Design of mobile, portable and ergonomic fish smoke machine on a motorcycle

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Abstract. Built and Used On Motorcycle The Mobile, Portable, and Ergonomic Fishmaker are the design of a fish-shaped fog-shaped device transformed into a tool that is on a motorcycle. During this fuming, results are still not optimal because it still interferes with the eyes, nose, and lungs. Smoked fish is only natural without a touch of technology and innovation. The shape of this cupboard is considered appropriate because it has an optimal smoke capacity, a good level of strength so stable when the process of curing, has a practical design because it is easy to carry, dismantled and stored. This fumigation equipment uses motorcycles, with higher production capacity and socialization to the public about the use of proper and correct fish sauce. The innovation of this tool is the reduction of smoke that combines some smoke-reducing functions to be harmless but safe, comfortable and healthy for the users and effective for the products of processed seafood. Its innovative advantages are Practically shaped like cupboard, sturdy and sleek; Ergonomic can be designed and redesigned according to user size; Mobile can be taken anywhere and light; Portable can be off pairs making it easier and lighter to carry and can be used inside the house if the outside is raining; Smoke free because smoke is trapped in the cupboard and after the smoke is complete the valve can be opened then the smoke will be wasted through the chimney after that the fish can be taken; Hygienic and leave a delicious aroma on fumigation results.

Keywords: fumigation, motorcycle, portable, easy to move, ergonomic

1. Introduction
Indonesia as an archipelagic country has a vast maritime zone of 5.8 million km² consisting of 2.3 million km² of territorial waters, a territorial sea of 0.8 million km² and an exclusive economic zone waters of 2.7 million km². Indonesia has a capture fishery potential of 6.4 million tons per year. The abundant resources must be accompanied by sufficient fish processing process in order to become a leading commodity of Indonesia, especially East Java. So far the distribution of fish sales in the form of raw sales that can only survive in a matter of days only. Thus, the process of preserving fish proved capable of prolonging the rot of fish. There are various kinds of fish preservation, among others by salting, drying, filtering, fumigation, fermenting and cooling fish. The benefits of eating fish are known to many people, as in Japan and Taiwan are the main foods in everyday dishes that provide the
effect of youth and life expectancy is higher than in other countries. Fish processing as a preservation function causes people to consume more fish, one of which is the process of curing fish.

Therefore it is necessary to fish and portable fish fumes that can accommodate more fish in one curing and safe for the health of the fishermen and users even able to be taken anywhere with a motor vehicle. The solution offered to overcome this problem is by Designing Soymaker Fish On Motorcycle The Mobile, Portable And Ergonomic is a portable fish and portable fish that can accommodate more fish combined with an ergonomic motorcycle. Considering the deficiencies of prior curing tools, these fumigators must be made of durable material in order to survive longer than previous tools and through QFD and Anthropometry testing [1]–[3] to analyze the feasibility of products in terms of consumers and also ergonomic tool users.

Output targets from this research are the result of appropriate technology in the form of the Design of soymaker fish on a motorcycle which mobile, portable, ergonomic and environmentally friendly.

2. Objective and Research Benefits

2.1. Research Objective
The general objective of this research is to support the government in the program of empowering the commodities of coastal resources with easy and ergonomic methods. While the specific purpose of this research are to created a prototype design of fish motorcycle on motorcycle the mobile, portable and ergonomic with the use of motor vehicles as an effort to create a fish fog device that is mobile, portable, and environmentally friendly and apply the design of mobile motorcycle, portable and ergonomic motorcycle modulator that is mobile, portable and environmentally friendly in coastal area of East Java.

2.2. Research Benefits
The benefits of this research are:
1) Fishermen community can more quickly perform fish processing from the sea.
2) Sucker Fish On Motorcycle has advantages in terms of mobility when compared with a fish-shaped smoker.
3) Suckers On Motorcycle can sustain the economic improvement of coastal communities.
4) Sucker Equipment On Motorcycle has a large fish storage capacity in one fog process, so the output of the product is more than the conventional tool.
5) Implementation of Soymaker Fish On Motorcycle does not cause health and environmental problems (environmentally friendly), because the combustion system is done in a closed with a chimney on the top.

3. Literature Review

3.1. Potential of Coastal Resources of Indonesia
Indonesia as a state of the archipelago has a vast maritime zone of 5.8 million km2 consisting of 2.3 million km2 of territorial waters, the territorial sea of 0.8 million km2, and 2.7 million km2 of exclusive economic zone waters. Indonesia has a capture fishery potential of 6.4 million tons per year. Newly exploited at 63.5% or 4.1 million tons per year. The level of exploitation rate is still far from its sustainable potential (Ministry of Marine Affairs and Fisheries, 2009).

East Java is one of the provinces that have the potential of marine fishery resources consisting of pelagic fish and demersal fish. The area of marine fisheries management in south-eastern Java has enormous potential because it is directly opposite to the Indian Ocean and has fish potency, especially big pelagic groups like tuna (Thunnus sp) and skipjack (Katsuwonus Pelamis). Including three major coastal areas in East Java, namely Lamongan, Probolinggo, and Mojokerto. These three coastal areas produce a wide range of marine products. The abundant resources must be accompanied by sufficient fish processing process in order to become a leading commodity of Indonesia, especially East Java. So
far the distribution of fish sales in the form of raw sales that can only survive in a matter of days only. Thus, other processes such as fumigation, proven to prolong the rot of fish.

3.2. Fish processing

3.2.1. Conventional Fish Fogging
Smoking defined as the process of penetrating volatile compounds in fish produced from wood-burning [2], [4], which can produce products with specific flavors and flavors, long shelf life due to antibacterial activity, inhibit enzymatic activity in fish that may affect the quality of smoked fish. The chemical compounds of wood smoke are generally phenols (which act as antioxidants), organic acids, alcohols, carbonyls, hydrocarbons and nitrogen compounds such as nitrous oxide, aldehydes, ketones, esters, ether, and further penetrates fish meat.

3.2.2. Health Effects of Conventional Cooking Equipment
Smoking (Figure 1) is one of the livelihoods of Indonesians in coastal areas besides fishers. Fumigation is one of the traditional processes of fish preservation and anti-microbial compounds contained in the smoke from burning fuels such as aldehydes, alcohols, ketones can inhibit the growth of bacterial decay and the occurrence of protein coagulation in fish so that fish can survive from decaying bacteria. Coconut shell fuels are included in the category of hardwood species consisting of lignin, cellulose, hemicellulose, and ash with moisture content of 6% -9%. Smoke generated by the burning of coconut shells in the fogging environment is a problem that exists in the curing room fish.

3.3. Previous Research on Motorcycles
The background of this research is that the two-wheeled motor vehicle in Indonesia, called the Motor (Figure 2), is a vehicle that is in great demand by the public as a motor vehicle whose price is affordable and can be used for various transportation purposes. Starting from self-transport (1 person), along with other people (2 people), along with 2 others (3 people), husband and wife with 1 or 2 children (4 adults and 2 children), carrying gallons of water, computer, merchandise such as household groceries, bakery cakes and others [5].

The use of motors with excess capacity is not allowed in the Traffic Act and is dangerous to both themselves and other users. Some motorcycle users have tried to add parts of the motor to increase capacity, such as adding a rear-mounted box, pulling a two-wheeled train behind it, and some installing a side train permanently.
To get the right anthropometric size of Indonesian children, we can compare the size of British children with Indonesian children of the same age. From the ergonomic technique and Figure 2, we can create a scheme that shows how minimal and maximally this sidecar can be used by the child based on anthropometry that has been processed.

Figure 3 shows that the children aged 5 and 8 years can easily board a sidecar in the position of 1 person who was transported. Also, in a position where the feet can be straightened easily in a sidecar. While in children aged 12 years, the legs began to bend when on the sidecar.

| Men (95%) | Women (95%) |
|-----------|-------------|

![Figure 3. Anthropometry of a 12-year-old child in a position to climb the sidecar](image)

### 3.4. Design of Curing Equipment of Motorcycle (on Motorcycle)

Musculoskeletal symptoms were reported by 215 fishermen, followed by 6 month interval for 18 months. Exposure information is collected through field observation and in-depth ethnographic interviews that allow the potential for ergonomic stress to be identified and cataloged with tasks and work stages. Symptoms that caused work disruption in the last 12 months were reported at 38.5% of the initial cohort. Lower back symptoms are the most common cause of work disorder (17.7%), followed by pain in the hands or wrists and shoulders (7%). Symptoms in the body region are more likely to be reported among individuals who are not full-time fish, and those who work other parts of the work or throughout the year have a much lower prevalence of symptoms; both may reflect the effect of healthy workers. A number of ergonomic stressors are identified at all stages of fishing with exposure variability dictated by some unpredictable factors such as weather; but also with the type of boat, equipment, crew size, and level of experience. Reduce associated ergonomic exposures [6], [7], [8]. Working among these traditional workers is important, regardless of whether they directly cause or contribute to their musculoskeletal symptoms, or aggravate the existing pathology.
To make it easier for fishermen to smoke fish from one coast to another. So in the design of the fish smoke tool located above the motorcycle. Based on the above conditions, then comes the idea of the Ergo-Design of Fish Cultivation Tool. This tool is the stuff to process fish smoke with capacity 120 in one process. This tool has the privilege that most of the cigarette smoke does not disturb the public (environmentally friendly) is marked with a chimney that is 3 meters high so that the smoke can be wasted into the free air and does not disturb the community around the SMEs. In addition, this tool is equipped with doors that can be opened at the front and rear so easy in the placement of fish before and after the fogging process.

East Java Province has become a region capable of producing high commodity sea products, but its process is still not well developed. Lack of capital makes them unable to increase production capacity and limited marketing. They still use traditional technology.

Because of such circumstances, there are still opportunities to improve efficiency and effectiveness through Small Business Development Programs in accordance with the situation and conditions of the small industry. The design of management, human resources, production, finance, and design will, in turn, enhance the competitiveness of small industries. The existing labor force in SME Fish Production has gained the skills of making fish from years of work experience and transmitted informally.

The conventional tool used for fumigation is a tool for baking goat satay or chicken satay. This tool is not sufficient because it can only burn about 20 to 30 fish in a process of fish exfoliation. That is once the process of curing fish takes about an hour, then the condition has not been able to meet the number of orders from consumers. In addition, this tool has a shortage during the processing of smoked fish, most of the smoke disturbs neighbors or the surrounding community or less environmentally friendly.

3.5. Biomechanics
Biomechanics is a human physical force that includes the power or physical power of humans while working and studying the workings and design of equipment to fit the physical capabilities of humans when doing work activities. Biomechanics encompasses the human body as a system consisting of interconnected elements connected, through joints and muscle tissue [9], [10].

Occupational biomechanics is a part of applied mechanics that studies the physical interaction between workers with machines, materials, and equipment aimed at minimizing complaints on the muscular-skeletal system in order to increase work productivity. Biomechanics is also used to evaluate a job, so it can produce a better way to work by minimizing the force and moment charged to the operator in order to avoid work accidents.

3.6. Nordic Body Map
Nordic Body Map is one of the most commonly used forms of ergonomic checklist questionnaires to find out one's discomfort with a product or object [11]. Nordic Body Map also aims to map the level of complaints of a person as material analysis and a particular action. The questionnaire uses a human body image that is divided into 9 main parts, namely, neck, shoulder, upper back, elbow, lower back, wrist, waist, knee, and heels/feet.

4. Method

4.1. Testing Method

4.1.1. Quality Function Deployment (QFD)
Quality Function Deployment (QFD) is a methodology in the process of designing and developing products or services capable of integrating 'consumer sounds' into the design process [12], [13]. QFD is a way for companies to identify and meet the needs and desires of consumers of products or services it produces. QFD is a methodology for translating consumer wants and needs into a product design that has specific technical requirements and quality characteristics.
4.1.2. Motorcycle Anthropometry Testing

Two-wheeled motor vehicles in Indonesia called motorcycle lasim, is a vehicle that is in great demand by the public as a motor vehicle that is affordable and can be used for various transportation purposes. The physical dimensions of motorcyclists related to motorcycle design and other detail parts such as fairing or other protective devices whose effectiveness depends on the relative position of the rider's body part.

Motorcycle design provides a problem for ergonomics experts because it has narrow constraints (constrain) so difficult for them (ergonomics experts) to design a motorcycle by the size of the user's body in general [5]. There are two types of problems found in designing an ergonomic motorcycle, namely: 1. Variations in the size of the motorist's body size; and 2. Relationship attitude of the rider body with the effectiveness of work when motorists use the motor.

Information or data on the anthropometry of human sitting attitude while riding very few motorcycles in the United Kingdom (UK). Previous studies have found the fact that motorcyclists in the UK generally have a height that is not compatible with the motorcycle they use [14]. In the design of this tool, anthropometric tests will be performed [15] to identify the motorist's ergonomics and comfort level for motor designs and fish fumes installed on the motor.

4.1.3. Nordic Body Map Operator / User Testing

In knowing the user's complaints related to the smokers on a motorcycle, researchers use Nordic Body Map. The Nordic Body Map [11], [16], (Nurmiyanto et al, 2015) is an ergonomic checklist questionnaire aimed at mapping out a person's complaint level in terms of 9 major body parts, namely a) neck, b) shoulders, c) top, d) elbows, e) lower back, f) wrist, g) waist, h) knee, and i) heel/leg.

4.2. Designing Curing Equipment on Motorcycle

Figure 4 shows a fish cure tool that is mobile, portable, and environmentally friendly.

![Figure 4](image)

Figure 4. Appropriate technology in the form of proposed fish and portable fish fogging tool

5. Results

5.1. Design of Fish Cultivation Tool that is Mobile and Portable

The proposer has made the design of a mobile and portable fish fogging apparatus for immediate application. This tool will be applied to various types of motorcycles with modifications that have been determined by the proposer. In the implementation, the tool will be installed on the motorcycle seat that had previously been given a wooden plinth. The wooden board serves to protect the motorcycle seat so as not to be damaged, so that motorcycle owners can use the motor with dual function (the use of personal motorcycle and selling smoked fish).
The Curing Tool Fish on Motorcycle has a length of 81 cm and a height of 97 cm. At the bottom of the tool there is two fish storage that has been done fumigation. Each of these components has a length of 31.2 cm and a height of 36 cm. At the center has a length of 21 cm, where this size can be flexibly adjusted to the width of the seat of the motor. The design of the curing device on motorcycle is shown in Figure 5.

![Figure 5. The design of a fish smoke appliance on an ergonomic motorcycle](image)

In Figure 5, the design of Fish Curing Tool on Motorcycle is in closed condition and looks in (open). It has 7 components that include chimneys, fish bags, fogging chambers, coals, upper doors, fish storage after the smoke, and the bottom door. Chimney works to remove smoke generated from the coal, so the temperature and the process of curing fish can be regular. The next component is a fish-made iron, which is used as a place to lay the fish when the curing process takes place. Fishing contained in the fogging room, space where the curing of fish takes place. Below the fogging chamber there is a place of coals, the place where charcoal or briquettes as a coal-fired laid. Coal place is equipped with sliding doors to facilitate the user in entering the charcoal or briquettes in the process of fogging. When the process of fumigation takes place, then the top door will be closed so that the smoke and heat during the process can be evenly and stable. In addition, this tool also has fish storage that has been through the process of fogging. Thus, users can store fish that have been done fumigation and do the process of fumigation with other fish.

In the implementation, the use of Fish Curing Tools on Motorcycle to conduct the process of curing fish does not take place on a motorcycle, but the top tool must be lowered first. This tool is equipped with a sliding wheel which is useful to facilitate the top tool component that can be lowered and automatically 4wheel buffer will come out. The designs related to the separation mechanism of the Curing Tool of lower and upper fish are as in Figure 6.

![Figure 6. Separation of Upper and Lower Catching of Fish Curing Devices](image)
Figure 6 shows the design of the separation mechanism of the bottom and upper fish fogging. In practice, the bottom tool will remain attached to the motorcycle seat, while the top tool will be lowered by shifting to the process of curing the fish. At the bottom of the tool there are 4 wheel buffers that will come out automatically when this component is lowered. When the process of curing fish has been completed, the device is re-installed on the seat of the motor by bending the four-wheel buffers and restore the starting position.

6. The Next Stage Plan

6.1. Toolmaking and Testing Tools

After the finished product is made, then testing the Fish Sucker on Motorcycle to the fisherman community in Coastal Area (Lamongan, Bangkalan, Gresik, Surabaya, and Pasuruan). Testing is done directly to the fishermen community by riding a motorcycle that has been installed a fish sneakers and fish curing test using the tool. Furthermore, the researchers conducted interviews with samples of fishers who have used a fish smoker on motorcycle to fill the Nordic Body Map questionnaire so that it can be known the complaints experienced by the sample.

6.2. Evaluating Tools

A motorcycle that has been tested then evaluated to improve the design of the tool to be more ergonomic in its application. In addition, complaints felt by user samples with the Nordic Body Map method will be analyzed for consideration of design improvements.

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