Journal of Natural Sciences Research www.iiste.org
ISSN 2224-3186 (Paper) ISSN 2225-0921 (Online)
Vol.6, No.6, 2016

The Risk Mitigation of Water Resources of Jatiluhur Reservoir with Green Business Continuity Management Approach

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Abstract
Jatiluhur Reservoir is the multipurpose reservoir functioning as water resources for irrigation, hydroelectric power plant, home and industry usages for the area of DKI Jakarta (capital city of Indonesia with the status of most densly populated city in the nation) and its surrounding regencies. Its existence bears other benefits to many communities such as inland fishing, tourism and water sport recreation. Last but not least important purpose, the reservoir flood has a significant role for flood control management in the area of Karawang District and its adjacent areas. Despite the many social welfares the reservoir can produce, the quality and quantity of water resources from Citarum River to the Jatiluhur reservoir bear some problems that affect some challenges in the water management. This research attempts to identify the real critical pulse of the problems by analyzing its business process in the water resources management along with their risk and impact that may affect the vitality of the business outcomes. The analysis approach for this study is using the standard of green business continuity management (GBCM) where all the of environmentally polluted/harming items are considered. Respondents are experts in the reservoir along with its business process and environmentalists. As for the technique of analyses itself, it employs descriptive analysis, decomposition trend analysis and business impact analysis (BIA). The outcome of this qualitative and quantitative research indicates that the strategic positioning of Jatiluhur as the national function to serve all the precedings turns out to be at critical stage. There are some discouraging signs that are found to be significant in this study such as 1) secondary disruption in the irrigation channel, 2) poor water quality,3) conflict of water use, 4) sedimentation, 5) damaged floodgates 6) absence of pipeline at the open channel, causing an alarming deterrent to the normal flow of water discharge. Hence, the status of the reservoir can be concluded as clear and present danger. The GBCM recommendation offered to counter measure the degradation of water quality and quantity is by having the participation of community stakeholders involved in reaching a uninamous future maintenance standard that meets enviromentally sound ordinance.
Keywords: Jatiluhur Reservoir, GBCM, Risk Management, Water resources

1.0 Introduction

1.1 Background

Jatiluhur Reservoir as one of the biggest reservoirs in Indonesiaandas multifunctional, stem the flow of Citarum River in Jatiluhur sub-district, Purwakartadistrict, West Java province. The main function for irrigation of paddy fields of approximately 242,000 ha, the drinking raw water supply of DKI Jakarta and its surrounding,the power plant with the installed capacity of 187.5 MW, the flood control especially in the district of Karawang and Bekasi, the water supply for industry and for aquaculture inland fishery, the tourism and the water sport (PJT II, 2015). Even that is no less important is as a source of drinking raw water supply for PDAM and PAM Jaya and its surrounding of 85% depending on Jatiluhur Reservoir (PJTII, 2014 and PAM DKI Jakarta, 2012).

Disruption to the functions of Jatiluhur Reservoir can cause the great harm such as the destruction of power plant, not being overcome of the flood in the district of Karawang and Bekasi, the disruption of irrigation system, the disruption of water supply for local residents, the damage to aquaculture, and the disruption of tourism activities. The disruption to the function of the reservoir can be influenced from the internal and external problemsand also the dam physically (the damage of operational system of the dam), the threat of natural disaster (flooding and landslides), the conflict of social, the sabotage, the upstream industry or activitys of other human activities both in the upstream and in the dam water. The situation, besides may cause cause casualties, also can inhibit the activity, cripple the business activity, the main thing is the interruption in the supply of water resources from Jatiluhur Reservoir which can threaten the stability of the country. Therefore, it is required integrated water resources management with the approach of the multi-criterion decision making analysis (MCDM) (Geng and Robin, 2013, Maarif, 2003) in order that Jatiluhur Reservoir can still perform its basic function although there is a disruption or disaster in order to protect the interests of shareholders and stakeholders.

The meaning of BCM,as described by Business Continuity Institute (BSi 2006 andBCI 2008),stated:
"*Business continuity managementis an holistic management process that identifies potential impacts that threaten an organisation and provides a framework for building resilience and the capability for an effective*

response that safeguards the interests of its key stakeholders, reputation, brand and value creating activities."

From the above definition, it can be concluded that the business continuity management is the practices undertaken by an organization with the goal to identify a series of threats, both from the outside and from the inside of activities of an organization, and to provide the instructions and measured needed to prevent, prepare, respond, continue, restore, repair, andhave a transition from a state of crisisin a consistent way back to its original statein accordance with the organization's strategi objectives. BCMis designed to protect the critical business process toward the failure, the natural disaster or which is created by humanand due to the loss of capital in relation to the availability for normal business processes (Peterson 2009). BCM can be said also as a strategy to minimize the effect caused by the crisis situation (Bonafade, 2007 and Seow, 2012).

In Kawamura and Nakatani (2012), BCM is rather seen as a system that supports the business continuity in the estimate of the disaster that would occur as a prototype system implemented to help control the damage and how to fix it when the disaster strikes. The basic principle of BCM is fast, precise, integrated, minimizing the impact of disaster and serviceso as to ensure the operational activities of Jatiluhur Reservoir to the community in a sustainable manner. The strategy of BCM is to conduct the integrated and sustainable mitigation, to apply the one command system, to involve the active role of all work units, and to cooperate between units of work, to intensify the socialization, the training and the integrated and testing to the entire working personnel (Quirchmayr 2004) in Jatiluhur Reservoir and to cooperate well with the related external institutions. The natural disaster which is often happening in West Java areaprovides lessons that are still plenty of room improvements that need to be done toincrease the effectivity of disaster handling in West Java area, specially Jatiluhur Reservoir having the vital functions both for water and power generation. Not only technical aspect, but also it includes the matters related to leadership and strategic management.

Green Business Continuity Management (GBCM) or BCM based on environmentally friendly which refers to the awareness of the importance and the appropriateness of the pollution prevention and the use of green technology (Gang 2011). GBCM is one approach to tackling the problem of business interruption, where BCM itself is the process of maintaining the continuity of operations or critical business processesat the time of interruption of business experience. GBCM requires knowledge, know how and practical experience regarding the environment control can be immediately transferred in GBCM. The main factor of the lack of environmental awareness is a latent risk, so that it is necessary to have GBCM. GBCM is BCM who prefers the concept of environmentally friendly and sustainable technologies. So that GBCM needs the knowledge, know-how and practical experience about the environmental control that is quickly transferred to GBCM (Gang 2010). As the definition expressed by Karagülle (2012), the green business is as a business practice which is environmentally friendly evaluated. In its practice, it may include the use of organic material and natural productsin building facilities, strictly protecting against the threat of emissions, being environmentally responsible to the supply of resouces and the organizational design as well as the processes should be more efficient and economical in using the resources. Unfortunately, it has not been so many theories about GBCM and not explained comprehensively. Mitigation of water resources management with the Green Business Continuity Manegement approach is necessary to be done, but in the literature search it is slightly found.

1.2 Aim of Research

The aim of research is to analyze the critical business processof Jatiluhur Reservoirmainly related to water resources management andto analyze the risk and impact toward the vital business.

2.0 Methodology

This research is conducted in Perum Jasa Tirta II (PJT-II) as the manager of Jatiluhur Reservoir, especially in the Managing Division of Dam (Division IV) and Sub-System of Irrigation of the Channel of Tarum Barat. The research location in Jatiluhur sub-district, Purwakarta district , West Java. Recalling the potential and the crisis threat which is bigger happened in Sub-system of Tarum Barat, it is seen from the status of poor water quality in the upstream. The time of data location is done in June 2014-December 2015.

Primary data are obtained from interviews and discussions with key person, especially with the managers of the dam and sub-systems of the channel of Tarum Barat, the management of several companies and managers of the industrial areas of Cikarang related directly with the channel of Tarum Barat and several practitioners of the drinking water management (PDAM and Perpamsi), especially related to critical factors and the risk analysis as well as the critical management related to the management of water resources of Jatiluhur Reservoir. The secondary data from the data of the result of observation, mainly the data of hydrology, water balance, discharge and the Company Report of PJT II published.

This research is part of a research dissertation author with complete research framework as follows:

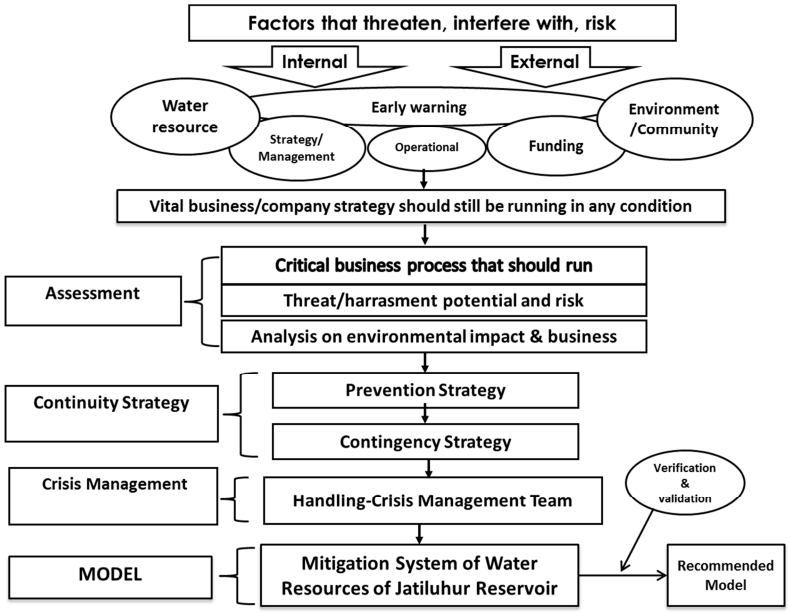

Figure 1. Conceptual framework of the research

The data analyses used is the analysis of descriptive statistics, the trend analysis with the decomposition method for the forecasting of the balance of Citarum Watershed for the next 15 years. The analysis of risk management with risk assessment and green businesss impact analysis as the approach of modified enterprise risk management integrated and businesss impact analysis (BIA) (COSO 2004, BSi 2012 and The NS Emergency Management Office 2012) using the indicator of risk/impact toward the environment. Business Impact Analysis (BIA) is the important component from the direct plan of a business organization (Bonafade 2007), namelythe component revealing the vulnerability of activities undertaken and developing the planning strategy for minimizing the risk. The identification of the type of disaster and the magnitude of the damage caused, the level of dependence of recovery uses Business Critical Quetionnaire. The analysis by rating with the green businesss impact analysis based on the level of severity multiplied by the possibility of likehood will produce the risk rating. The value of risk rating can be made a reference for the following action, mainly for mitigation toward the emerging impact (technical, financial, and other impacts).

Risk map-green business impact analysis is calculated based on the result of justification of key person toward the fourth critical business factors above based on the value of risk rating. The rating value is obtained from the result of the multiplying of the risk of the possibility of likelihood/probability with its impact/severity (risk rating = probabilityx severity). The score of the probability value is of 1 to 5, namely 1=Improbable (Rare), 2=Remote (unlikely), 3=Occasional (moderate), 4=Probable(likely) and 5=Frequent (Almost Certain) and the value of severity1=negligible (insignificant), 2=Low (minor), 3=Moderate (significant), 4=Significant (Major) and 5=Catastrophic (Severe). This method is a slight different from the method to calculate Heat Map from Water Risk Assessment asA Practical Approach for Financial Institutions (WWF 2011), mainly on the value scale of 1- 3 (low-high).

3.0 Result and Discussion

3.1 Critical factors of Water Resources Management of Jatiluhur Reservoir

Based on PP Number 7 2010, the meaning and the objective of the existence PJT II are to carry out and to support the policya and the government program in the economy and the national development mainly in the utilization and management of water resources, andthe optimalization of the use of company resources to produce the goods and services based on the principles of sound corporate management. Aside from that, the company is expected to be the motivator in order to encourage the economic growth in the surrounding community.

To be able to run the function, PJT-II for 2014 has conducted the business activities as follows:

- General Services for Irrigation Management for the paddy fields of approximately 242,000 ha.
- Electrical Power Production Business (power plant) with the installed capacity of 187.5 MW. Electricity production of $1.00{,}14x10^6$ kWh, where 80% is sold to PT PLN with the price of Rp 300/kWh, while the rest is to be used by the company.
- Raw water supply distributed to PDAM District, PAM Jaya, and industrial area in the working area of PJT II.
- Flood control in the district of Karawang, Bekasi and Jakarta.

- Test Laboratories and Heavy Equipment Rental.
- Management of Watershed.
- For aquaculture of inland fishery.
- Tourism Business at the reservoir site.
- Water sport.

Based on the result of deep interview with the management of PJT II as the company having the full authority toward the management of Jatiluhur Reservoir and strengthened by the justification of experts (key person), both from the representatives of the management of PJT II, the practitioner of PDAM, and Executive Derector of PERPAMSI (The Drink Water Supply Association of Indonesia), Industrial Representatives of Jababeka and Local Government in this case represented by The Environmental Management Agency of West Java. From the eighth functions above after analyzed and discussed by the main tasks, the level of interests and the strategic function and the business of PJT II as well as the threat and impact if not running properly. Then the critical business processis seen from GBCM of the management of Jatiluhur Reservoir and the existence function of PJT II, namely there are four main functions:

- The availability of water for irrigation, as the national strategic function.
- The Raw Water Supply distributed to PDAM District, PAM Jaya, and industrial area which is in the working area of PJT IIas the business function.
- The power plant as the business function and the strategic function.
- The flood control mainly in the district of Karawang and Bekasi as the national strategic function.

On these four functions illustrated in Figure 2. Meaning, the existence of Jatiluhur Reservoir managed by PJT II as the provided of water resources having the vital function. The four functions if not running properly and well, it will have a direct impact and far-reaching.

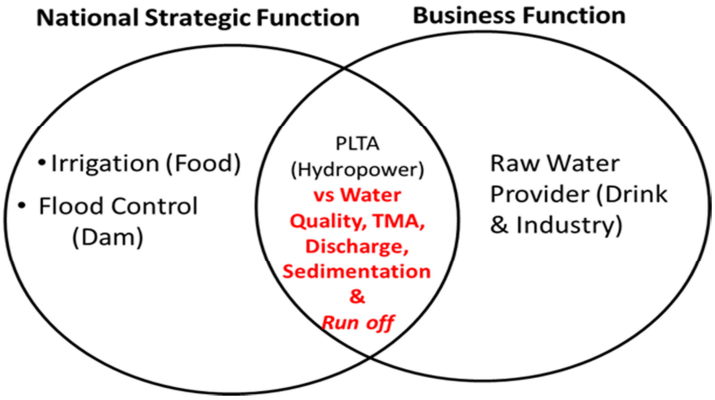

Figure 2. Vital business function or critical and strategic (critical process business) of the management of Jatiluhur Reservoir and the function of the existence of PJT II

The function of Jatiluhur Reservoir managed by PJTII is the main water supply for irrigationhaving the national strategic function and also the social function. This is because West Javais mandated as the national granary and the largest in Southeast Asiareaching ±242,000 Ha. If the water supply of Jatiluhur Reservoir is disturbed and the community cannot irrigate the paddy fields, for example High Water Level (TMA) is below the standard set (<76 m above sea level) or the extreme the drought of reservoir, then the earliest risk is paddy water shortage or conditioned droughtthus threatening the crop failure (advanced risk) and if the distribution of this widespread occurence of water shortage then at the community level about irrigation can be the seizure of water (water conflict) even it is also possible the occurence of mass demonstration. The condition has a direct impact on PJT II namely the risk of the change of Directors because the company is regarderd as failure to carry out its function. The impact which is broadly or Nationally is to disrupt the food supply and the economy, especially in West Java.

Based on the data of Water Balance of Citarum River period of 1990-2008, the volume of the flow of Citarum River is fluctuated and tends to decrease, even in 1997 and 2006 it happens the extreme condition with the lowest volume so that the water balance of Citarum River becomes negative (deficiency) of -378.13Milion $M^3$and -47.76 Million M^3. Meanwhile, the government program for increasing the food security throughthe expansion of paddy fieldsrequires sufficient irrigation water, plus more water needs fordomestic which continues to increase as the population growth.

Data on 1990-2008 show the flow of Citarum River tends to decrease in every year, and predicted for the next 15 years it will continue to decrease. Meaning, the volume in Million M^3 is predicted to continue to decrease from year to year, wherethis is caused by several factorslike the increase of population, the occurence of land converion (deforestation in the upstream) so that the catchment area is decreasing, the silting of the river

and the damage of the watershed in the up stream as a result of high settlement activity. While, other river flow hasthe fluctuated pattern but tending to increase although slightly (Figure 3).

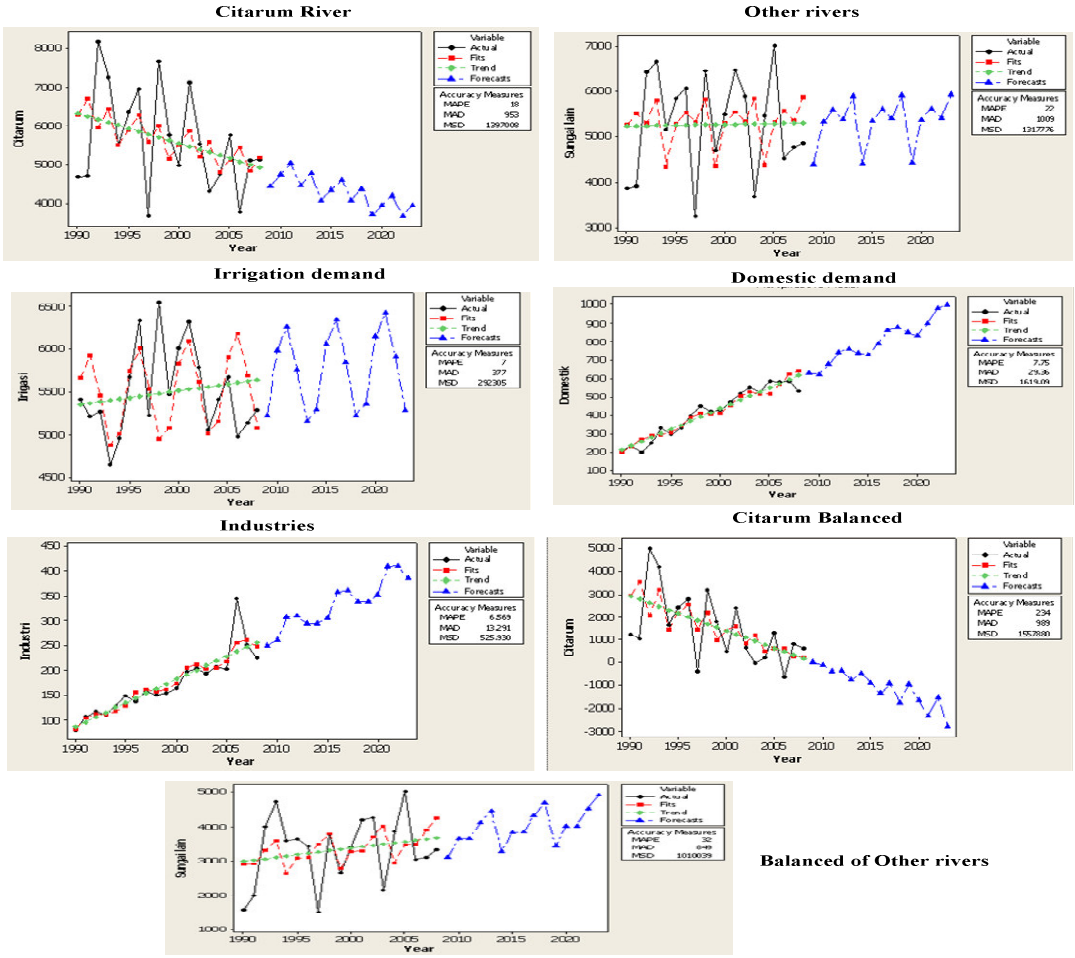

Figure 3. The Forecasting of the balance of Citarum watershed of the next 15 years

Based on Figure 3, the projection result (forecasting) with the decomposition method can be expected in the future, the potential of water resources availability both for the irrigation and for the drinking raw water will continue to decrease. This is because the volume and the flow discharge of Citarum River continue to decrease due to the silting of river, the erosion, the sedimentation, and the high run off, while the demand continues to rise. On the other hand, the water quality status of Citarum River and the water of Jatiluhur Reservoir are heavily contaminated which have threatened the availability of water resourceswhich are worthy for irrigation and raw water (BPLHD West Java 2010). It is also clarified Riani et al., (2014) was that the pollution caused by heavy metals in waters Saguling and Cirata (Riani, 2015) which is the upstream reservoir Jatiluhur which adversely affected the life of the organism as a teratogenic effect, which resulted in reproductive disorders that cause unviable embryo, death, and etc. This means that pollution in the dam water is a serious problem, not only resulted in poor water quality, but threatens the life of the organism in it and threaten the living creatures that consume them sooner or later.

3.2 Risk Assesment and Green Business Impact Analysis

Fourth vital or critical business function and strategic from the management of the water resources of Jatiluhur Reservoir if analyzed by using BIA (Seow 2012) applied with the approach of risk indicator toward the environment damage (environment risk indicator) in this case the writer names it the risk map-green business impact analysis of Jatiluhur Reservoir. The mapping result (risk map) produces the risk rating for each critical factor of Jatiluhur Reservoir (Figure 4).

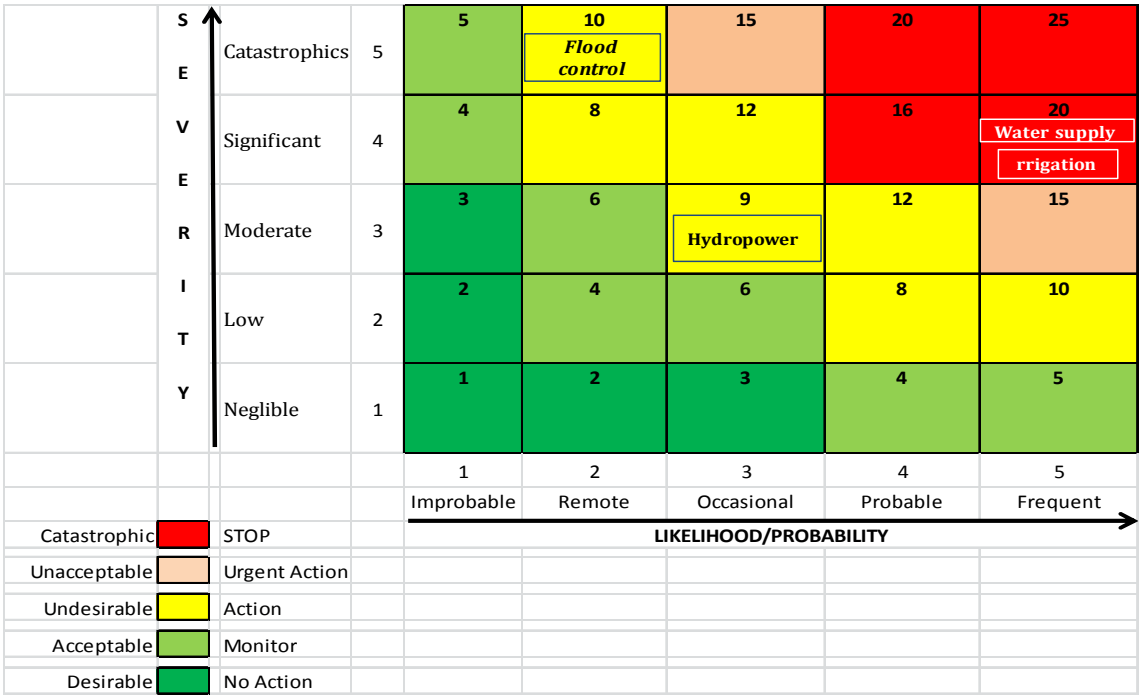

Figure 4. Risk Map - Green Business Impact Analysis of Jatiluhur Reservoir

In Figure 4 it shows that the critical factor which has a value of the highest risk ratingamounting to 20 (extreme) and must be stopped, where it happens often happens (almost certainly the case) and the impact is significant. This extreme or very high rating happens to the function of Natural Resources for irrigation and the supply of raw water both for drinking water and industrial water. Meaning, the second strategic functions should become the major concern, because it is already included in the category of crisis toward disaster. For the function as PLTA (hydropower), which is still in the safe condition, it must remain vigilantbecause it has already a risk rating of 9 (Undesirable). This is undesirable because if the turbine is not functioned it will disrupt the electricity power supply sold to PLN, so it can lessen the income. The flood control function as the flood control also has the rating of 10 (Undesirable), meaning it must be vigilant because it is not continuously monitored it can dangerous, mainly in the rainy season.

Risk Map in Figure 4 from four business activities having the strategic function is also explained in detail per topic in accordance with the current condition. For the irrigation function (Table 1), the very serious threat is the disruption along the channel of secondary irrigation is caused by the silting of the channel due to the sedimentation, the hyacinth, the algae/plants that grow at the base of the uncontroled channel causing the water cannot irrigate the paddy field well. The thing occurs continuously and becomes the big problems in the maintenancen because it should be done continuously along the year and immediately, it needs the energy, time and high cost. The total channel should be maintained, the length is reaching 2,500 km. If the channel is not maintained well and the farmer's field is not irrigated, so it can trigger the conflict by the farmer community and it can be in crisis.

Besides the secondary channel problem, all topics of risk and threat for irrigation need to get attention, boht in water quality problem, the sedimentation problem, the damage of Floodgates, the conflict of water interest and the culture/habit of the community of West Java who want to be always inundated the paddy field, different from the behavior of the farmer community of East Java. Even the water discharge irrigated the farmer's field in West Java is usually minimal 1 liter per second, it can be reduced with the system of optimum allocation of water need for the agriculture with the innovation of intermittent irrigation technology (Rejekiningrum, 2013).

Table 1. Map of Risk and Impact (Heat Map) for the Availability of Irrigation Water

Topic	Description	Likelihood	Severity	Mitigation
Availablity of Irrigation Water		(SCORE = 20)		
1. Disruption of Secondary Channel /the channel is not maintained.	• Disruption along the channel of secondary irrigantion is caused by many hyacinth, algae/plants that grow at the base of the channel & uncontrolled causing the waternot reaching the last rice terrace, to become the biggest problems in the maintenance (routine & high cost) & can trigger the conflict.	Frequent (5)	Catastrophic (5)	It is necessary to have the routine maintenance and to cooperate the farmer and the related institution and the community leaders to maintain together, to minimize the fertilizer and the organic material in order to be not wasted to the channel.
2. Water quality status	• The status of quality of water is heavily polluted by the physical and chemical parameters, and the poisonous material threatens the agricultural productivity and the ecosystem.	Frequent (5)	Significant (4)	It must be the strong action and sanction for the noncompliance, the empowerment of community to become the curbing of KJA.
3. Water conflict	• The conflict level of the water seizure not only on the level of rice farmer but also the breeder, the industry and the population.	Frequent (5)	Low (2)	The curbing and strong sunction for the noncompliance and the new technology education
4.Sedimentation	• The height of run-off as the result of change of the land function in the up stream causes the silting of the river body and the flood in the watershed.	Frequent (5)	Significant (4)	It should be the strong action and sanction for the noncomplince, the empowerment of community to become the curbing of KJA in accordance with the feasibility.
5. Floodgate	• The damage of the divider door of irrigstion water that is far from the main and secondary channels.	Frequent (5)	Low (2)	Checking and routine maintenance.
6. Cultural threat /Mindset of farmer	• Farmer in West Java has the culture or the habits of paddy should always be inundatedof ≥ 15-20% and the water dischargeof ≥ 1 liter/second.	Frequent (5)	Moderate (3)	It is conducted the education, the building and rasing the public awareness mainly the the result of research of optimum allocation of water need for agriculture with the innovation of intermittent irrigation technology.

Special for the topics which risk rating value of ≥ 16 or extreme (Catastrophic) need the attempt to stop or prevent the occurence immediately (STOP), because it was seen from the cost if it is let or no preventive action it can threaten the living continuity of business, the prolonged crisis to a disaster. While from the time side, the lateness in the handling cana danger the living continuity and from the quality side, the outcome of the business/project activity is no longer useful orcannot be used. Meaning, if the condition of strategic function or business until this level, the crisis can not be overcome in the quite long period; the normal business will be stopped, this category is named the disaster in GBCM, signed by the red color. Mitigation that needs to be done needs the routine maintenance and cooperate the farmer community and related institution and the community leaders to maintain together, minimizing the fertilizer and the other organic matterin order not to be waste to the channel.

For the risk rating of very high or unacceptable with the value of 15 (orange color approaching red), the cost requires the significant funding allocation (loan), while the time can happen the failure to fulfill the key deadline in relation with the annual budget or the strategic plan. Meanwhile, from the business quality, it can happen the failure to fulfill the need of some stakeholders. In this level, the business enters in the crisis category which has a wider impact or the longer term; implied in the business. While for the risk rating, it ranges 8 – 12 entering the undesirable category, it is necessary to be careful and need the follow-up and the prevention.

The main business function as the raw water supply shows the serious problems, because it enters the extreme category (crisis toward disaster), it should be overcome and stopped, mainly related to the water quality (Table 2). Because the Water Quality Status (Turbidity, Physical, Chemical, Biology Parameters and Poisonous Material) is heavily polluted and enters the disaster category in GBCM, so it needs the follow-up and action plan. Mitigation done is it should be strong action and sanction for the noncompliance, the empowerment of

community to maintain the environment and it is conducted the curbing offloating net (KJA) in accordance with the feasibility or the carrying capacity of the dam water area. Even Sharma and Singh (2015) more pointedly stated that with the increasing in anthropogenic inquisitive as a concern of disregard to the socio-cultural values of water reservoir, there is increase in quality deterioration of their water. Because the increases in anthropogenic activities contribute to the accumulation of hazardous chemicals, such as heavy metals, in the environment (Hamzah *et al.,* 2015, Lias *et al*., 2013; Ismail, 2006; Tucel *et al.,* 2007)

For the waters of Jatiluhur Reservoir, ideally the number of KJA is only 4,040 swath, while at the moment it reaches almost 31,000 swath. PJT-II as the owner of authority of Jatiluhur Reservoir collaborating with the Local Government of Karawang District and Local Government of West Java and supported by Ministry of BUMN and Ministry of Public Worksshould be able to stop, of course by strong and elegant ways.

While for the problem of open channel and no pipeline, it should be the central government preparing the infrastructures and the pipeline of raw water from the time of Jatiluhur Reservoir to PAM Jaya or industries in the downstream, specially in the work areas related to the main channel of Tarum Barat. If there is a possibility because the real business of PJT-II can explore the business cooperation (B to B), for example with PAM Jaya or even with Local Government of DKI Jakarta or even the private sectors.Because if from the government program based on the data of Ranking of Infrastructural Project Based on Criteria contained on RPJMN 2015-2019 with the financing scheme of APBN/APBD and BUMN none of which are specifically infrastructure which directly addresses the problems of clean water, specially in West Java and Jakarta. For the problems of high run off and water discharge are starting to decrease, the thing needs to be overcome comprehensively involving the entire related stakeholders. Which in essence is the mitigation done is the Maintenance of Watershed in the upstream and the law enforcement and the strong sanction.

Table 2. Map of Risk and Impact (Heat Map) for the raw water supply

Topic	Description	Likelihood	Severity	Mitigation
Raw Water Supplyof PDAM/PAM and Industry		(SCORE = 20)		
1. Water Quality /Water Quality Status (Turbidity, Physical, Chemica, Biology Parameters and Poisonous Material)	• Turbidity in water body causes the selling value of raw water to the water company or the low industry. • The water pollution with the physical and chemical parameters causes the selling value of raw water to the water company or the low industry.	Frequent (5)	Catastrophic (5)	It should be a strong action and sanction for the noncompliance, the empowerment of community to maintain the environment, the curbing of KJA in accordance with the feasibility.
2.Open channel and no pipeline.	• No direct pipeline from the waters of Jatiluhur Reservoir to PAM/ industry.	Frequent (5)	Significant (4)	• It is necessary to have the routine maintenance and cooperate with the farming community and related institution and the community leaders to maintain together. • Investment of Pipeline.
3. High run off.	• High/big run off causes the water not saved.	Frequent (5)	Significant (4)	Maintenance of Watershed in the upstream and the law enforcement annd the strong sanction.
4. Water discharge (m^3/second) is decreasing.	• Water discharge is continuously decreasing, the need is increasing at the time of the water discharge or water speed per second is not the problem and seldom occured, but based of the plan of Jatiluhur Jakarta pipeline water demand 2030.	Probable (4)	Significant (4)	Maintenance of Watershed in the upstream and the law enforcement and the strong sanction.

For the map and the risk rating related with the main business function, the management of water resources of Jatiluhur Reservoir as the hydroelectric power plant with the risk rating of 9 entering the undesirable category and in GBCM is called the incident. Meaning the strategic function of Jatiluhur Reservoir as PLTA keeps moving, but it should be always vigilant because the threat of the turbine damage is often happened, in its implementation PLTA in Jatiluhur Dam there are six turbines and not all operated, and two turbines are made as the backup (Table 3).

Table 3. Map of Risk and Impact (Heat Map) related to PLTA.

Topic	Description	Likelihood	Severity	Mitigation
Hydroelectric Power Plant (PLTA)		(SCORE = 9)		
1. Water quality status (especially the chemical and physical parameters)	• Water quality status which is poor especially the chemical parameter can cause the corrosion.	Probable (4)	Significant (4)	There must be strong actions and sanctions for noncompliance, the empowerment of community, to be the curbing of KJA in accord with the feasibility.
2. Height of Water Level (TMA)	• The height of water level which is fluctiated but stil in the safe and controlled condition (86-107 m dlp)	Probable (4)	Moderate (3)	It has been SOP and the system is always monitored.
3. Water Discharge (m^3/second) is continuously decreasing.	• Water discharge is continuously decreasing, the need is increasing (the water discharge is decreasing).	Occasional (3)	Low (2)	Maintenance of watershed in the upstream and the law enforcement and the strong sanction.
4. Turbine Maintenance	• Due to the bad quality often causes the corrotion on the turbine and the Floodgates.	Occasional (3)	Moderate (3)	Maintaining the water quality of reservoir and the routine maintenance.

Map and risk rating related to the main business function of Jatiluhur Reservoir as the flood prevention with the risk rating of 10 also including to the category of undisirable and in GBCM it is called in the incident category. Meaning, the strategic function of Jatiluhur Reservoir as the flood prevention for Karawang District and its surrounding remains a major and must always vigilant because the flood threat can always happen, mainly in the rainy season (high rainfall). To overcaome the matter, PJT-II together with Local Government of West Java conducts the maintenance of watershed in the upstream and conducts the conservation and the Government conducts the law enforcement and the strong sanction. In detail, the related topic with the main function as the flood control and the heat map and its mitigation can be seen in Table 4. To handle the high fluctuation of water level (*morning glory*) actually it has been the operational standard of procedure (SOP) and the work instruction, namely the work instruction of operation for carrying out the opening and the closing of the Hollow Jet Valve (PJT II 2012). This is done to fulfill the need of irrigation water in accordance with the Team of Coordination of Water Resources Operationand when the time of the water is not excluded through turbine or the capacity of water turbine expenditure exceeded. Likewise the emergency disaster management procedure (incident), when an incident occurs procedurally already contained well within SOP companies and always observed. For handling the issues such as Ubrug Spillway, when Curug Dam and Walahar Dam should open and close all also been contained in SOP Company (PJT II 2013). Therefore, it is very clear who is responsible and how the workflow is already stated clearly, but everything is still very operational and procedural.

Table 4. Map of Risk and Impact (Heat Map) related to the function as the flood control.

Topic	Description	Likelihood	Severity	Mitigation
Flood Control		(SCORE = 10)		
1. Rainfall	Due to the high rainfall, the catchment area and thewatershed in the upstream of Citarum River is damaged.	Occasional (3)	Significant (4)	Watershed maintenance in the upstream and the law enforcement and the strong sanction and conducting the conservation.
2. Height of Water Level (*Morning Glory*)	High fluctuation of the Height of Water Level.	Remote (2)	Catastrophic (5)	It has been SOP and the system is always monitored.
3. Ubrug Spillway		Improbable (1)	Catastrophic (5)	Idem
4. Curug Dam		Improbable (1)	Catastrophic (5)	Idem
5. Walahar Dam		Improbable (1)	Catastrophic (5)	Idem
6. Concrete corrosion	The impact of water which is polluted can be in corrotion to become the concrete.	Improbable (1)	Low (2)	The lessening of pollution/the repair of the water quality mainly H_2S
7. Threat of decreasing the dam surface	The assessment result of the dam since the founding, the height of the surface has been low of 2.5 m.	Improbable (1)	Low (2)	It should be done the dam assessment.

Special for the problem of concrete corrosion threat on the body of the damdue to the water pollution in the dam water, special for the chemical content, the company management should conduct the preventive action and conduct the immediate action, for example through the reduction of pollution/repair of water quality in the dam water mainly H_2S and chemical compound which is corrosive and dangerous. Similarly for the problem of the threat of the decrease of dam surface since its founding has reached 2.5 m also worth noting

through the dam re-assessment. Therefore, the event which can threaten the dam function as the flood control, PLTA, the irrigation and the source of raw water can be always maintained and can be known early. So that the preventive steps can be done soon, avoided from the event and can minimize the risk (Boecmer, 2009 and Gang, 2011). Therefore, the crisis event moreover to become disaster can be avoided.

This is the important role of GBCM of a company or business unit or other strategic institution so that the potential threats to the organization and the impact on the business operation can be identified faster/early. If it is realized, it can provide the guidelunes and steps needed to prevent, prepare for, respond to, resume, recover, repair, and so that the organization can still operate properlyin accordance with commitment and strategic objectives of the company. GBCM can provide a framework to build the resilience of the organization with the ability to respond effectively which can safeguard the interests of key stakeholders, reputation, brand, and other value creation activities. Therefore, the approach of GBCM can be a strategy to minimize the effect due to a crisis situation and the management of water resources in Jatiluhur Reservoir can continue and go well.

Conclusion and Suggestion

Conclusions

- The critical business processof water resources management of Jatiluhur Reservoir is to maintain the availability of irrigation water, as the provider of raw water for drinking water processing especially PDAM and DKI Jakarta, hydropower, and flood control for Karawang district and its surrounding.
- Threats and risks as well as endangering the greatest impact on the functioning of irrigation and raw water provider, because it can threaten food security, clean water crisis, threatening economic stability in fact, even the country's stability.
- The threats which are very serious on the irrigation of raw water supply are:
  - Disorder along the secondary irrigation channel is caused by silting of the channel due to sedimentation, many plants that grow at the base of the uncontrolled channel (hyacinth, algae, etc).
  - Poor water quality of Jatiluhur Reservoir.
  - High maintenance cost of irrigation channel, Floodgates, turbine and water processing because the maintenance is continuously along the year and needs a high effort.
  - The susceptible of the event of the conflict of water seizure.
  - Open channel and no pipeline.
  - High run off.
  - The water discharge and its volume is decreasing.

Suggestion

- It is necessary to have the routine maintenance and immediately especially toward secondary irrigation channel and water quality, to establish the cooperation between the farming community and the related institutions (stakeholders) and the community leaders for keeping together the irrigation channel, and minimizing the water pollution.
- Mitigationdone should be strong action and sanction for the noncompliance, the empowerment of community, the curbing of KJA in accord with the feasibility or the carrying capacity of the dam water.
- In order for the quality and availability of water are more maintained, it is necessary to have the development of infrastructures through the pipeline of the water channel of Jatiluhur Reservoir to PAM Jakarta and industry.

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