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Model of Pollution Management Control in Badung River: Enhancing Role of Traditional Law on Common Resource

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Badung River in the Denpasar city of Bali Province, Indonesia, faces many challenging issues recently. As a common pool resource, the river has been under pressure from many activities including household activities which dump household wastes, and pollution externalities arising from dyeing and screen printing of fabric industries. Conventional approach to control the pollution might not be effective since it will end up in zero sum game. This paper attempts to explore the role of traditional instituion in managing common pool resource such as controlling river pollution. This research is aimed to know the effectiveness of traditional law on managing pollution of printing and dyeing industries on this big river. Survey method was used for collecting primary data and then the data was analyzed by ordinal regression to determine the effect of internal and external factors which influence the intensity of pollution. The result indicates that even though traditional might help to influence household and industry's decision making, it might not sufficient enough to reduce the pollution of the river. Other factors are influencing the waste management, such as level of waste management knowledge of the entrepreneur, the attitude of the entrepreneur toward public program especially on waste and pollution management, the financial support, and the education level of government supervision. Furthermore, Government of Denpasar City need to arrange policy that giving incentive to businessman who handling waste properly and also giving reward to traditional organization who implementing local wisdom and norm to control river pollution strictly.

Keywords

Pollution management, dyeing and screen printing industries, pollution externalities, traditional law, common pool resource

Dyeing, screen printing and other fabric related industryes in Denpasar City have grown rapidly driven by progress of tourism industries in Bali. Along with the benefits of these industrial activities which provide jobs and increase the export of Bali's products, these industries also create negative externalities in the form of pollution to the river due to the indiscriminate disposal of industrial wastes. The textile processing starting from the the production process, delivering the material and finishing the final products, all dispose wastes, therefore creating health problems to the communities. Such a problem has become evident in the the dyeing and screen printing industries at the Pemogan Village, South Denpasar District. Lack of control and regulation has driven

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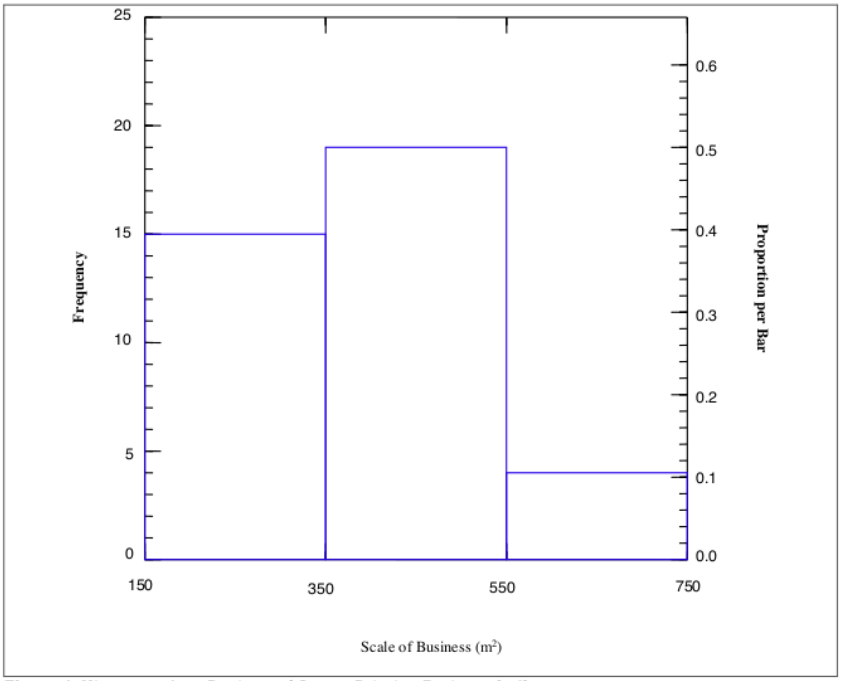

Figure 1. Histogram Area Dyeing and Screen Printing Business (m^2)

these industries to grow rapdily. As a result, enironmental problems, especially from immersion activities (coloring process on the fabric), and on dyeing activities (giving style and color to the fabric have become more serious. A study carried out by the Environmental Research Center of Denpasar City, showed that water quality of Badung River, the biggest river in the Denpasar City has been heavily polluted due to the presence of heavy metal content in the water. Waste from small and home industries such as from dyeing and screen printing industries was hazardous and toxic, and cannot be processed merely using conventional waste treatment known as IPAL (waste water treatment installation).

It is also important to note that most of dyeing and prints industries at the Pemogan Village are operating without legal permit from the government. Rather they are lincesed under traditional organization known as Desa Adat (customary village). Due to this lack of formal permit, they do not comply with pollution prevention mechanism as stipulated under Environmental Law 32/2009. The law stipulated that all industries should treat their waste water into IPAL. Therefore, when their permit is issued by customary village, their wastes are not properly treated and they have no incentives to make efforts to prevent polluting

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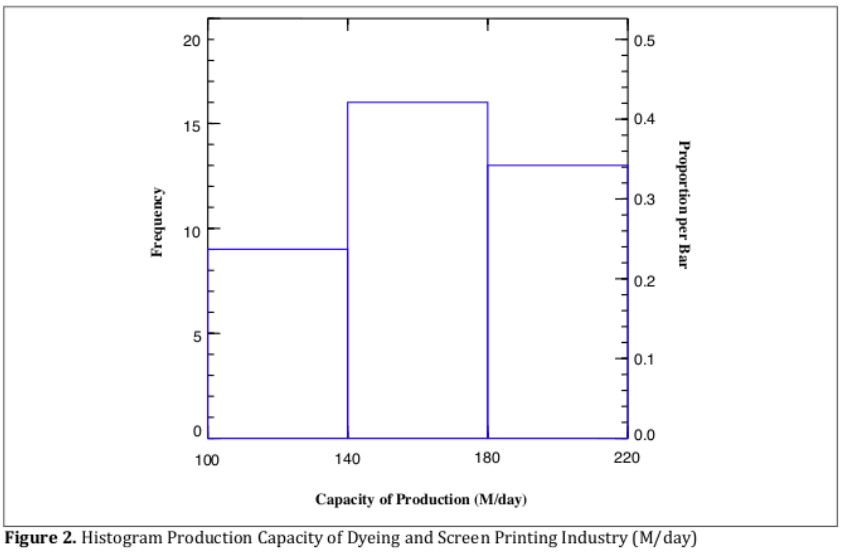

Figure 2. Histogram Production Capacity of Dyeing and Screen Printing Industry (M/day)

the environment. Studies carried out by Bali-Nusa Tenggara Environmental Regional Office and Center for Environmental Studies of Udayana University in 2006 indicated that immersion and dyeing activities in the Pemogan Village have polluted the rivers with toxic pollutant from hazardous materials.

Conventional approach to control such pollutiing industries is either using command and control (CAC) or market based approach (Spence and Weitzman 1994; Austin 1999). If CAC approach is used, the government could simply ban the industries from operationg. Similarly, heavy taxes could be imposed once the government decides to use a market based approach. Nevertheless these conventional approaches are sometimes failing to resolve the complexity of small industries (Pezzoli 2000). Recognizing this, many agencies are pursuing different strategies to control pollution (Sterner 2003; Connor and Bright 2003). One of these startegies is to use customary laws and institutions as a vehicle for pollution prevention startegies. Motivated by the role of these tradtionional institutions to control pollution, this research was carried out.

METHOD

The research was conducted at the Pemogan Village, Denpasar, Bali with the objectives are to asses waste intensity produced from dyeing and screen printing industries and to formulate the model for pollution management at Pemogan Village by means of traditional laws and institutions. Quantitatve and qualitative data in this study were gathered from a survey conducted at the village in September 2010. Quantitative data include age of respondent, production capacity of business unit, total are of operation and number of people employed. Qualitative data include education, knowledge, attitudes, sources

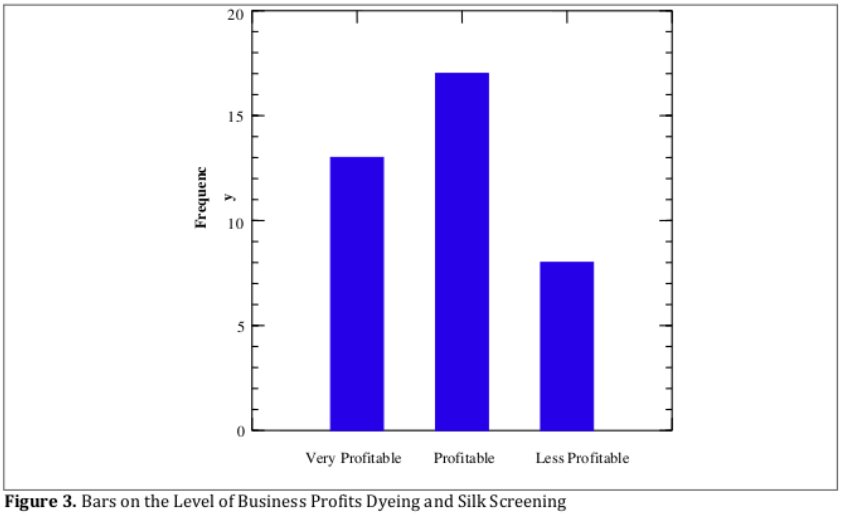

Figure 3. Bars on the Level of Business Profits Dyeing and Silk Screening

of capital, coaching and supervision from the government, and the intensity of waste management.

Data were then analyzed by descriptive and analytic approaches. Ordinal regression analysis was used to analyze factors affecting waste management such as internal factors (the characteristics of the business, and business) and external factors (guidance and supervision from the government). The choice of ordinal regression is due to the fact that the response variable, namely the intensity of waste management by businesses, was measured using ordinal scale, whereas the independent variables or predictors were measured by the ratio and ordinal scales. Coefficients estimated from ordinal regression reflect the magnitude of change in ppredictor variables jointly affect changes in response variables (Mason, Lind, and Marchal 1999).

The ordinal regression is written in the following form:

$$\text{link}(\gamma_{ij}) = \theta_j - [\ \beta_1 x_{i1} + \beta_2 x_{i2} + \ldots + \beta_p x_{ij}\ ]$$

where:

link(γ_{ij}) = link function representing dependent variable;

γ_{ij} = cumulative probability from category j to case I;

θ_j = threshold for category j;

p = sum of total coefficient regression;

$x_{i1} \ldots x_{ip}$ = value of predictor for case j;

$\beta_1 \ldots \beta_p$ = coefficient regression.

The coefficients of the ordinal regression were estimated using statistical software package of SPSS Version 15.

RESULTS AND DISCUSSION

Variable Analysis

What follows are the description as well as analysis of the variables obtained from the survey and from analysis of ordinal regression. The discussion begins with descriptive analysis of some business characteristics of dyeing and silk-screening industries

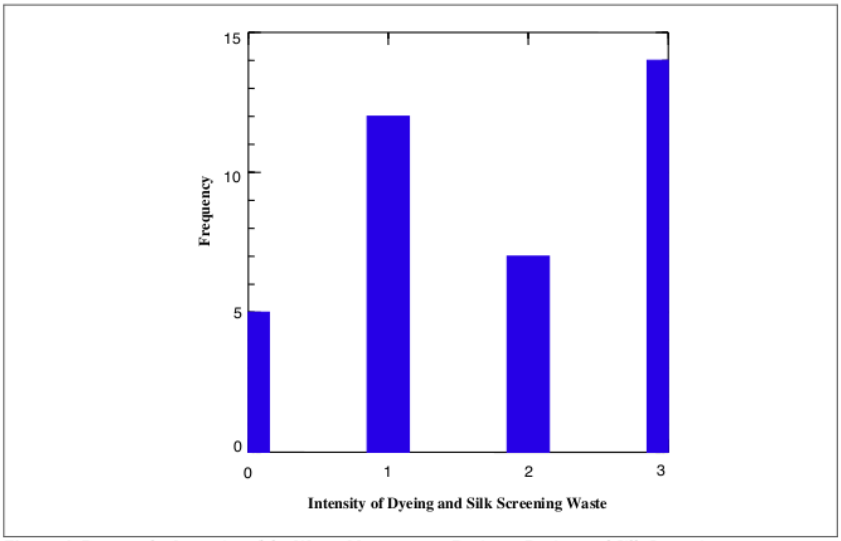

Figure 4. Bars on the Intensity of the Waste Management Business Dyeing and Silk Screening

which include the total area of business, production capacity, the amount of labor, capital resources and the level of profits. It is then followed by results and discussion from ordinal regression analysis. The descriptive analysis is also meant to figure out the behavior of explanatory variables of the intensity of waste management undertaken by dyeing and screen printing business.

The business area. The area of dyeing and screen printing owned by respondents ranges from 150 to 750 m^2, with an average area of 400 m^2. Most respondents, 50.00% can be categorized as the owner of larger busines area (350-549 m^2). Among all respondents, 10.53% are the owener of the largest busines are class (500-750 m^2), while the majority of respondent, 39.47% are owning small business area (150-349 m^2). It is commonly known that businesses area is associated with capacity of production. The greater the area, the larger the production capacity. Consequently the larger the capacity the bigger the volume of waste disposed (Figure 1).

Production capacity and profit. Production capacity per month of dyeing and screen printing industry's respondents ranges from 100 to 220 meters, with an average of 158.8 meters. Most respondents, 42.11% have a medium production capacity per day 140 - <180 M. Respondents who have the highest production capacity per day (180-220 M) are 34.21%, while those who have lowest production capacity per day (100 - <140 M) are 23.68%. To assess the profitability of the dyeing and screen printing business, three qualitative self-assessment indicators are used: less profitable, profitable, and very profitable. Majority of the respondents, 44.74% stated that their business is profitable, 21.05% stated very profitable and 34.21% said that their business have less favorable rates of return (Figure 2).

Labor and sources of financial capital. The

Table 1. Results of Ordinal Regression Analysis of Variables that Influence the Intensity of Waste Treatment in Pemogan Village

Variables	Coefficient	Std. Error	Std Wald	db	Sig.(p)
Age	-0.188	0.124	2.304	1	0.129^{NS}
Education level	-0.728	0.755	0.928	1	0.335^{NS}
Entrepreneurs knowledge	0.110	0.081	4.866	1	0.017*
Attitude	0.346	0.130	7.117	1	0.008*
Scale of business	0.002	0.005	0.183	1	0.669^{NS}
Capacity of production	-0.017	0.017	0.982	1	0.322^{NS}
Benefit	0.139	0.832	0.028	1	0.867^{NS}
Source of capital	2.099	1.337	3.463	1	0.032*
Employment	0.306	0.427	0.512	1	0.474^{NS}
Traditional organization control	0.406	0.254	2.545	1	0.041*

Source: Primary data analysis, 2010.

number of people working in dyeing and silk-screening business ranges from 10 to 20 people, with an average of 5 persons. Most dyeing and screen printing business (50%) employs two to four persons, while the remaining employs five to six people (47.37%). Only around 2.63% of the industry that employs more than seven people. As for financial sources, it is acknowledged that the major source of dyeing and screen printing business financial capital is loan from banks and their own saving, 36.84% obtained their financial sources from the bank loan, while majority of the people, or 63.16% use their own source of saving as capital (Figure 3).

Intensity of dyeing and screen printing waste. Intensity of dyeing and screen printing waste is measured by the ownership and effectiveness of wastewater used. It has a value of ordinal scale ranging from 0 to 3. From analysis, it is found that five dyeing and screen printing industries, representing 13.16% of the total industries, have no wastewater treatment plant (WWTP); 31.58% of the industries have WWTP, nonetheless these industries are known to have less effective to neutralize the waste; Industries which have proper WWTP and deemed to be effective enough to neutralize the waste is 18.42%; There are 14 industries (36.84%) which consider being very effective in neutralizing their wastewater.

Overall, the effectiveness of waste treatment of dyeing and silk screening seems to be very low, since 24 firms or 63.16% of the industries have waste management intensity values less than two. These 24 dyeing and screen printing industries have potential to pollute the river, soil and the deep-well belong to communities. Efforts are needed to reorganize and to improve waste management of these dyeing silk screening businesses (Figure 4).

Result Discussion

Table 1 presents the result of ordinal regression analysis of explanatory variables on waste management intensity. The explanatory variables include characteristics of businessman and entrepreneurs as well as guidance and supervision by the government. From the analysis, it is found that the characteristics variable of dyeing and screen printing businessman which significantly affect the intensity of dyeing and silk screening waste management are: (1) the level of knowledge; and (2) attitudes towards waste management program of dyeing and silk screening industry. Formal education of businessman, in the meantime, surprisingly does not significantly affect the intensity of dyeing and silk screening of waste management.

In general, the level of knowledge and attitudes of businessman could be categorized as medium category

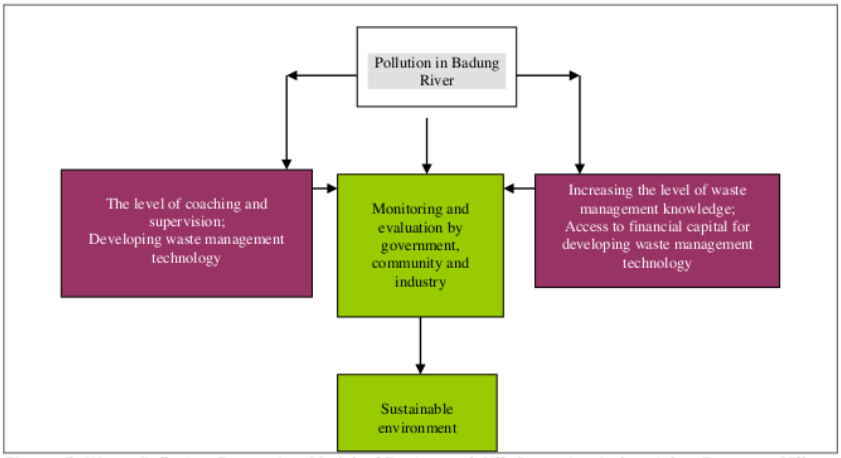

Figure 5. Waste Pollution Prevention Model of Dyeing and Silk Screening Industrial at Pemogan Village, South Denpasar District, Denpasar-Bali

which means that even though their knowledge and attitudes are sufficient, there is still tendency for them to produce pollution. Effort to increase their knowledge and attitudes towards waste management programs could be administered through mentoring and training about industrial waste management techniques of dyeing and silk screening into more environmentally friendly waste management.

Result from regression also indicates that source of capital affects significantly on the intensity of dyeing and silk screening waste management. The coefficient for this variable shows a positive sign which indicates that lower level use of capital would associate with low intensity of waste management. As is commonly known that neutralization of dyeing waste requires significant incremental cost for waste treatment. Therefore, providing more funding is critical to reduce the pollution in this case. Other variables such as area of business, production capacity, level of business profits and the amount of labor used in dyeing and screen printing business did not significantly affect the intensity of dyeing and silk screening of waste management.

It is important to note that result from regression analysis indicates that the level mentoring, supervision and control by traditional organization in terms of environmental management significantly affect the intensity dyeing and screen printing waste management. The estimated coefficient indicates positive sign. This implies that supervision and control by the traditional organization on dyeing and screen printing business especially on environmental management need to be more encouraged.

Results from analysis also indicates that there are discrepancies between the total area of business, production capacity and waste treatment system. This indicates that among business owners, knowledge about good and bad waste treatment system, as well as waste treatment technology is lacking. As in the business area, production capacity would also influence the level of business profits, which in turn affect the capacity of the industry in managing its

waste. It is expected that with larger production capacity and high profit levels, the industry will be able to build wastewater installation and would be able to manage its waste properly.

Figure 5 presents a framework model of pollution prevention based on handling waste of dyeing and screen printing industries in the area being studied. The models shows that waste management intensity of dyeing and screen printing industry depend on: (1) the level of knowledge about waste management business; (2) attitudes toward the stencil dyeing waste management program; (3) access to financial capital for developing waste management technology; and (4) level of mentoring and supervision by the traditional organization.

CONCLUDING REMARKS

Small-scale fabric industries, especially at the village level, play a significant role to local economy. Nevertheless, despite their significant in providing jobs and income for the communities, these industries also generate negative environmental externalities from the dyeing and screen printing proceses. The environmental extemality not only pollute the river, which is vital as source of water for communities, but alos might impose health hazard to communities from toxic and haradous materials dumped into the river. Conventional approach to control the pollution such as command and control by banning the industries might impose harm than good, and it might not be effective to combat the pollution. A different approach might be needed that is by empowering local institution and wisdom. This study also found that waste management of dyeing and screen printing industry will be effective if the model of controlling, monitoring and evaluate pollution take into account the following factors: (1) increase the level of entrepreneurs knowledge; (2) strengthen the positive attitude of entrepreneurs towards the management of waste program; (3) increase the level of coaching and supervision by the traditional organization by enhancing traditional law; and (4) providing access to capital sources. Furthermore, Government of Denpasar City need to arrange policy that giving incentive to businessman who handling waste properly and also giving reward to traditional organization who implementing local wisdom and norm to control river pollution strictly.

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