
	2	3			3			4	3	2		15	5	3,00		0,7071		3
	3	3			3			5	2	4		17	5	3,40	3,00	1,1402	0,3162	1
	4	2			3			4	3	2		14	5	2,80		0,8367		4
	5	3			3			3	2	2		13	5	2,60		0,5477		5
	1	5			4			3	4	4		20	5	4,00		0,7071		1
	2	3			3			2	2	3		13	5	2,60		0,5477		4

Level of UASs Significance in The Construction Stages	**3**	4			4			4	3	3		18	5	3,60	3,24	0,5477	0,7925	3
	4	4			4			5	2	4		19	5	3,80		1,0954		2
	5	2			3			1	2	3		11	5	2,20		0,8367		5
UASs Impact due to Implementation Supervision on The Construction Project Activities	**1**	3			2			3	2	3		13	5	2,60	2,67	0,5477	0,9381	4
	2	4			1			3	1	2		11	5	2,20		1,3038		6
	3	3			2			1	1	1		8	5	1,60		0,8944		9
	4	5			3			5	4	5		22	5	4,40		0,8944		1
	5	4			3			5	2	4		18	5	3,60		1,1402		2
	6	4			3			5	2	3		17	5	3,40		1,1402		3
	7	3			3			1	3	2		12	5	2,40		0,8944		5
	8	2			3			1	3	1		10	5	2,00		1,0000		7
	9	2			2			1	2	2		9	5	1,80		0,4472		8
Factors Implementation of UASs (drone)	**1**	4			3			5	4	3		19	5	3,80	2,96	0,8367	0,6693	1
	2	2			3			3	1	2		11	5	2,20		0,8367		5
	3	5			3			3	1	3		15	5	3,00		1,4142		3
	4	5			3			1	1	2		12	5	2,40		1,6733		4
	5	4			4			3	3	3		17	5	3,40		0,5477		2
Areas of Concern Currently Preculding UASs Usage	**1**		3	5		3	4				5	20	5	4,00	4,00	1,0000	0,3162	3
	2		4	4		4	4				5	21	5	4,20		0,4472		2
	3		4	5		3	2				5	19	5	3,80		1,3038		4
	4		3	4		4	4				3	18	5	3,60		0,5477		5
	5		4	5		4	5				4	22	5	4,40		0,5477		1
Usefulness of Conventional Monitoring (Inspection)	**1**		4	5		5	5				5	24	5	4,80	4,03	0,4472	0,4821	1
	2		4	5		5	3				3	20	5	4,00		1,0000		4
	3		3	5		5	3				3	19	5	3,80		1,0954		5
	4		4	4		5	3				5	21	5	4,20		0,8367		3
	5		4	5		5	4				4	22	5	4,40		0,5477		2
	6		4	3		5	2				3	17	5	3,40		1,1402		7
	7		4	5		4	2				3	18	5	3,60		1,1402		6
	1		3	1		3	3				3	13	5	2,60		0,8944		4
	2		3	1		4	3				4	15	5	3,00		1,2247		2

Effectivenes Perception of UASs Monitoring (Inspection)	**3**		3	1		3	4				3	14	5	2,80	2,84	1,0954	0,3847	3
	4		3	2		2	2				3	12	5	2,40		0,5477		5
	5		3	2		4	4				4	17	5	3,40		0,8944		1
Data, Quality and Cost	**1**	2	4	2	3	3	3	2	2	2	4	27	10	2,70	3,16	0,8233	0,5005	10
	2	3	4	2	4	4	3	4	4	3	5	36	10	3,60		0,8433		3
	3	4	4	2	4	5	4	5	4	4	5	41	10	4,10		0,8756		1
	4	4	2	1	4	2	3	5	4	3	2	30	10	3,00		1,2472		5
	5	3	4	1	3	5	4	3	2	3	5	33	10	3,30		1,2517		4
	6	4	3	1	4	4	4	5	4	5	5	39	10	3,90		1,1972		2
	7	3	2	2	4	2	3	3	3	4	4	30	10	3,00		0,8165		5
	8	3	2	2	3	3	2	4	3	3	3	28	10	2,80		0,6325		8
	9	2	3	2	3	3	3	3	3	2	4	28	10	2,80		0,6325		8
	10	3	2	2	4	2	3	5	4	3	2	30	10	3,00		1,0541		5
	11	2	2	3	3	3	3	2	3	2	3	26	10	2,60		0,5164		11
Management Aspects	**1**	3	4	4	4	4	3	5	3	2	3	35	10	3,50	3,76	0,8498	0,2702	5
	2	3	4	4	4	3	4	4	4	3	4	37	10	3,70		0,4830		3
	3	4	3	3	4	4	4	4	3	4	3	36	10	3,60		0,5164		4
	4	5	4	3	4	5	4	5	4	3	5	42	10	4,20		0,7888		1
	5	3	4	4	3	5	4	5	3	2	5	38	10	3,80		1,0328		2
Usage Performance	**1**	4	3	3	4	3	3	4	3	3	3	33	10	3,30	3,18	0,4830	0,4658	2
	2	4	2	3	3	3	3	3	3	4	3	31	10	3,10		0,5676		4
	3	5	3	4	4	4	4	3	3	4	4	38	10	3,80		0,6325		1
	4	3	2	3	4	4	3	3	3	3	4	32	10	3,20		0,6325		3
	5	2	2	2	3	3	2	3	3	3	2	25	10	2,50		0,5270		5

INPUT RESULT RESPONDENT'S ANSWER UASs & CONVENTIONAL

QUESTIONNAIRE			AGREEMENT & IMPACT RESPONSE					TOTAL	AGREEMENT & IMPACT RESPONSE (%)					TOTAL
			5	4	3	2	1		5	4	3	2	1	
Supervisory Application Use On-Going Construction	**1**	Aerial photography to track job progress	0	0	0	0	9	9	0%	0%	0%	0%	100%	100%
	2	Aerial photography for logistics and production planning	0	0	0	0	5	5	0%	0%	0%	0%	100%	100%
	3	Management Productivity	0	0	0	0	6	6	0%	0%	0%	0%	100%	100%
	4	Inspection of areas difficult or impossible to access	0	0	0	0	5	5	0%	0%	0%	0%	100%	100%
	5	Safety monitoring and support (K3)	0	0	0	0	7	7	0%	0%	0%	0%	100%	100%
	6	Land surveying, thermal imaging, laser scanning or other data collection	0	0	0	0	0	0	0%	0%	0%	0%	0%	0%
	7	Others	0	0	0	0	0	0	0%	0%	0%	0%	0%	0%
Usefulness of Visual Assets in Various Areas (UASs)	**1**	Aerial monitoring to track job progress	3	2	0	0	0	5	60%	40%	0%	0%	0%	100%
	2	Logistics and production planning	0	3	2	0	0	5	0%	60%	40%	0%	0%	100%
	3	Management Productivity	0	2	2	0	1	5	0%	40%	40%	0%	20%	100%
	4	Inspection of areas difficult or impossible to access	1	3	1	0	0	5	20%	60%	20%	0%	0%	100%
	5	Safety monitoring and support (K3)	4	1	0	0	0	5	80%	20%	0%	0%	0%	100%
	6	Land surveying, thermal imaging, laser scanning	0	3	1	0	1	5	0%	60%	20%	0%	20%	100%
	7	General managerial issuess	1	3	0	1	0	5	20%	60%	0%	20%	0%	100%
	8	Technical Issuess	0	4	0	0	1	5	0%	80%	0%	0%	20%	100%
Type of View Inspecting The Visual Data (UASs)	**1**	Closer View	3	2	0	0	0	5	60%	40%	0%	0%	0%	100%
	2	Internal View	1	2	2	0	0	5	20%	40%	40%	0%	0%	100%
	3	Higher Elevation	2	3	0	0	0	5	40%	60%	0%	0%	0%	100%
	4	Specific Angle	4	1	0	0	0	5	80%	20%	0%	0%	0%	100%
	5	Working Performing Tasks	1	3	1	0	0	5	20%	60%	20%	0%	0%	100%
UASs Budget Allocation in The Future	**1**	Conduct a study of UASs implementation in the company	0	1	4	0	0	5	0%	20%	80%	0%	0%	100%
	2	Purchase UASs and license	0	1	3	1	0	5	0%	20%	60%	20%	0%	100%
	3	Conduct a UASs training for the staff	1	1	2	1	0	5	20%	20%	40%	20%	0%	100%
	4	Invent the company's UASs procedures or manuals	0	1	2	2	0	5	0%	20%	40%	40%	0%	100%
	5	Collaborate with other company regarding UASs effective procedure	0	0	3	2	0	5	0%	0%	60%	40%	0%	100%

Level of UASs Significance in The Construction Stages	**1**	Data Collection	1	3	1	0	0	5	20%	60%	20%	0%	0%	100%
	2	Production Control	0	0	3	2	0	5	0%	0%	60%	40%	0%	100%
	3	Procurement Scheduling	0	3	2	0	0	5	0%	60%	40%	0%	0%	100%
	4	Site Layout and Handling	1	3	0	1	0	5	20%	60%	0%	20%	0%	100%
	5	Safety (K3) and Motivation	0	0	2	2	1	5	0%	0%	40%	40%	20%	100%
UASs Impact due to Implementation Supervision on The Construction Project Activities	**1**	Replace the traditional method supervision	0	0	3	2	0	5	0%	0%	60%	40%	0%	100%
	2	Reduce amount of worker to supervise	0	1	1	1	2	5	0%	20%	20%	20%	40%	100%
	3	Reduce amount of total cost overall the project	0	0	1	1	3	5	0%	0%	20%	20%	60%	100%
	4	Improve report status (Live)	3	1	1	0	0	5	60%	20%	20%	0%	0%	100%
	5	Improve operation and decision making	1	2	1	1	0	5	20%	40%	20%	20%	0%	100%
	6	Improve safety of jobsite personel	1	1	2	1	0	5	20%	20%	40%	20%	0%	100%
	7	Improve Safety of adjacent public	0	0	3	1	1	5	0%	0%	60%	20%	20%	100%
	8	Reduce time observation	0	0	2	1	2	5	0%	0%	40%	20%	40%	100%
	9	Minimize the risk of miscommnunication	0	0	0	4	1	5	0%	0%	0%	80%	20%	100%
Factors Implementation of UASs (drone)	**1**	Efficient and effective	1	2	2	0	0	5	20%	40%	40%	0%	0%	100%
	2	Reduce cost of employeement	0	0	2	2	1	5	0%	0%	40%	40%	20%	100%
	3	Improve productivity	1	0	3	0	1	5	20%	0%	60%	0%	20%	100%
	4	Reduce working hour	1	0	1	1	2	5	20%	0%	20%	20%	40%	100%
	5	Improve communication (report)	0	2	3	0	0	5	0%	40%	60%	0%	0%	100%
Areas of Concern Currently Preculding UASs Usage	**1**	Legal status to operate	2	1	2	0	0	5	40%	20%	40%	0%	0%	100%
	2	Ability to learn how to operate one	1	4	0	0	0	5	20%	80%	0%	0%	0%	100%
	3	Privacy	2	1	1	1	0	5	40%	20%	20%	20%	0%	100%
	4	Safety of jobsite personnel	0	3	2	0	0	5	0%	60%	40%	0%	0%	100%
	5	Cost to buy and operate	2	3	0	0	0	5	40%	60%	0%	0%	0%	100%
Usefulness of Conventional Monitoring (Inspection)	**1**	Project progress monitoring	4	1	0	0	0	5	80%	20%	0%	0%	0%	100%
	2	Job site logistics	2	1	2	0	0	5	40%	20%	40%	0%	0%	100%
	3	Productivity Improvement	2	0	3	0	0	5	40%	0%	60%	0%	0%	100%
	4	Quality Inspection	2	2	1	0	0	5	40%	40%	20%	0%	0%	100%
	5	Safety monitoring and support (K3)	2	3	0	0	0	5	40%	60%	0%	0%	0%	100%
	6	General managerial issuess	1	1	2	1	0	5	20%	20%	40%	20%	0%	100%
	7	Technical Issuess	1	2	1	1	0	5	20%	40%	20%	20%	0%	100%

Effectivenes Perception of UASs Monitoring (Inspection)	**1**	Monitoring or inspection in terms of their value for*money* ?	0	0	4	0	1	5	0%	0%	80%	0%	20%	100%
	2	Monitoring or inspection in terms of their*safety* ?	0	2	2	0	1	5	0%	40%	40%	0%	20%	100%
	3	Monitoring or inspection in therms of*accuracy* ?	0	1	3	0	1	5	0%	20%	60%	0%	20%	100%
	4	Monitoring or inspection in terms of their*speed* ?	0	0	2	3	0	5	0%	0%	40%	60%	0%	100%
	5	Monitoring or inspection in terms of their quality of*data* ?	0	3	1	1	0	5	0%	60%	20%	20%	0%	100%
Data, Quality and Cost	**1**	Accurate land area surveys	0	2	3	5	0	10	0%	20%	30%	50%	0%	100%
	2	Better quality photos and quicker turnaround	1	5	3	1	0	10	10%	50%	30%	10%	0%	100%
	3	Unique perspective of project (area hard to see)	3	6	0	1	0	10	30%	60%	0%	10%	0%	100%
	4	Clients love to see their project from the perspective	1	3	2	3	1	10	10%	30%	20%	30%	10%	100%
	5	Improve relation with the client	2	2	4	1	1	10	20%	20%	40%	10%	10%	100%
	6	Provides a new perspective on real time progress	3	5	1	0	1	10	30%	50%	10%	0%	10%	100%
	7	Cost savings and convenience	0	3	4	3	0	10	0%	30%	40%	30%	0%	100%
	8	Images are fantastic from marketing point of view	0	1	6	3	0	10	0%	10%	60%	30%	0%	100%
	9	Much slower than using drone monitoring	0	1	6	3	0	10	0%	10%	60%	30%	0%	100%
	10	Provides long distance clients with up to date real-time footage of the current status of work	1	2	3	4	0	10	10%	20%	30%	40%	0%	100%
	11	Easy operation	0	0	6	4	0	10	0%	0%	60%	40%	0%	100%
Management Aspects	**1**	Construction Productivity Improvement	1	4	4	1	0	10	10%	40%	40%	10%	0%	100%
	2	Construction Job Progress	0	7	3	0	0	10	0%	70%	30%	0%	0%	100%
	3	Construction Site Security	0	6	4	0	0	10	0%	60%	40%	0%	0%	100%
	4	Construction Inspection	4	4	2	0	0	10	40%	40%	20%	0%	0%	100%
	5	Construction Estimating Cost	3	3	3	1	0	10	30%	30%	30%	10%	0%	100%
Usage Performance	**1**	Flexibility and efficiency of use	0	3	7	0	0	10	0%	30%	70%	0%	0%	100%
	2	Operation time and speed	0	2	7	1	0	10	0%	20%	70%	10%	0%	100%
	3	Match between system and the real world (use of waypoints and pre-programmed routes)	1	6	3	0	0	10	10%	60%	30%	0%	0%	100%
	4	Recognize, diagnose and error prevention	0	3	6	1	0	10	0%	30%	60%	10%	0%	100%
	5	Visibility of system status	0	0	5	5	0	10	0%	0%	50%	50%	0%	100%

PERSPECTIVE ASSETS PICTURE AND VIDEO

SUBSET OF 20 ASSETS			SUMMARY OF MAIN FINDINGS	
ASSET	**ASSET TYPE**	**COMPANY RESPONSE**	**(A) USEFULNESS**	**(B) IDENTIFIED PROBLEMS**
Asset 01	Video	PT. Tata Bumi Raya ***PROJECT 1***	Project Progress Job Site Progress Marketing Needs	K3 (Secure, Health, and Safety) Quality Issues Worker Behavior
Asset 02	Picture	PT. Tata Bumi Raya ***PROJECT 1***	General Inspection Project Progress Job Site Progress Material Monitoring	Inventory Problem Material Problem Field Organization K3 (Secure, Health, and Safety) Quality Issues Field Organization
				Material Problem
Asset 03	Video	PT. Artha Beth Jaya Abadi ***PROJECT 2***	Project Progress Job Site Progress K3 (Secure, Health, and Safety) General Inspection Monitoring of Logistic Works	K3 (Secure, Health, and Safety) Quality Issues Worker Behavior Inventory Problem Material Problem Field Organization
Asset 04	Picture	PT. Artha Beth Jaya Abadi ***PROJECT 2***	Project Progress Job Site Progress Material Monitoring General Inspection	Quality Issues Worker Behavior Inventory Problem Material Problem Field Organization
Asset 05	Video	PT. Wika Realty ***PROJECT 3***	Project Progress Job Site Progress	K3 (Secure, Health, and Safety) Quality Issues Worker Behavior
Asset 06	Picture	PT. Wika Realty ***PROJECT 3***	Project Progress Job Site Progress Material Monitoring General Inspection	K3 (Secure, Health, and Safety) Quality Issues Field Organization

ASSET	ASSET TYPE	COMPANY RESPONSE	(A) USEFULNESS	(B) IDENTIFIED PROBLEMS
Asset 07	Video	PT. Adhi Karya (Persero) Tbk ***PROJECT 4***	Project Progress K3 (Secure, Health, and Safety) General Inspection	Quality Issues Worker Behavior Field Organization K3 (Secure, Health, and Safety)
Asset 08	Picture	PT. Adhi Karya (Persero) Tbk ***PROJECT 4***	Job Site Progress Material Monitoring General Inspection Project Progress	Quality Issues Worker Behavior Inventory Problem K3 (Secure, Health, and Safety)
Asset 09	Video	PT. Bumi Agung Semesta ***PROJECT 5***	Project Progress Job Site Progress Material Monitoring General Inspection	K3 (Secure, Health, and Safety) Quality Issues Worker Behavior Inventory Problem
Asset 10	Picture	PT. Bumi Agung Semesta ***PROJECT 5***	General Inspection Monitoring of Logistic Works Job Site Progress Material Monitoring	Material Problem Field Organization Worker Behavior Inventory Problem K3 (Secure, Health, and Safety)
Asset 11	Video	PT. Yasa Patria Perkasa ***PROJECT 6***	Project Progress Job Site Progress K3 (Secure, Health, and Safety) General Inspection	K3 (Secure, Health, and Safety) Quality Issues Worker Behavior
Asset 12	Picture	PT. Yasa Patria Perkasa ***PROJECT 6***	Monitoring of Logistic Works Job Site Progress Material Monitoring	K3 (Secure, Health, and Safety) Field Organization
Asset 13	Video	PT. PP (Persero) Tbk ***PROJECT 7***	Project Progress Job Site Progress K3 (Secure, Health, and Safety)	Quality Issues Worker Behavior Field Organization

ASSET	ASSET TYPE	COMPANY RESPONSE	(A) USEFULNESS	(B) IDENTIFIED PROBLEMS
Asset 14	Picture	PT. PP (Persero) Tbk ***PROJECT 7***	Job Site Progress Material Monitoring General Inspection	K3 (Secure, Health, and Safety) Field Organization Quality Issues
Asset 15	Video	PT. Wijaya Karya Bangunan Gedung Tbk ***PROJECT 8***	K3 (Secure, Health, and Safety) Job Site Progress Project Progress	Worker Behavior Field Organization
Asset 16	Picture	PT. Wijaya Karya Bangunan Gedung Tbk ***PROJECT 8***	Job Site Progress Material Monitoring General Inspection	K3 (Secure, Health, and Safety) Field Organization Quality Issues
Asset 17	Video	PT. Warna Bhuana Indonesia ***PROJECT 9***	Project Progress Job Site Progress Material Monitoring General Inspection	K3 (Secure, Health, and Safety) Quality Issues Worker Behavior
Asset 18	Picture	PT. Warna Bhuana Indonesia ***PROJECT 9***	General Inspection Monitoring of Logistic Works Job Site Progress Material Monitoring	Material Problem Field Organization Inventory Problem K3 (Secure, Health, and Safety)
Asset 19	Video	PT. MultiBangun Adhitama Konstruksi (MULTIKON) ***PROJECT 10***	Project Progress Job Site Progress K3 (Secure, Health, and Safety) General Inspection	K3 (Secure, Health, and Safety) Quality Issues Worker Behavior
Asset 20	Picture	PT. MultiBangun Adhitama Konstruksi (MULTIKON) ***PROJECT 10***	Monitoring of Logistic Works Job Site Progress Material Monitoring	K3 (Secure, Health, and Safety) Field Organization

DATA PROVIDED *(SIGNED COMPNAY MARK)*

..22.., Februari 2018
Data disediakan oleh
(Data provided by)

(.....) *Nama dan Paraf*
Cap Perusahaan

PT. Bumi Agung Semesta

..... Februari 2018
Data disediakan oleh
(Data provided by)

MULTIKON
PROYEK PEMBANGUNAN
RS PANTI RAPIH
YOGYAKARTA

(.....) *Nama dan Paraf*
Cap Perusahaan

PT. MultiBangunan Adhitama Konstruksi (MULTIKON)

.....8.., Februari 2018
Data disediakan oleh
(Data provided by)

(Setyo Utomo) *Nama dan Paraf*
Cap Perusahaan

PT. Adhi Karya (Persero) Tbk

....., February 2018
Data Provided by

PT. TATA BUMI RAYA
PROYEK MALIOBORO PARK VIEW

(Rahmat H.) *Name and Signed*
Company Mark

PT. Tata Bumi Raya

Bogor, 17 Februari 2018
Data disediakan oleh
PT. Wijaya Karya Bangunan Gedung

(Frisky Sustiawan)

PT. Wijaya Karya Bangunan Gedung Tbk

DATA PROVIDED *(SIGNED COMPNAY MARK)*

Senin, 12, Februari 2018

Data disediakan oleh

(Radityo Adhi Widiyono)

PT. PP (Persero) Tbk.

PT. PP (Persero) Tbk

Yogyakarta, 19 Februari 2018

Data disediakan oleh

(Data provided by)

(PT. WIKA REALTY)

PT. Wika Realty

March

4, Februari 2018

Data disediakan oleh

(Data provided by)

(.....)

PT. Warna Bhuana Indonesia

12, Februari 2018

Data disediakan oleh

(Data provided by)

YASA GEDUNG

(Enggar Priambada, ST)

PT. Yasa Patria Perkasa

21, Februari 2018

Data disediakan oleh

(Data provided by)

artha beth jaya abadi

JOGJA APARTMENT ★★★★

(AGUS BUDI SUSILO)

PT. Artha Beth Jaya Abadi

T TEST TABLE

T-Test

Group Statistics

	Method	N	Mean	Std. Deviation	Std. Error Mean
Data Quality and Cost	UASs	11	16.6364	3.74894	1.13035
	Conventional	11	15.0000	3.31662	1.00000

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Data Quality and Cost	Equal variances assumed	.282	.601	1.084	20	.291	1.63636	1.50920	-1.51177	4.78450
	Equal variances not assumed			1.084	19.707	.291	1.63636	1.50920	-1.51478	4.78750

T-Test

Group Statistics

	Method	N	Mean	Std. Deviation	Std. Error Mean
Management Aspect	UASs	5	3.6400	.38471	.17205
	Conventional	5	3.8800	.41473	.18547

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Management Aspect	Equal variances assumed	.153	.706	-.949	8	.371	-.24000	.25298	-.82338	.34338
	Equal variances not assumed			-.949	7.955	.371	-.24000	.25298	-.82395	.34395

T-Test

Group Statistics

	Method	N	Mean	Std. Deviation	Std. Error Mean
Usage Factors	UASs	5	3.3600	.38471	.17205
	Conventional	5	3.0000	.58310	.26077

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Usage Factors	Equal variances assumed	.340	.576	1.152	8	.282	.36000	.31241	-.36042	1.08042
	Equal variances not assumed			1.152	6.928	.287	.36000	.31241	-.38030	1.10030

T TEST TABLE

T-Test

Group Statistics

	Method	N	Mean	Std. Deviation	Std. Error Mean
Total Worker Wage	UASs & Conventional	5	.21160	.113885	.050931
	Conventional	5	.44960	.277473	.124090

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Total Worker Wage	Equal variances assumed	5.850	.042	-1.774	8	.114	-.238000	.134135	-.547316	.071316
	Equal variances not assumed			-1.774	5.310	.133	-.238000	.134135	-.576829	.100829