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Collaboration Building Prototyping Based on Sketch as Communication Language in Indonesia Rural Area

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Abstract

Researchers and builders collaborate on the manufacture of two-wheeled vehicles prototype for the Cikadu community in the rural village of West Java, Indonesia. Ethnography is used to understand the activities and solutions of two-wheeled vehicles in the community. The default, intervention, and compromise phase describe the process of collaboration with the community and execution through prototyping involving local workshops. Transparency, mutual trust, and mutual acceptance are the three intersections of the process phase carried out. Regarding collaboration of the local builder, manufacturing process for vehicle prototype, as matter of fact local builder utilizes and refers heavily on perspective sketches rather than shop drawings, these local builder utilizes perspective raw sketches during the logical measurements and prototypes assembling process.

Keywords: collaboration, Cikadu, ethnography, sketch, rural vehicle

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1. Introduction

Integration of different backgrounds and understanding, especially regarding specialized knowledge that is essential in the development of design produce a new understanding of design objectives (Vanella, 2017). The focus of this paper is on the integration of researchers and builders at the time of making the prototype for 30 days, the aim is to reveal the collaboration in developing two-wheeled vehicles into three-wheeled in line intended for rural communities in Cikadu, West Java, Indonesia.

Cikadu District is located in the southern mountains of West Java Province, Indonesia, consisting of 10 villages. Most of the roads in Cikadu are in poor conditions, and currently improvements to the quality and width of the roads are being made. The two-wheeled vehicle prototype development project is based on the public's heavy reliance on such vehicles as agricultural means of transportation to transport commodities from mountain slopes. Changes to two-wheeled vehicles in Cikadu were carried out by the community due to adjustments to the condition of dirt roads that turned into muddy and slippery when it rained, rocky roads and sharp inclines or slanted so that it was difficult for two-wheeled vehicles with manufacture default to pass through village roads in Cikadu.

Integration and collaboration require simplicity of communication, the intensity of coordination, co-location, and experimentation (Vanella, 2017). Collaboration has the complexity of a theoretical system, so that collaboration is distinguished by the level of need and agreement of the perpetrators on tolerance, coordination, cooperation, and work activities on limiting something, and to achieve this, different abilities, decision making, limits of knowledge and different powers are required. (Mary L.Kinnaman RN MN, 2004).

The influence of social change and the actors involved determine the design collaboration process, so the reason for the inclusion of non-designer participants lies in the given contribution (Cristiele A. Scariot, Adriano Heemann, Stephania Padovani, 2012). In the1990s, collaborative design was developed so that it is known as user-centered design and is very useful for the development of consumer product design (Sanders, 1992). Collaboration as part of user-centered design is used in a system, product, or service design approach that involves consumers with the hope to seek in-depth understanding when conducting product development research related to user needs and requirements. The greater involvement of the user in the design process results

in a product that fits its environment and purpose (Maguire, 2001).

The collaboration is making prototypes of two-wheeled vehicles with partners or local builders by taking into account the activities, needs, availability of materials and components in the area, the next stage vehicle can be made by local communities to meet their specific needs.

Prototypes are made based on the ability of local workshops/builders. The ability of builders in Cikadu is formed as a result of the demand to repair agricultural machinery independently. In the beginning, Cikadu only had one mechanic or workshop located in the center of the Cikadu district, then he taught his skills to the local community so that some people who learned from him could open independent workshops in another village. His disclosure to sharing his knowledge with the community in Cikadu has made him a very trusted person and a source of information regarding machine improvements.

Road improvements made by the government in 2018 resulted in major social changes in Cikadu. Connection with the capital of West Java through a 30 km road makes it easier for the community to access metal materials or vehicle components with sufficient availability and affordable prices. Road repairs were carried out by the West Java Government by utilizing old roads built by the colonial government in the 1920s. The purpose of the colonial road is as transportation access from plantation products in Cianjur and South Bandung regions to the largest tea processing plant in West Java, located in Koleberes Cikadu. The repaired road shortens the travel time, previously it took about 10-12 hours to reach Cikadu from the capital of West Java, and can now be reached within 3-4 hours. Other social changes area with the advent of workshops and small shops along the way, such as tire workshops, general workshops for vehicle engines, or overhaul and workshops capable of changing vehicles.

Collaboration with local development is carried out to understand the changes of two-wheeled vehicles in Cikadu since the changes was implemented and understand community activities in Cikadu related to natural conditions, vehicles used, limitations of standard factory vehicles (manufacture default), and changes that are often made to two-wheeled vehicles to cross the roads with heavy luggage. The solution provided based on the knowledge of local development on the changes of vehicles is a form of independence and innovation in the Cikadu.

According to Holbrook and O'Shaughnessy, co-creation activities that study the perspective of consumer culture, related to consumption procedures, or the use of a product due to consumer interest in a product will provide additional product value and symbolic meaning (B.Holbrook, 2002). Co-creation then develops into a new paradigm for consumers, industry, and manufacturers to achieve value. The aim is to develop new ways of doing business and opportunities for industry and manufacturing through increased interaction of stakeholders involved in a business sphere (Voima, 2011). Another theory to describe co-creation is it is part of consumer culture with industry by being more open and involving consumers (Arnould, 2005), (Penanzola, L Verkantesh A, 2006). Co-creation strongly emphasizes interaction and mediation between consumers and industry to produce the best technology, innovation, and forms of service, besides that co-creation can provide an understanding that input from consumers as consideration can produce new discoveries through their involvement, participation, and empowerment. (Galvagno, 2014).

The involvement of the workshop community as part of the prototype development project activity is part of participatory design, this is based on Simonsen's statement which states that participatory design is a project that has a contextual relationship or everything that is applied/designed according to local characteristics or circumstances (Simonsen, 2014). Participatory design involves concrete and tangible activities. The main characteristic of participatory design is the use of the design by doing method through mock-ups and prototypes (Liam J. Bannon, 2013). The process involves workers and is usually carried out by the community or ordinary workers, through the involvement of their abilities or skills in the participatory design process (Ehn, 2008). Responses related to issues and abilities or skills are part of the complexity and determine the quality of infrastructure conditions in participatory design. Infrastructure is defined as part of a “useful system” condition, which consists of various actions, activities from various parties related to understanding the issue framework and point of view of thought so that attachments from various issue frameworks or differences of thought are found (Thomas Binder., 2015).

In addition to the mock-up and prototype processes, participatory design also involves participatory sketches. Tversky states that the sketch function as a collection/combination of various requirements to allow users to use sketches to bring up various thoughts and understandings as multi-expression (multimodal expression) through oral and written mode. Sketches are used as a supporting role for communication between designers and users, especially limitations when discussing abstracts about concepts and design interactions. "Sketches" convey ideas in the form of figurative stories (metaphorically) through the relationship of interpretations to objects that are

projected (spatial) on paper as an abstract story of the elements and their relationships (Tversky, 2002). The effectiveness of the sketch is in the speed of completion compared to mock-ups or models, especially during revision and trial-and-error. Two-dimensional thinking is easier to understand than three-dimensional one (Tversky, 2002). The findings obtained from research using "user participatory sketching" can complement the basic technical needs of users, consisting of real communication, disclosure of rationale through design concepts or unveiling underlying thoughts. User-generated sketches can also facilitate design by providing resources to the idea exploration process. Documentation of user needs in a visual way allows interpretation of the problems encountered (Jin-Yi Wang, 2012).

Participatory design proceeds through investigative activities, understanding, reflection upon, establishing, developing and learning from each other among the actors so that there is a process of reflection that reveals the use of knowledge (reflection in action). The actors involved generally follow two rules as a principle and require the designer to strive in studying the reality of the situation where the user exists. On the other hand, users strive to articulate their aim and desires as a way to learn appropriate technology owned by the community. (Robertson, T., & Simonsen, J, 2013). Luck Rachel's conclusion that the root of participatory design is on the part of local accountability or responsible action on the involvement of local community activities (Rachel, 2018). Participatory design cannot be applied from one situation to another, so it is not a universal process. Participatory design cannot be formulated or made in complicated rules and rigid and strict definitions, but the essence of participatory design is a commitment to participation in the design process. (Robertson, T., & Simonsen, J, 2013). The means and technical support for collaboration in the development of participatory design lies in the activeness and reflection activities of the participants involved.

2. Etnography as Paving the Way for Collaborative

Ethnography emphasizes the understanding of the activities that exist in the community and is included in the method of collecting quality data that is rich in descriptions, besides that it is also made based on actual conditions (Davies, 2004), (J.Blomberg, 2003). The criticism from various kinds of literature on the application of ethnography as applied to design development research is elusive understanding of a collaborative approach when seeking an in-depth understanding of the complexity of cultural insight. Design ethnography is more likely to produce a narrow understanding, or only based on previously known standards. Otto's thinking about the concept of applying anthropology to design is to give rise to new fields of academic research, thereby offering new contexts and opportunities to expand participatory design research. (Otto, 2013). Design anthropology is expected to not only be rich in description, facilitation, or advocacy, although it is used as a methodology, it is hoped to enrich discourse and its determination by changing or reframing various design conversations carried out. (Mette Gislev Kjaersgaard, 2016).

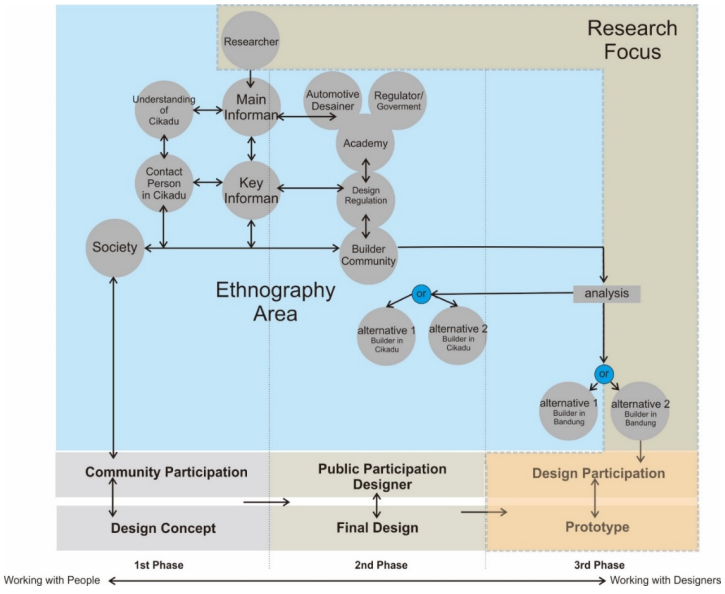


Figure 1. Ethnography and 3 phases of prototype collaboration strategies adopted from Yangki Lee

Figure 1 describes the ethnographic process carried out by researchers to obtain information and understanding about Cikadu by conducting observations and interviews. These phases are adapted from Yangki Lee's Strategy regarding the role of design in the design participation model. Yangki-Lee divides 3 phases of design participation, namely as a process of working with people and working with designers, and this phase is defined as community participation. The explanation regarding community participation is the participation of the community in the research area, design participation is defined as the world of collaboration or realm of collaboration and public participation is defined as an abstract area when the designer works or the world of expertise (Lee, 2008).

Before doing the collaboration, the researchers established communication by looking for the key and main informants, which in turn provided access to be able to communicate with the Cikadu community. The selection of informants is based on the presumption aspect, with the hope of gaining in-depth understanding, experience, and information about the condition of the community so that there is a match between the problem and the research objectives. (Ulin, 2016). The main informant plays an important role in providing a reference for researchers in conducting observations on the workshop which aims to open up opportunities for collaboration in making vehicle prototypes in Cikadu. The informant was obtained during the initial survey to the Cikadu area, the main informant works as the Head of the Agro Techno Park Center in Cikadu and has been living there for more than 5 years. Besides being known by the community in Cikadu, the informant currently serves as the secretary of West Java Food Crops and Horticulture Service so that he has extensive information and networks on the government and community in Cikadu.

Through the main informant, the researcher obtained a key informant who served as the Head of Subdistrict in the Cikadu District. The participation of these informants provided an overview and initial understanding of community activities related to two-wheeled transportation, and the existence of workshops/builders in Cikadu. Information about the reasons and how the vehicle changes were made generates possible opportunities for collaborative activities with the local community to work on a two-wheeled vehicle prototype project in Cikadu. Andy Crabtree explains the function of ethnography and participatory design in developing game prototypes as a way to be able to produce effective designs through realistic designs. (Crabtree, 1998).

The methodology of this research is based on the experiment of researchers when collaborating with builders on the development of prototypes of two-wheeled vehicles, using ethnography and the use of participatory design processes for rural communities in Cikadu, West Java, Indonesia. The phenomenon that are expressed based on experience during the research are narrated by adapting the participation model developed by Yangki Lee, especially in the design participation phase, as to gain new understanding and experience regarding cooperation with rural communities and the application of participatory design to develop the suitable vehicle for that community.

3. Community Phase as a Way To Understanding Real Condition in Cikadu

Figure 2. Activities of community in transporting goods in Cikadu using two-wheeled vehicles

Figure 2. is the explainations of condition Cikadu's community activities related to the use of two-wheeled

vehicles as a means of transportation. As an example is the use of two-wheeled vehicles by community to find clean water resource in and around Cikadu's rivers and then take it to their homes. Two-wheeled vehicles are also used when harvesting vegetables in hilly areas far from settlements, and carry sap water or *Arenga Piñata* which is placed in bamboo or used cooking oil cans. In this phase, Cikadu community also explained the changes in their vehicles to carry heavy loads by adding wood to support goods, raising motorbikes by adding suspension. The researcher records the placement of the observed items by describing them.

Figure 3. *Ojek rangkong* designed by the Cikadu community

Figure 3. shows the Rangkong vehicle used to transport goods, wood, gravel, and crops. The vehicle is made/modified by workshops in Cikadu based on the owner's needs by utilizing used or found materials. The changes are made by moving the fuel tank to the front of the steering wheel, lengthening the middle chassis, and leaving the seat for the driver. The owners of these vehicles are referred to as "ojek drivers" and serve the needs of the local community to transport goods. The cost is set and depends on the negotiation, distance traveled, road conditions, and the number of goods transported. Rangkong is a part of the transportation infrastructure, which is the key to growth and development, built from a simple logic as the main need to be able to access the market and get the benefits or ideas from the market (Abhijit banerjee, 2020).

The consideration of Cikadu community to change two-wheeled vehicles arises due to current terrain and geographical conditions. Limited materials and knowledge have resulted in unique vehicle changes as shown in figure 3. The changes of two-wheeled vehicles from a universal design or a general product concept, similarity of benefits and functions to product development that emphasizes the functional side based on each work activity is a characteristic of user-based product development activities. (Shraddha Sangelkar, 2012).

Figure 4. Observation of road conditions in Cikadu

Figure 4. Shows the road conditions often taken by two-wheeled vehicles in Cikadu. The wheel treads due to frequent traffic by two-wheeled vehicles then become a rail line and help two-wheeled vehicles cross the dirt road so as not to get off the track and fall into a ravine. The conversion of two-wheeled vehicles in Cikadu utilizes the rail line by immersing the wheels into the rail line so that the driver only follows the rail line. Changes to the height of the vehicle were carried out not only due to heavy loads but also to avoid snagging because of the depth of the rail line.

The changes in two-wheeled vehicles that utilizes the availability of materials and local capabilities is mentioned by Zhan as one of the characteristics of the craft. The craft approach is something local, the manufacture and production are based on the use of local materials, techniques, abilities, and forms (Zhan, 2017). Craft for the community is part of the rhythm of life that is rich in material, deep-rooted culture, has the value of

independence, and expresses culture and ethics.

Figure 5. Workshop observation in Cikadu

Figure 5 shows the condition of motorcycle repair shop with permanent and temporary buildings in Cikadu. There are two workshop criterias in Cikadu, the photo on the left is an example of a commercial workshop, with the understanding that the owner's and mechanic's work and earn money from the workshop they manage by applying clear rates and completion times for the work they do. The work done in commercial workshops is usually related to repairs to factory standard two-wheeled vehicles. The photo on the right represents a semi-commercial workshop, the workshop continues to serves its customers for vehicle repairs, besides that it also serves individuals needed who want to repair their own vehicles. The photo on the right shows a motorcycle owner who is in the process of painting and repairing his two-wheeled vehicle in someone else's workshop. The workshop owners also take part by giving instructions or teaching the owner of the motorbike if he finds difficulties when doing repairs independently. The non-formal learning process occurs in semi-commercial workshops, the workshop owners are open to sharing their knowledge with communities that need it the most. Tariffs charged to customers are negotiable, and fees are charged only on vehicle components, and the owner often refuses to receive money for services that have been provided. A polite way to replace the service fee can be done by giving cigarettes or crops. The types of service in semi-commercial workshops are very diverse, ranging from routine repairs, vehicle changes, agricultural machinery repairs, painting four-wheeled vehicles, and on-call mechanics for emergencies. At the time of the new planting season, the activities in the workshops in Cikadu were a little bit less crowded because customers, workshop owners, and mechanics were also involved in planting activities on their land.

The equipment owned by Cikadu workshops consists of hand power tools, manual metal arcs, air compressors, mechanical tools, and no workshops that have lathe equipment were found. Doing repairs independently, or *do it yourself* can be seen in Figure 3. The picture in the middle shows a two-wheeled vehicle that was modified using wood, used oil drums, rims, and fiber rope ties obtained from palm trees or *Arenga Pinata*. Yangki Lee said that making products independently as part of a cultural alternative in design participation is called "do it yourself" based on the direction of the people involved in the manufacture and the rules they form. (Lee, 2008).

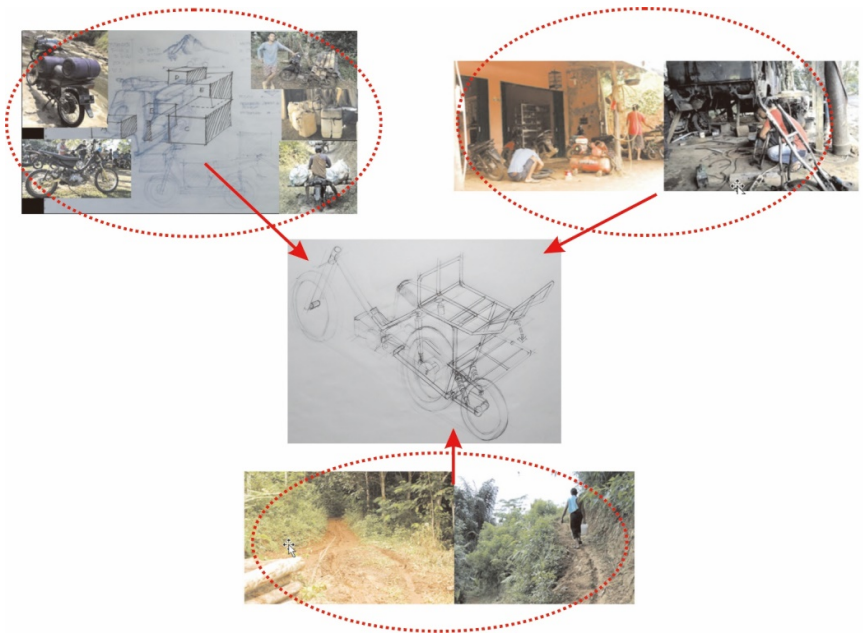


Figure 6. Inline three wheeled vehicle design concept

Figure 6 shows the design concept by considering three conditions. The discussions were conducted on the process of determining the concept of two-wheeled vehicle design in Cikadu, involving researchers, youth leaders from local community institutions, builders involved in the making of prototypes, head of sub-district and surveyors. The main criteria obtained are not changing the existing condition of two-wheeled vehicles and adding removable goods containers. The design concept developed is the addition of a third wheel at the rear to withstand the additional load placed on the container. The consideration of adding a third inline wheel is intended to reduce the width of the vehicle, when compared to the placement of the wheels on the left or right of the vehicle, so that the designed vehicle can still pass through a narrow path and tread on the rail line. The recommendation from Cikadu sub-district head is that the vehicles designed should not compete with or be the same as the vehicles that have been made by the community, but fill the gaps of the existing two-wheeled vehicles.

4. Public Participation and Intervention Phase through Design

The public participation phase or as an expert world, designers or researchers work to produce designs (Lee, 2008). Further observations gained an understanding that the trimming of two-wheeled light-vehicle, plastic bodies, accessory components were carried out due to easily broken components, and the use of vehicles during daytime. Damage can occur as a result of the motorcycle falling, hitting hard materials and being damaged by the vibrations when traveling on bumpy roads. Two-wheeled vehicles in Cikadu usually do not pass the 5-year tax registration due to the removal of important components related to safety matters.

The interventions based on the above cases lead to developing vehicles by adding facilities to carry goods without having to remove important components related to safety riding parameters-, and minimizes changes to the original vehicle. This intervention approach, when adapted from Yangki Lee's thinking, is referred to as top-down policy- oriented.

The design concept development process in the public participation phase is divided into three levels, namely the Basic Idea Level or without considering the type of motor used, the Rationalization Level, and the Idea Enrichment Level.

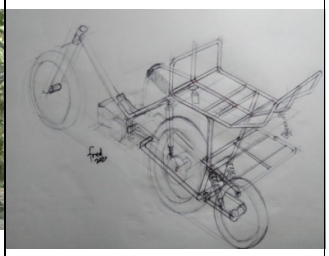
Level	Real Condition	Design	Goods
1			 

Table 1. Public Participation of Basic Idea level

This phase emphasizes the design of a container that is placed at the rear based on previous observations and a third-wheel system that is attached to a two-wheeled vehicle to withstand the load. There are three columns, the column on the left contains photos of transported goods and photos of modified two-wheeled vehicles to complement the previous photo data. The column on the right describes other possible items transported by two-wheeled vehicles in Cikadu. The column in the middle is the researcher's basic idea regarding the addition of a cargo container at the back and the addition of third wheel at the very back of the motorcycle. The sketch of the idea made in this phase top place the container at the back of the seat.

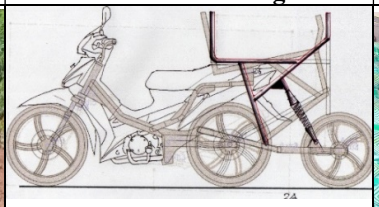
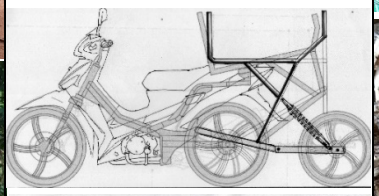
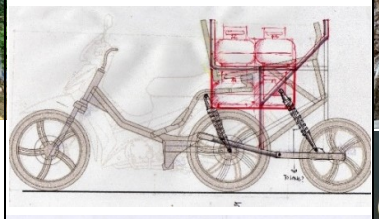
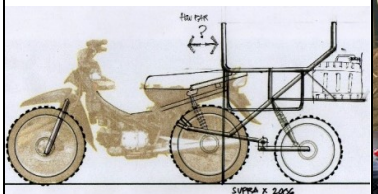
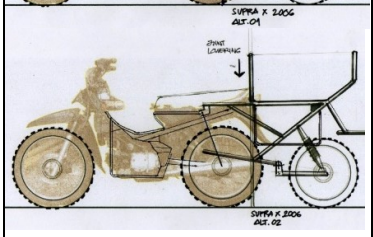
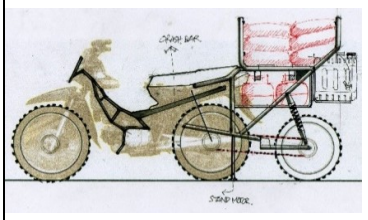
Level	Real Condition	Intervention Design	Goods
2	 	     	   

Table 2. Public participation of rationalization level

Table 2 shows the design of the container adapted to the two-wheeled Honda Supra X as a towing vehicle, the population of two-wheeled vehicles of Honda Supra X is quite dominant in Cikadu due to its toughness and availability of fast-moving parts. In this phase the rationalization of the third wheel and container design was made by reverse engineering Honda Supra X chassis in three dimensions. The three dimensions image serves to determine the location of the connection points or joint between the container and the chassis. The refueling will be quite difficult due to the part of the container that covers the seat.

In this phases, the sketch is needed to find a solution for filling the fuel tank which is located at the back of the two-wheeled vehicle. Two alternative solutions obtained are cutting the seat or backing the container. The input obtained from the user of the container is not positioned far behind the seat, and it will be shorten the vehicle. The input and ideas obtained from the user are the tilt of the back stanchion, which functions as a gravity lock

for the goods being transported or the goods at the back will suppress the goods in front of them so that they are more stable when carried. To avoid competition with Rangkong, it is necessary to observe regularly the goods when transported around village roads.

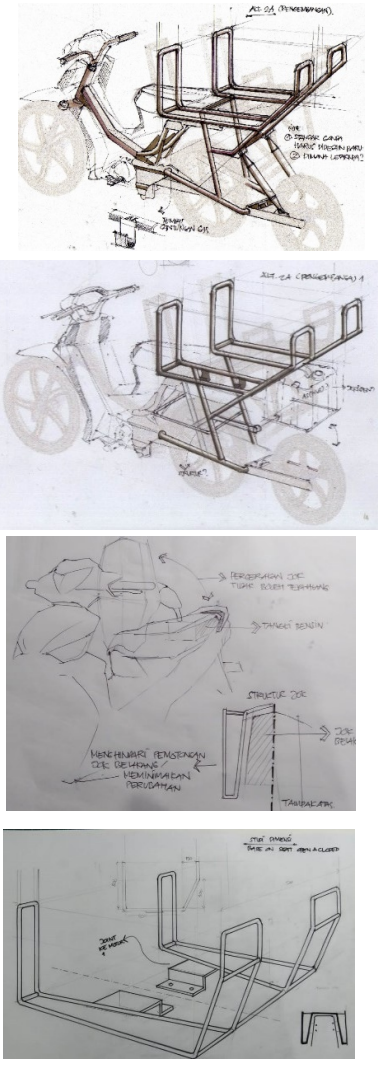
Level	Real Condition	Final Design	Goods
3			

Table 3. Public participation of enrichment idea level

Table 3 shows the enrichment idea process Design development in this phase focuses on the top of the cargo container to unblock opening and closing the system under the seat so that the fuel tank can be filled. Input from the builder stated that the three supporting iron pipes were changed into four, and were placed on the outside of the seat, so as not to block the seat opening system. The comparison can be seen through the sketches of table 1 and table 3.

5. Compromising Phase of Design Participation and Prototyping Collaboration

The focus of this research lies in this phase in the form of making prototypes involving local workshops so that

the vehicles can be made independently by the community in Cikadu. During the observation, the researcher found one of the workshops that had a simple jig, which was used to help hold the two-wheeled vehicle chassis when making changes.

Figure 7. Simple Jigs

Figure 7 shows a simple jig table which is made by the builder. This strengthens the researcher's belief in the ability of the workshop to produce prototypes of the vehicles that have been designed. The workshop is owned and run by Daris, and assisted by a colleague. Daris is a small man with a height of 5 Feet, 42 years old, and his last education is lower secondary school. According to Daris' narrative, his ability as a motorcycle builder was obtained when he worked in a workshop owned by his brother in his village as casual or doo odd jobs. Daris then began to learn to weld from his colleagues who worked in the workshop. Daris' first experience modifying a two-wheeled vehicle was done by making an underbone motorcycle for the Honda Supra X. Daris said that when he started the project, he only had to used head tube from a Honda Supra X, and then made the chassis and installed the machine. Daris said he still keeps the motorbike in his village and uses it to transport grain at harvest time. The main work that Daris does during the day is making the canopy frame and metal doors, and at night he modifying or making the chassis because he need to be focused and nothing was distracting.

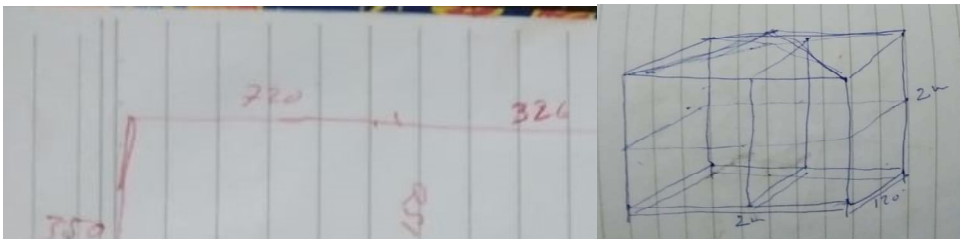


Figure 8. Examples of working drawings in Daris workshop

Figure 8. shows a working drawing of the iron frame in Daris' workshop, perspective drawing and the size used in millimeters. Standard working drawings are made based on the understanding of the employer and Daris as the maker. During the discussion before making the prototype, the researcher showed a sketch of the vehicle to be made and asked the standard of working drawings needed by Daris. According to him, the preparation of shop drawings will take longer, and the sketches made are sufficient to start the work of making prototypes, besides that, the researchers also assist during the prototype work. Daris also stated that there is no need to build a scale model, arguing that design imperfections will be found in the prototype and not in the scale model. Daris's important question during the discussion was regarding the dimensions of the cargo compartment and the weight

imposed on the vehicle. The researcher explained that the dimensions were determined through a horizontal arrangement of three 3kg cash tubes, the height was determined based on the two vertical gas cylinders and three additional gas hangers on the right and left sides, while the pay load charged was 250 kg.

The discussion will also included about financing. The researcher will bear the cost of components, materials, repairs to a damaged vehicle engine, and Daris is very reluctant to discuss the cost of his labor and thoughts at the time of making the prototype, finally the researcher discusses this with the informant who introduced the researcher and Daris. In the end, the wages for Daris were paid by the informant.

Furthermore, the process of working on the prototype begins with trimming the components of the plastic body and determining the connection point between the motor and the goods container and the third wheel. Daris gave input to change the dimensions of the rims from 14 to 17 inches because they are widely avalaible. The use of the same size of rims causes the use of the same swing arm, thus saving time and easier to adjust the center point when installing the wheels. The researcher also had a discussion with Daris for additional to the third wheel which was connected using a chain to the wheel in front of him. Daris agrees and understands, this is done to increase traction on the third wheel if the front wheel does not get traction. Daris also gave an input regarding the addition of the shock absorber and container support with the same tilt. According to Daris, the same degree of inclination will make the motorcycle look better. Based on the results of the discussion, the researcher then made more sketch detailed of the shock absorber, strut bar.

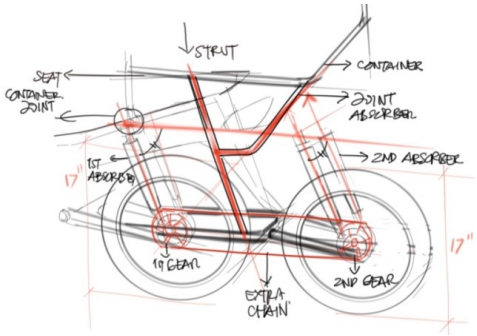


Figure 9. Adjustment of design sketches based on input from Daris

Figure 9. shows a sketch adjustment based on the input from Daris regarding the slope of the support bar using red, shock absorber and chain installation as the rear wheel drive.

Figure 10. Towing arm sketching and making

Figure 10 is a sketch to explain the position of the towing arm bracket attached to the towing motor chassis. Daris had no difficulties in making of this component, even Daris prepared a jig as a motor mount so that the dimensions of the right and left components had the same length and were balanced. The next stage is the installation of the third wheel and adjusting the tilt of the towing arm.

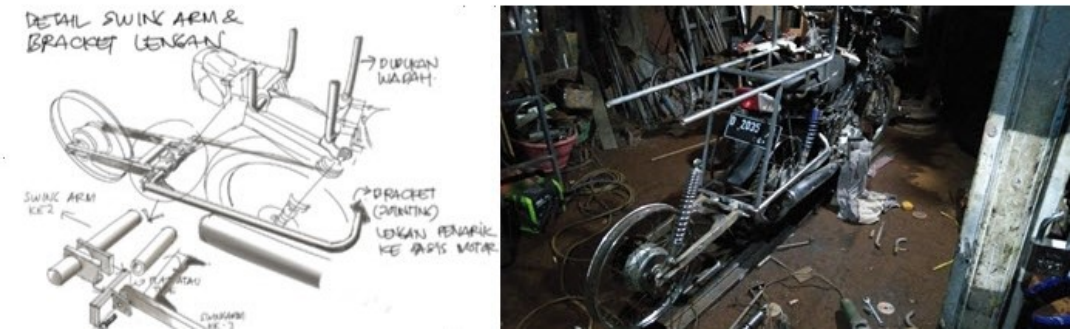


Figure 11. Swing Arm Details and Sketching

Figure 11 is a sketch of the swing arm that the researcher prepared when Daris worked. The researcher's thoughts on the container bracket, towing arm and details of connecting the rear swing arm to the towing arm components. Researchers try to always accompany Daris during the process of making prototypes and hold discussions to prepare drawings. Prototype work is carried out every day starting at 06.00 pm and finishing around 11 pm, except at certain times when Daris has to install his work.

Daris often asks for sketches to be made with perspective compared to orthogonal view. According to him, perspective sketches can explain shapes from three sides and are easier to understand than orthogonal view, the weakness of it view lies in the image that must be displayed in full from the top, side, and front views. Lack of understanding of the orthogonal view at the time of making the prototype can be identified when questions arise about the appearance used and the clarity of the parts that are depicted.

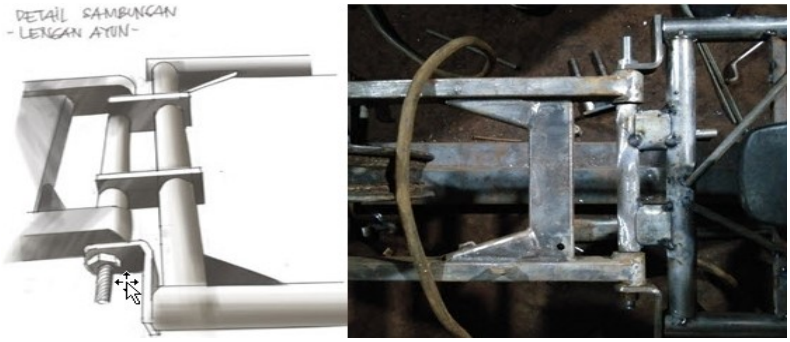
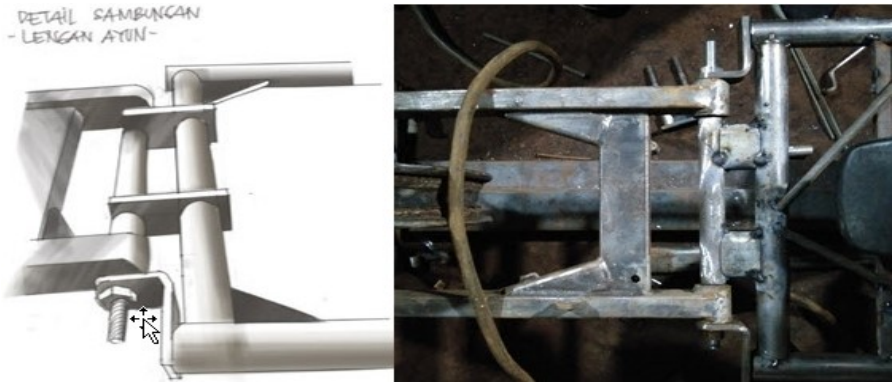


Figure 12. Difference between sketch and creation

Figure 12. The yellow circle shows the difference between the perspective sketch made by the researcher and the work done by Daris. He explained the reason to cut the plate will required longer time than an oval pipe, and oval pipe will be stronger due to welded on all sides.



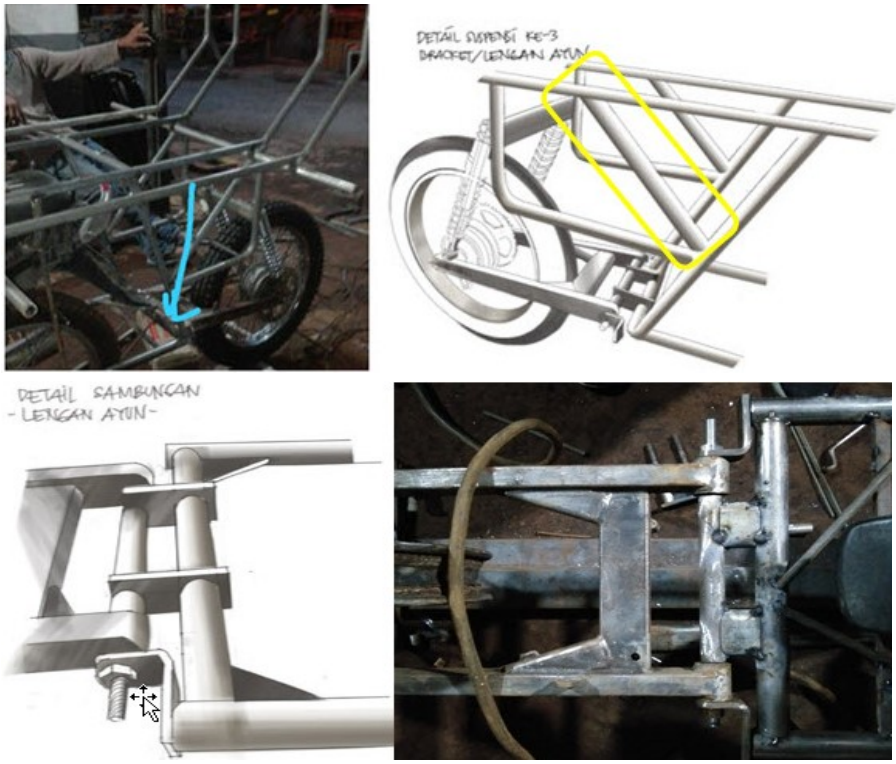


Figure 13. Mismatch of sketches and Results

Figure 13. shows the incompatibility of perspective sketches with work based on measurements and scale 1:1. The perspective sketch has a weakness against the actual size, the measurement process on the 1:1 scale workpiece turns out to be more appropriate so that the bar circled by the yellow line becomes a single unit and is efficient in the use of materials.

Figure 14. Manufacturing error

Figure 14. The yellow dotted line shows the error in making the gas cylinder support, the red dotted line shows the repair of the gas cylinder support. The error occurred due to the absence of the researcher during the manufacturing process, the lack of a sketch of the gas cylinder support, and the measurement of the gas cylinder made by Daris based on the bottom diameter of the tube and not calculating the outer diameter of the tube. This error was solved by sliding the iron pipe and adding a gas cylinder clamp.

6. Transparency, Mutual Trust and Acceptance

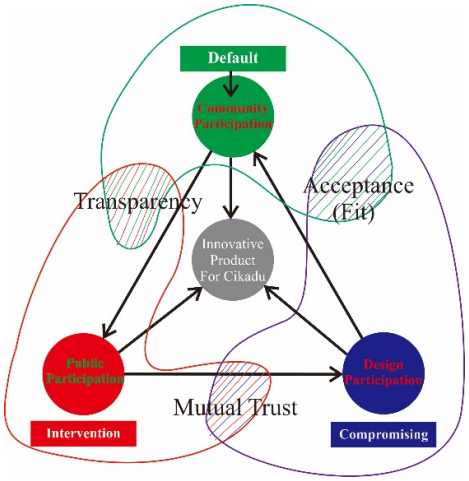


Figure 15. Rural Vehicle Design Participation Model in Cikadu

Figure 15 is a participatory design and collaboration model in the process of making vehicle prototypes in Cikadu. Community participation is the phase of researchers to understand the real conditions of the people in Cikadu which related to transportation activities. Public participation is the nature of the designer's work through design interventions that consider safety factors so that transportation activities carrying goods do not need to let go of vehicle lighting and turn lights. The addition of a removable container at the back of the motorbike is useful for carrying goods in the village's internal area. When traveling outside the village area, the container along with the third wheel can be removed and the motorbike will comply with roadworthy provisions. The Design Participation phase is a world of collaboration between researchers and builders to realize abstract thoughts that use sketches to become prototypes in actual size or function. Compromise is finding a meeting point between the different understandings, knowledge of researchers and builders regarding the design made, available materials and components, experience and skills.

The intersections from each phase are prerequisites for collaborating with the community in Cikadu. Tranparency is an intersection of understanding real conditions and intervention through design. The open attitude of researchers and Cikadu community is important for collaboration, especially in conditions of remote communities that are not yet known by researchers. The process of being able to enter, be accepted and be open to each other in a new community requires references from informants who have the knowledge and are trusted by their community, especially informants from leaders in the research area. The attitude of trust in the rural community in Cikadu towards their leaders considers researchers as important guests from leaders in their area. There is a feeling of guilt if guests from leadership figures in their area are not assisted and the form of their actions is an open attitude towards researchers.

The intersection between public participation or intervention and design participation as compromise is trust. This mutual trust will arise over time the researcher allocates in the research area. Trust will not arise in one visit to a research area, let alone to collaborate. Through frequent visits and spending time with the community in Cikadu, there is an attitude of mutual trust and understanding of the abilities between researchers and the communities invited to work together or collaborate. Community commitment in the interior, especially in Cikadu is very strong. If they say they can, then Cikadu people really do it wholeheartedly. This mutual trust becomes a guide for researchers when collaborating, the manifestation of this mutual trust is a quick response to Daris' needs regarding the components he needs. This is evidenced by the mistakes in making of the prototype, the researcher is very sure that Daris will be willing and able to fix the errors component he made, including coordinating with fellow mechanics to repair damaged motorcycle engines.

The intersection between community participation or default and design participation or compromise is acceptance. This is in the form of the hope that the design can be accepted and suitable for the community in Cikadu and can be made independently by the community of workshops in the area.

7. Conclusion and Discussion

Figure 16. Perspective Sketch and Prototype Results

Collaboration should be done if the researcher and builder obtain an agreement. The researcher's and builder activeness also require flexibility, adaptability to any situation or condition. In fact, the agreement in the prototyping process gained by revamping the understanding intimating shop drawing is not the only way to transfer the information regarding the prototype from the researcher's mind to the builder. The Solution of the drawing it is going to be used is the most important for both sides, in addition, collaboration hinted the attitude of advice accepting and trusting to both sides capability are the best way to collaborate.

Perspective sketches become a language that communicates the researcher's thoughts to the builder. The builder then provides a response or feedback to the researcher regarding his understanding of the sketches made or discussed during the making of the prototype.

The perspective sketch drawings replace the shop drawings. Shop drawings are standardized drawing language, with the aim that components or workpieces can be made by workers in manufacturing who understand the shop drawings. The case of collaboration in making prototypes in Cikadu is not manufacturing standard prototypes, but rather the utilization of the craftsmanship skills of local people who have workshop experience with the fact that there is limited knowledge of reading shop drawings.

The solution for collaborative prototyping in Cikadu was decided by using a sketch image, as an agreement on the language of the image that can be understood by both parties. Agreements on the language of sketches became an important meeting point in collaborations involving different backgrounds of knowledge, even though these sketches did not become standard in the manufacturing process so that the priority was that the process of making prototypes could be carried out. The use of dimensions or sizes in working drawings is also not shown in the prototyping process. The overall dimensions of the object are based on the logic of the dimensions of the goods placed on the container and the dimensions of the components so that the overall dimensions of the prototype are obtained. The weakness of using perspective sketches compared to the preparation of working drawings in advance is the occurrence of several errors due to the trial-error process and the incomplete detail of the perspectives made. The solution that was decided to avoid mistakes in the next product manufacture involving workshops in Cikadu was to make as-built drawings and placement of dimensions on 3-dimensional perspective drawings.

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