Reporting from the Field: Vietnam

Integrated Polices for Fish-based Eco-Industrial Cluster Development in Vietnam

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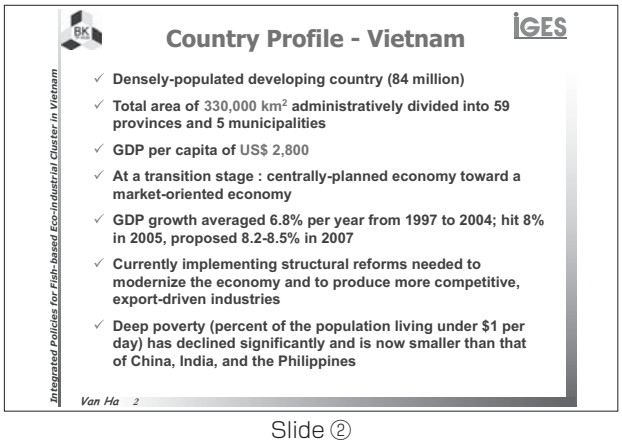
Good afternoon. It is my pleasure today to present to all of you, to bring you to Vietnam for the case of fish-based eco-industrial cluster development in Vietnam. We are researchers from Ho Chi Minh City University of Technology.

Let me start with the country profile of Vietnam. Vietnam has a high density of population with about 84 million people and the total area is 330,000 km^2. The GDP per capita is about $2,800 US, and the GDP grew up to 8% in 2005 and is proposed to 8.2% to 8.5% in 2007. The country is at a transition stage from a centrally-planned economy towards the market-oriented economy.



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In terms of the industrial development in Vietnam, countries belonging to Asia-Pacific Economic Cooperation (APEC) is the biggest investor to Vietnam with more than 65% of foreign direct investment (FDIs). FDI from Japan started from 5.3 billion in 2005, and go up to the 7 billion until the end of this year. We expect it maybe go up to 10 billion by the end of this year. Japan is also the leading country of the Official development assistance (ODA) to Vietnam; for example from 1992 to 2005, the ODA from Japan is 11 billion US$, especially could be expected to 10 billion per year to 2006. The major player is Japan International Cooperation Agency (JICA), Japan External Trade Organization (JETRO), and Japan Bank for International Cooperation (JBIC).

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Let me bring you to Vietnam. This is our study area, and now we already arrived to Ho Chi Minh City.

And then to An Giang Province is our study area and you can see that there are many fish cages.

This is An Giang province, which is the entry point of the Mekong River to Vietnam and after that the Mekong River divides into two rivers. The first river

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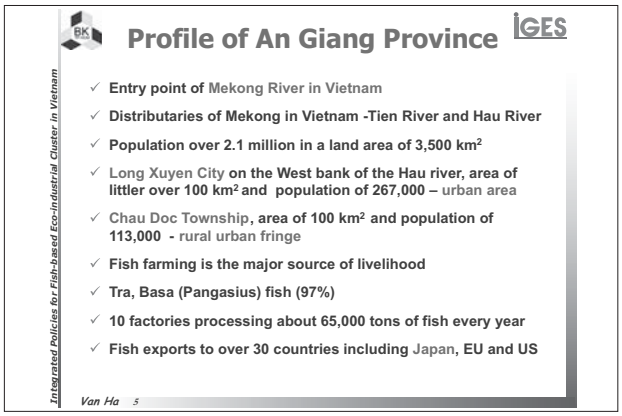

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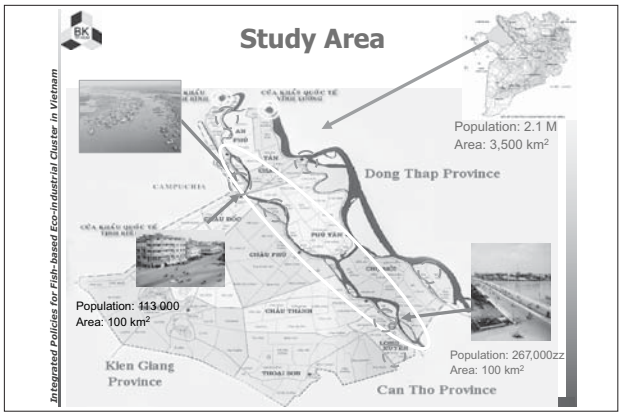

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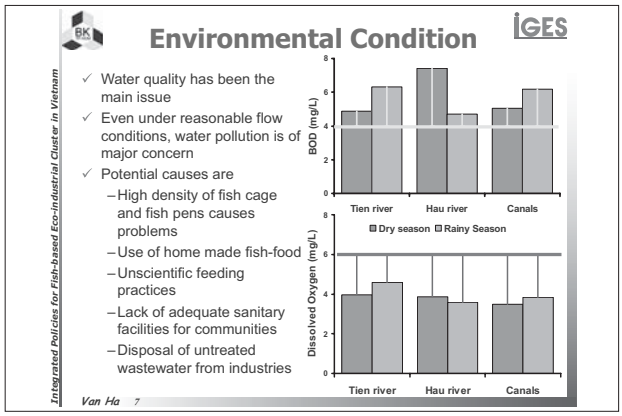
is called Tien River and the second one is called Hau River. The province is divided into 11 districts, and one city we call as Long Xuyen City has a population of about 267,000 people in the area of 100 km^2.

The other town is what we call Chau Doc. One of the advantages of this province is that they have three international ports, thus we can access to Cambodia. Because the water is available, the fish aquaculture has developed very fast in those areas. If you go along the river, you can find more than 3,000 of fish cages as shown in the photo, and also in the areas there are seven existing fish aquaculture areas.

The water quality is our main concern. The water quality is environmental issue, and the water quality also affects the fish qualities. For example, in order to make the international exporting market, the fish meat should be white in color. But if the water quality is not clean enough, then the fish meat will turn to yellow. The water quality found in the fish cage areas start to be contaminated because of very high density of the fish cage, because all of the fish farmers use the homemade fish food, and also because we do not have enough sanitary facilities to the communities.



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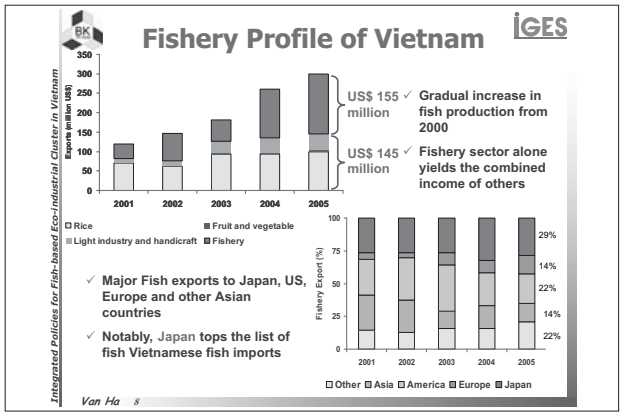
This is the fishery profile of Vietnam. From the graph, you can see that it increases every year, especially fishery allowance yields combined income from the other sectors. Vietnam is well known for the



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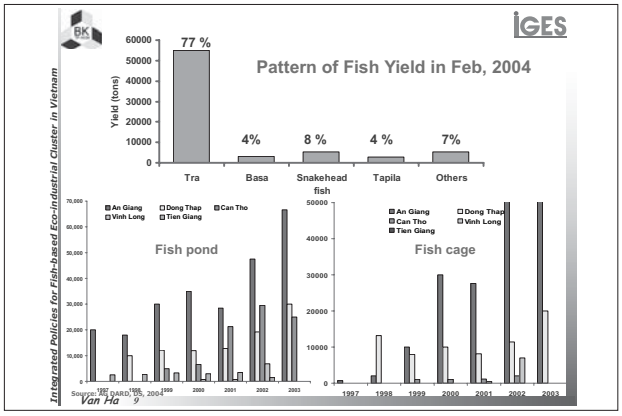
fisheries exporting products, and we export the fishery to over 30 countries including Japan, US, Europe, and other Asian countries. I do not know that how many of you here have tried the fish imported from Vietnam, but Japan is the leading country to import the seafood from Vietnam. It occupied 29% of the market.

Most of the Vietnamese fish export comes from the Mekong delta, and they occupy around 85% by mainly catfish. An Giang province, our study area, is the top province which produces the highest yield of the fishpond and fish cage amongst the provinces in Mekong delta.



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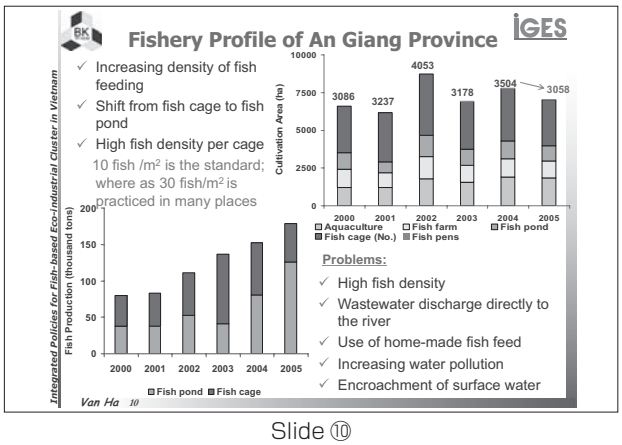
If you look at the fishery profiles of the An Giang province, you can see the increase of the density of fish feeding, and also they are shifting from the fish cage to the fishpond. If you look at the graph, the number of the fish cages decreased from 3,500 to 3000, and therefore the yield from the fish cage also decreased from 80,000 to 50,000 ton. On the other side, the fishpond have been staying in the same size of area, but the yield from the fishpond increased from 80,000 to 130,000 ton. This is very good even to environment, because it reduces the water pollution. On the other side, it is also very good signal on economic benefit, because the fishponds bring more income compared to fish cages.



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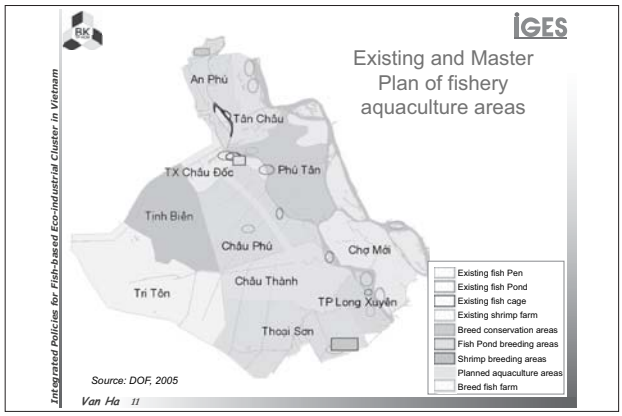

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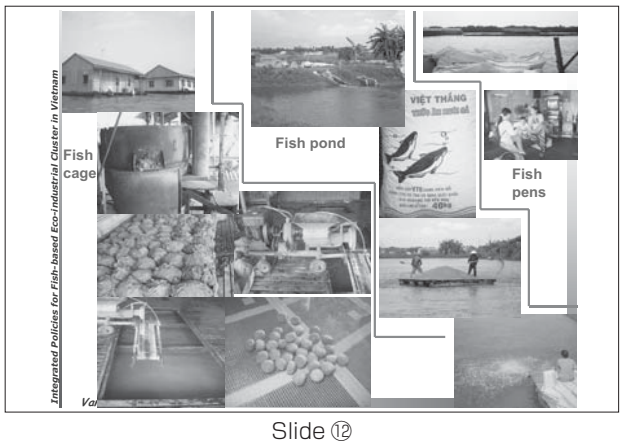
These photos show the three types of the fish aquaculture in Vietnam. The first type is what we call fish cage, and you can see the people living in this float house. This is a float, and this is the cage where they can feed the fish. The fish were fed with mainly homemade fish food, and what is important is the farmers use the rice straws to cook the fish food. On the other side, in the fishpond, the fish was mainly fed by the industrial food. The third one is the fish pens. It is located along the river, and the fish farms make the pens to keep the fish.



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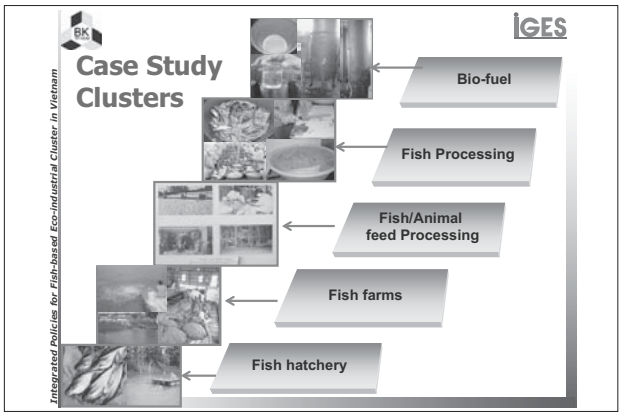
In our studies, we found that there are five main sectors relating to the cluster. The first one is the fish hatchery, and the second is fish farm, and then fish/animal feed processing, fish processing, and bio-fuel.



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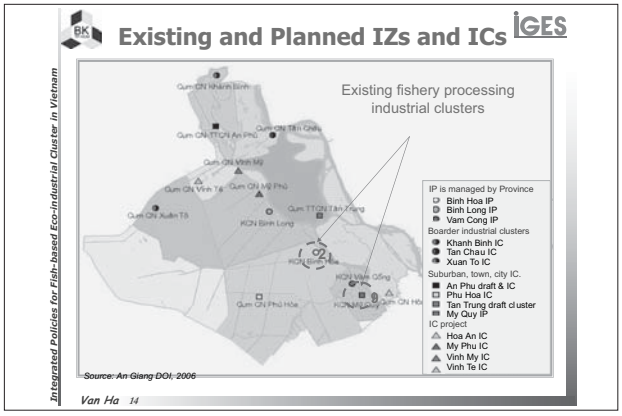
In An Giang, we have about 11 fish processing industries, and nine of them are located in the Long Xuyen city. They receive the fish mainly from the rural areas. The study is to try to identify the potential to establish the fish based industrial cluster in the sub-urban areas, in the fringe areas of the Long Xuyen city.



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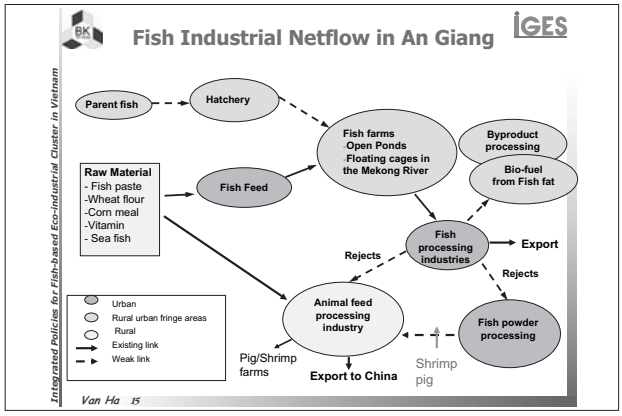
From our analysis, we found out the baby fish from the hatcheries, go to the fish farms, and after six months they will be harvested and processed into the fish products and for exporting. The fish feed will be transferred to the bio-fuel, and the skin, head and bones of the fish will be brought to produce fish powder or used to process animal feed processing. In this chart, you can see the dark circle is located in the urban areas while the five circles in the upper part are located in the rural areas. We try to link them together, and you can see there already exists the cluster, there already exist some links among the components. However, some of the links are quite weak and need to be strengthened by different tools like policies and technologies. However, we also find that further potential components that could join the cluster in future are shrimp and pig.



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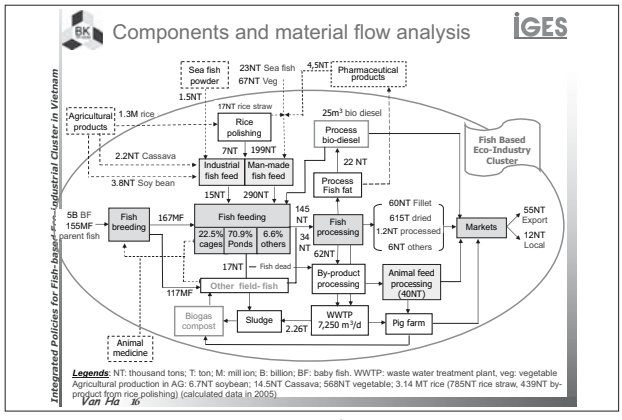
We also carried out the material flow analysis for one model of the fish based eco-industrial clusters. This slide is too complicated so I am not going into details, but the model shows us that we have very good material efficiency flows from the fish breeding to the fish feeding, and to the fish processing, producing different types of fish products to export to the market. One of the byproducts from the fish processing such as the fish fat is transferred to bio diesel, and



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the bio diesel will supply the energy to the fish farms to feed the fish. Another byproduct from the fish is used for animal/fish processing and goes to bigger farm. As to wastewater, the wastewater from the fish processing after treatment can be used for the fish farms, and the sludge from the wastewater treatment can be used as fertilizers.

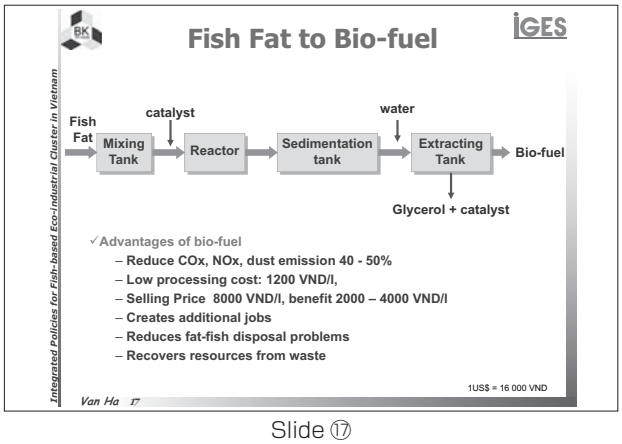
I think one of very important technologies that allows us to maintain successful eco-industrial cluster in our case is the way to transfer from the fish fat to bio-fuels.

As you know that catfish contains a lot of fat, 20% of fat. In the past, we considered it as a stock of waste, but now one of the companies is already successful to transfer fish fat to bio-fuel. They are now in the process of scaling up their product up to 6,000 tones per day.

The fish fat will be mixed with catalyst and then it will pass to the reactor, sedimentation tank, and extracting tank. The outputs then will be divided into bio-fuel and glycerol. Both products have very high economic values. Let me give you some advantages of the bio-fuels. For example, it can reduce the emission of carbon dioxide and dust up to 40 or 50%. It is very cheap to produce the bio-fuel. It is only 10 cents per liter, but it can bring the benefit of 20 cents per liter. It can save to the government about 14 millions USD per year by saving for the subsidized policies to the imported fossil-fuel. Again, it also creates additional jobs and reduces the fat fish disposal and the resources from the waste.

We also analyzed the strengths, the weakness, the opportunities and the potentials of each case by comparing the present situation and ideal cluster.

In the summary of the SWOP analysis, what can we find? We find that industrial clusters have a lot of strength. For example, they have availability of water. We have the large number of the small and medium



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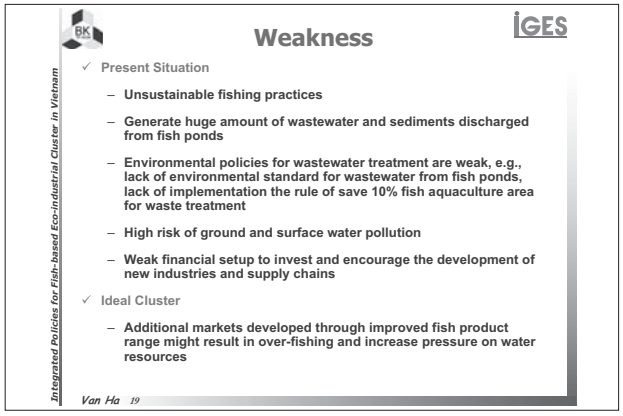

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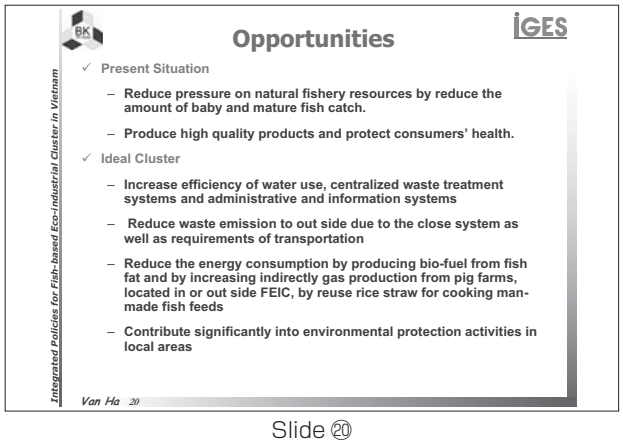

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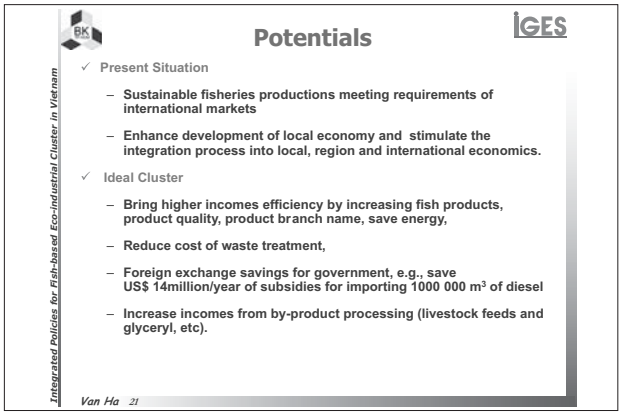

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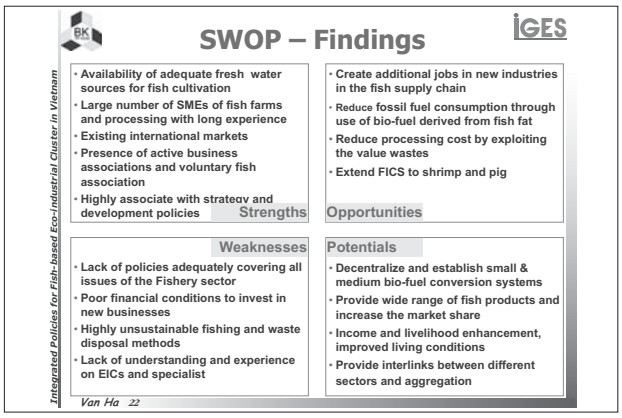
enterprises of fish farms, fish processing with very long experience, and we have very strong existing force from the international markets. And we have associations, voluntary fish association, and again, the industrial cluster is very highly associated with the strategies and development from the policies. On the other side, some weaknesses are that we do not have the policy to cover all sectors of fisheries, and poor financial conditions, which can lead to the highly unsustainable fishing and waste disposals. The clusters give another opportunity to the society such as to create a new job, reduce the fuel consumption, reduce the processing cost, and it can be extended to other products like shrimp and pig. It also has some potential to establish decentralized small and medium bio-fuel conversion systems. It can provide a wide range of fish products and increase the income. Especially it can provide the interlink between the different sectors already exist.



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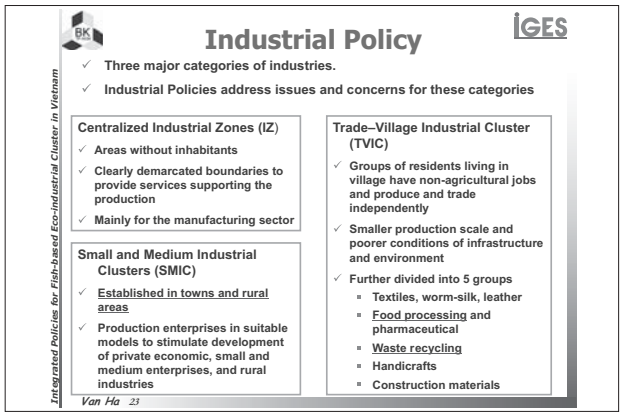
According to the Vietnamese situation, we have three types of the industries. The first one is called the centralized industrialized zones, the second type is the small and medium industrial clusters, and the third type is the trade-village industrial clusters. Among the three types of industries, the small and medium industrial clusters shows high potential to become economical eco-industrial clusters.



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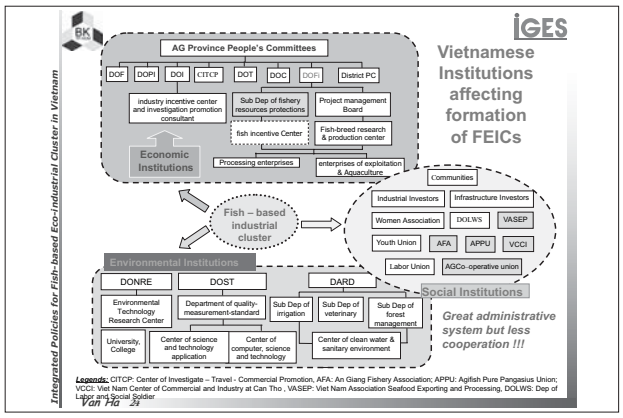
Further study shows that some institutions affect the formation of the eco-industrial clusters, especially in this system analysis. An Giang Department of Fisheries, established in July 2006, has a significant role in the system. Under this department, we have the sub-department of fishery resource protection and the fish-breed research and production center.

In the social institution, there are still a lot of groups related to the fish association such as An Giang Fishery Association, Vietnam Center of Commercial and Industry, and Vietnam Association Seafood



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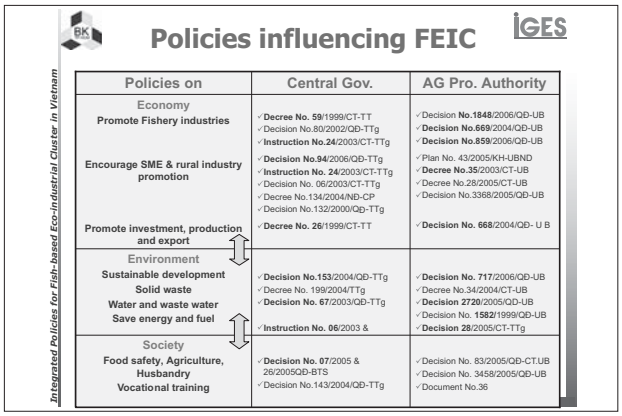
Export and Processing. These are the foundation to become the clusters. In our study, we found that Vietnam has great administrative system but unfortunately it lacks cooperation.

In terms of policy control, we have two levels; one level is from the central government, and the second level from the province. In our study, we found that policies have three very important components; economy, environment and society. In the first component, the policy is to promote the fishery industry, encourage small and medium rural industry promotion, and support investment, production and export. As for environment, sustainable development, solid waste, water and wasterwater are the key components, and especially saving energy and fuel is important. For the society, the government placed concerns on the food safety, agriculture, husbandries, and vocational training.



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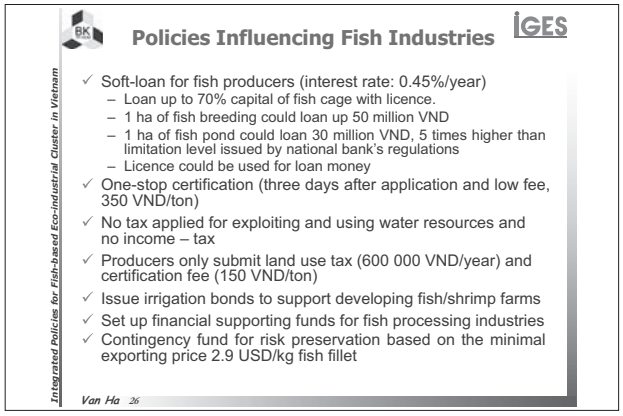
Let me give you some detail about policies in practice in Vietnam. In order to stimulate the fish industry, the government has issued many economic incentive policies. For example, the first one is soft loan of the fish producers, which gives very low interest rate, only 0.45% per year. Only the fish farmers in An Giang province can loan money by their fish license, and they can loan up to 70% of their capital. For example, one hectare of fish breeding allows to loan up to $3,000 US, one hectare of the fishpond allows to loan up to $2,000 US, which is five times higher than the limitation of the level of National Bank regulation. The government also issued the one-door stop administration for issuing the license on fishery. No income tax is applied to exploiting and using water resource. Producers only need to submit the land use and the license fees. The government also issued irrigation bond to support the development of shrimp and fish farms. Finally, they set up the financial supporting fund for the fish processing industries, for example, contingency funds for risk preservations.



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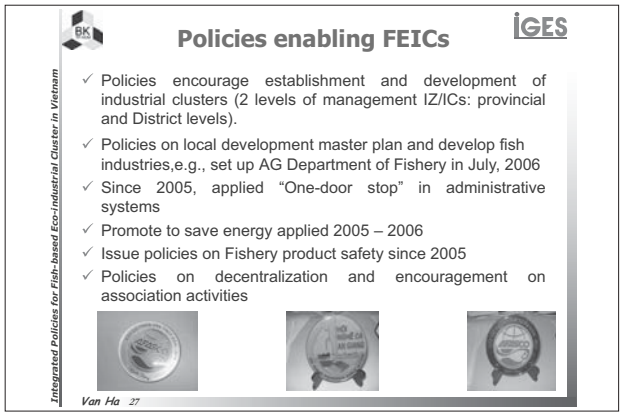
Some policies play important role in enacting function of the fish eco-industrial clusters. For example, the policy encourages the establishment and development of industrial clusters. As I told you before, there are two levels of management system for industrial zone in Vietnam; provincial level and district level. At the second level, the procedure required is very simple. The government has issued some policies to encourage the shift from agriculture to fisheries by establishing the Department of Fishery, setting up one-



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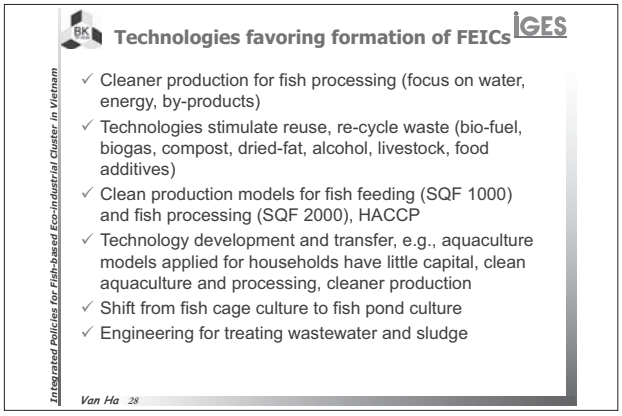
door stop in administration system. Besides, in 2005 and 2006 we had the policy to promote to save the energy. To protect the fishery products safety, we have the policies on decentralization and promotion of the association activities.

In term of technologies, there are three key technologies for the survival of the industrial clusters. The first one is the cleaner production for fish processing. The second is the technology that stimulates reuse and re-cycle of waste, and the third one is the clean production models for fish feeding and fish processing to meet the international standards such as SQF 1000, SQF 2000, and HACCP.



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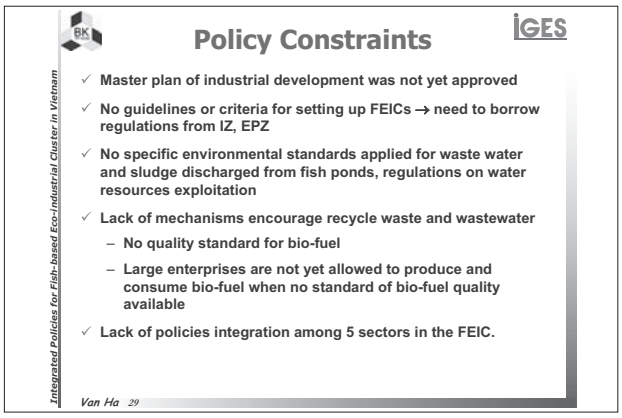
Policies play important roles; however, policy still has some missing - some gaps. In Vietnamese case, we have found no guidelines, no criteria for setting up the fish eco-industrial cluster or for any eco-industrial clusters. We do not have environmental standard that applies to the wastewater and sludge discharged from the fishpond. It is very important to note that we do not have the integration between the policies among five sectors. For example, we do not have the mechanism to encourage recycle of waste and waste water. I talked about bio-fuels, but in the country, they do not have quality standard for bio-fuel and therefore large enterprises are not yet allowed to produce or to consume bio-fuel due to lack of the standards.



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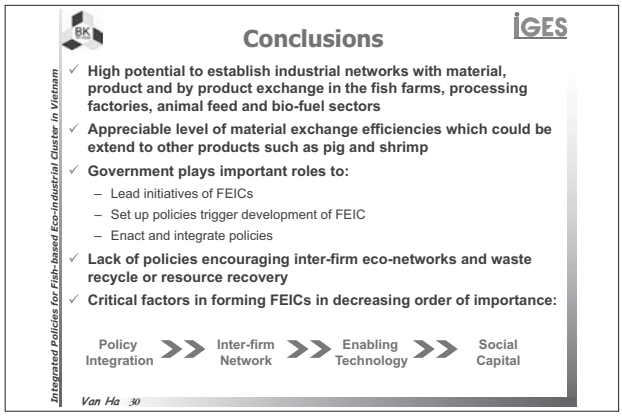
I come up with the conclusion. We found out very high potential to establish the industrial networks with materials, products and by-product exchanges in fish farms, processing factories, animal feed and bio-fuel sectors. The material analysis flow showed us very high efficiency of material flows, which can be extended to other product like pig and shrimp. The government plays a very important role to lead the initiative of the fish eco-industrial cluster, set up the policies trigger development, and enact and to integrate the policies. We can see the policy integration is more important than inter-firm network and enabling technology and social capitals in our case study.



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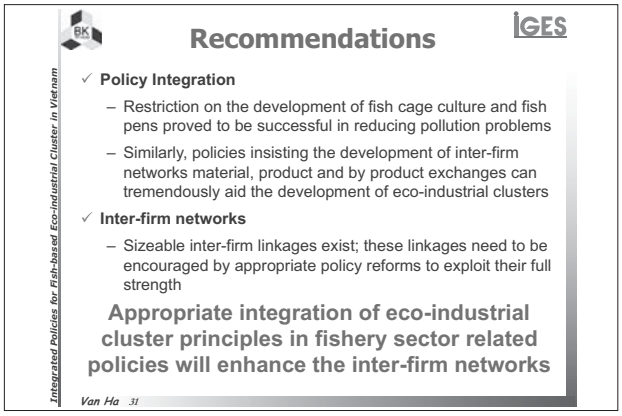
Our study recommends that the development of fish cage culture and fish pens have significantly reduced the water pollution, and also there are some links already existing in the cluster, but we need the policies to integrate and encourage the inter-firm network, and stimulate the product and by-product exchange. We found that in Vietnamese case, the international export market is a driving force to bring



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all fishery business together to build up the fish-based eco-industrial cluster. Finally, we believe that fish eco-industrial cluster is a key tool to achieve the sustainable development of the fisheries and bring more economic benefit to the fishery business in our country and in Asian countries.

I would like to take this opportunity to thank all of you to give me your time to listen and also a special thanks to Institute for Global Environmental Strategies, Kansai Research Centre and to our partner to give our university a chance to join the project and give the presentation today. Thank you.

【ベトナムからの報告】

Integrated Policies for Fish-based Eco-industrial Cluster Development in Vietnam

水産業を中心とした環境調和型産業クラスターの開発へ向けた統合的政策

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Integrated Policies for Fish-based Eco-industrial Cluster in Vietnam

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Country Profile - Vietnam

- ✓ **Densely-populated developing country (84 million)**
- ✓ **Total area of 330,000 km^2 administratively divided into 59 provinces and 5 municipalities**
- ✓ **GDP per capita of US$ 2,800**
- ✓ **At a transition stage : centrally-planned economy toward a market-oriented economy**
- ✓ **GDP growth averaged 6.8% per year from 1997 to 2004; hit 8% in 2005, proposed 8.2-8.5% in 2007**
- ✓ **Currently implementing structural reforms needed to modernize the economy and to produce more competitive, export-driven industries**
- ✓ **Deep poverty (percent of the population living under $1 per day) has declined significantly and is now smaller than that of China, India, and the Philippines**

Integrated Policies for Fish-based Eco-industrial Cluster in Vietnam

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Industrial Development in Vietnam

Integrated Policies for Fish-based Eco-industrial Cluster in Vietnam

- ✓ **Asia-Pacific Economic Cooperation (APEC) is the biggest investor of Vietnam - more than 65% of her FDI**
- ✓ **Among the top 14 foreign investors to Vietnam, 10 are APEC member economies with an average capital of over 1 billion US$**
- ✓ **Japan is one of the largest investor and the leading source of official development assistance (ODA) for Vietnam in 1992-2005: US$11 billion**
- ✓ **FDI from Japan - US$4.3 billion in 2004, $5.3 billion in 2005, $7 billion until 8/2006.**
- ✓ **Propose to join WTO by the end of Year 2006**
- ✓ **Major Players**
  - **Japan International Cooperation Agency (JICA),**
  - **Japan External Trade Organization (JETRO)**
  - **Japan Bank for International Cop. (JBIC)**

Countries	Number of Projects	Capital (US$ million)
Taiwan	1230	7165
Republic of Korea	811	4675
Japan	476	5088
Singapore	329	7920
Netherland	52	1790

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Location of An Giang Province

Integrated Policies for Fish-based Eco-industrial Cluster in Vietnam

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Integrated Policies for Fish-based Eco-industrial Cluster in Vietnam

Profile of An Giang Province

- ✓ Entry point of Mekong River in Vietnam
- ✓ Distributaries of Mekong in Vietnam -Tien River and Hau River
- ✓ Population over 2.1 million in a land area of 3,500 km^2
- ✓ Long Xuyen City on the West bank of the Hau river, area of littler over 100 km^2 and population of 267,000 – urban area
- ✓ Chau Doc Township, area of 100 km^2 and population of 113,000 - rural urban fringe
- ✓ Fish farming is the major source of livelihood
- ✓ Tra, Basa (Pangasius) fish (97%)
- ✓ 10 factories processing about 65,000 tons of fish every year
- ✓ Fish exports to over 30 countries including Japan, EU and US

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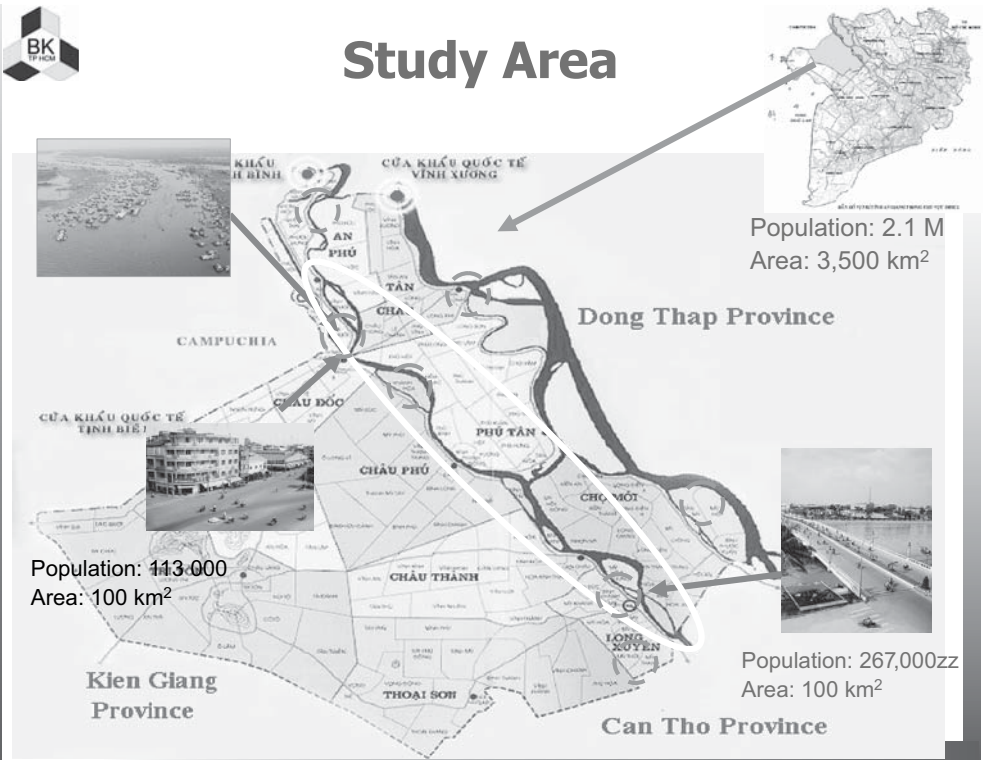
Integrated Policies for Fish-based Eco-industrial Cluster in Vietnam

Study Area



Population: 2.1 M
Area: 3,500 km^2

Population: 113,000
Area: 100 km^2

Population: 267,000zz
Area: 100 km^2

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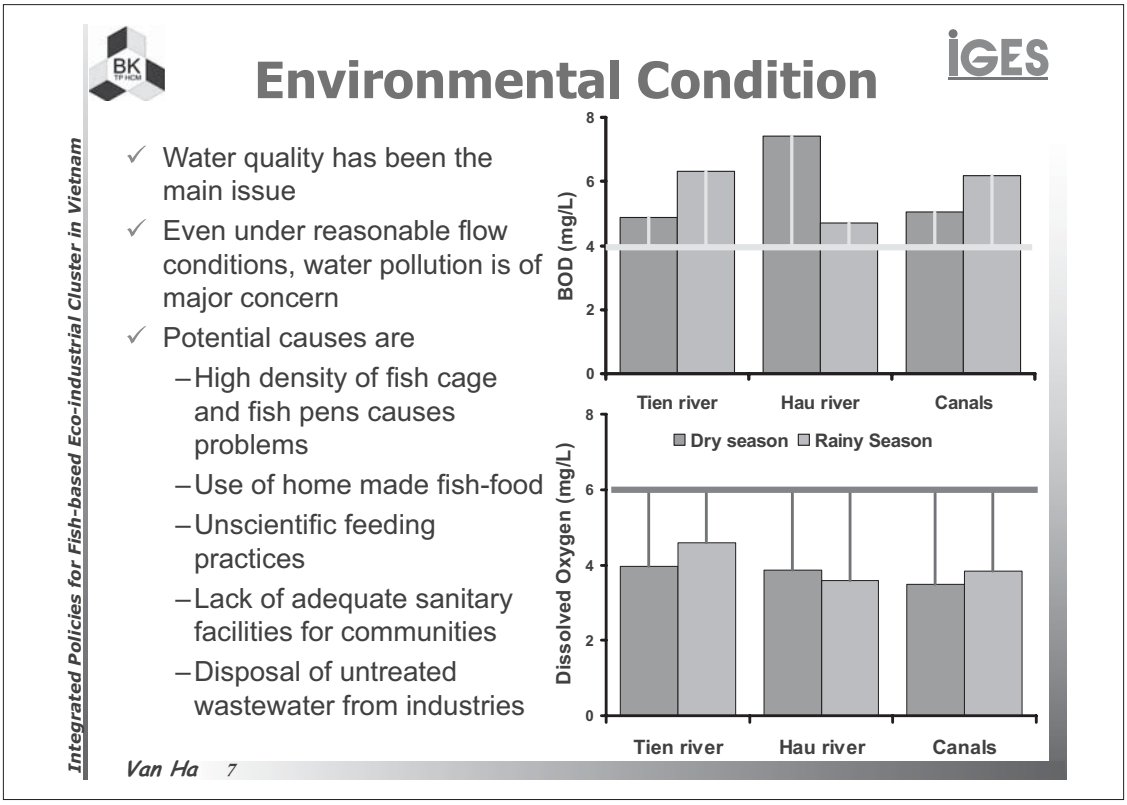

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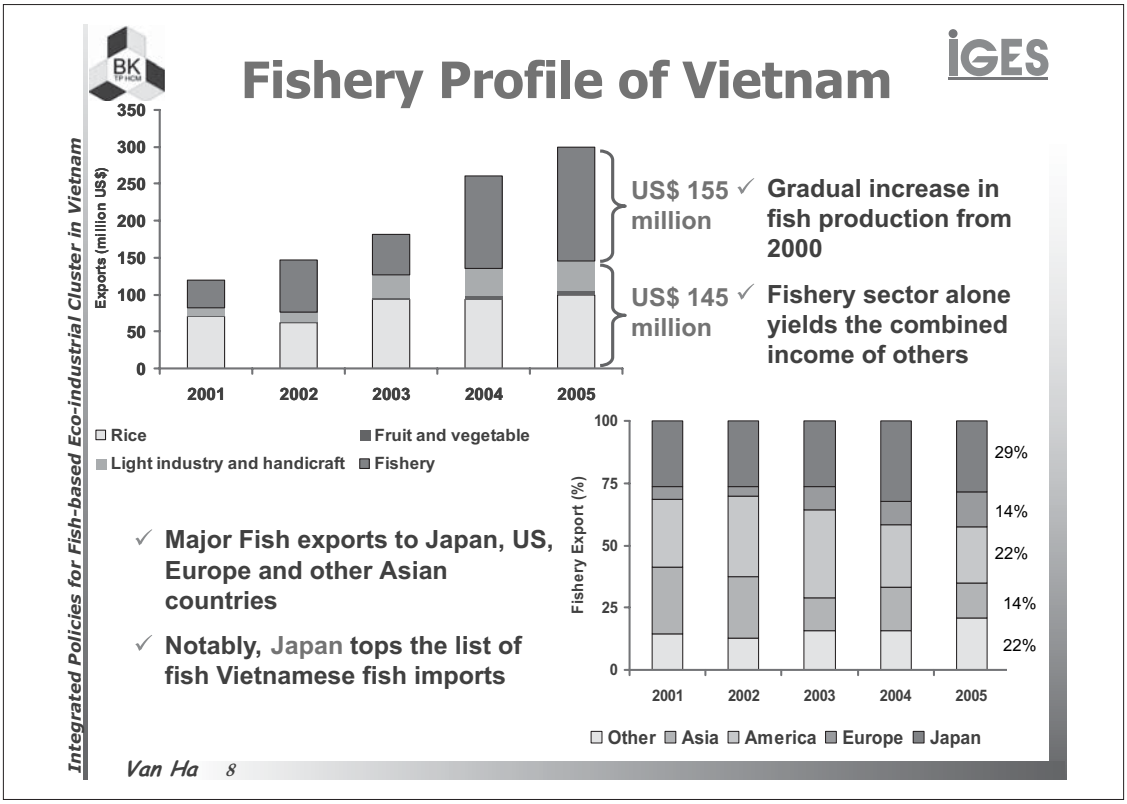

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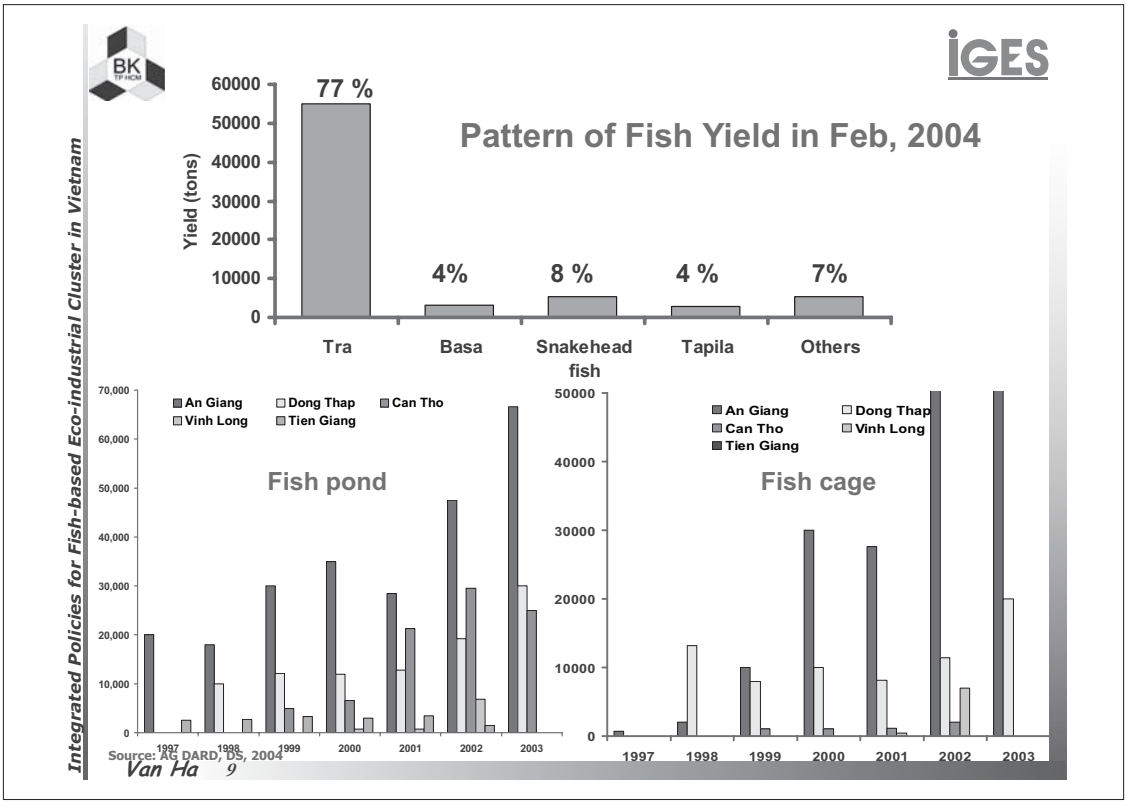

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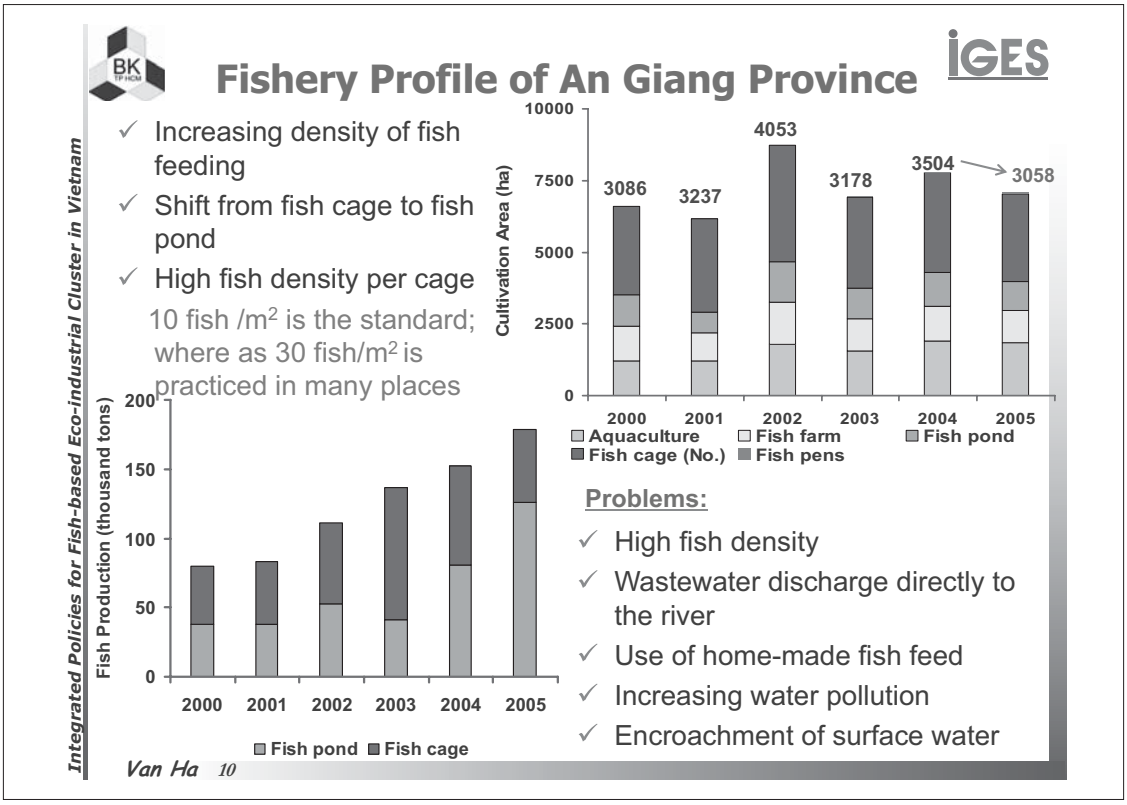

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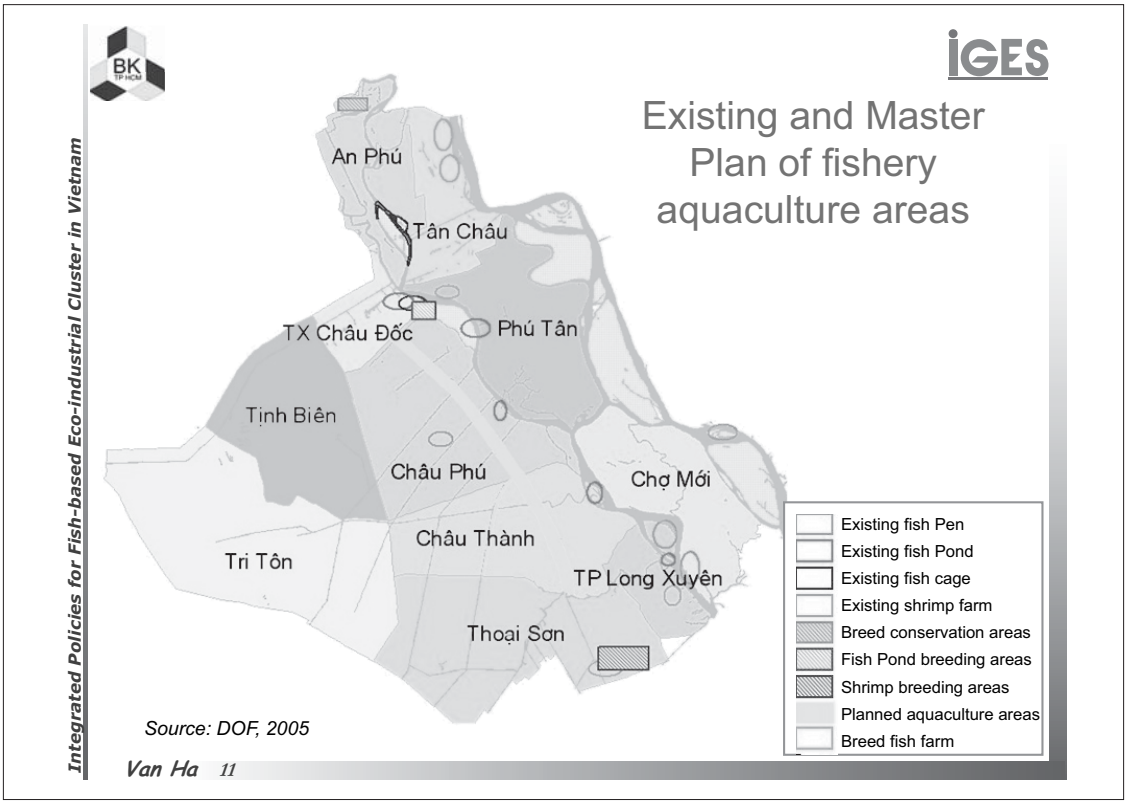

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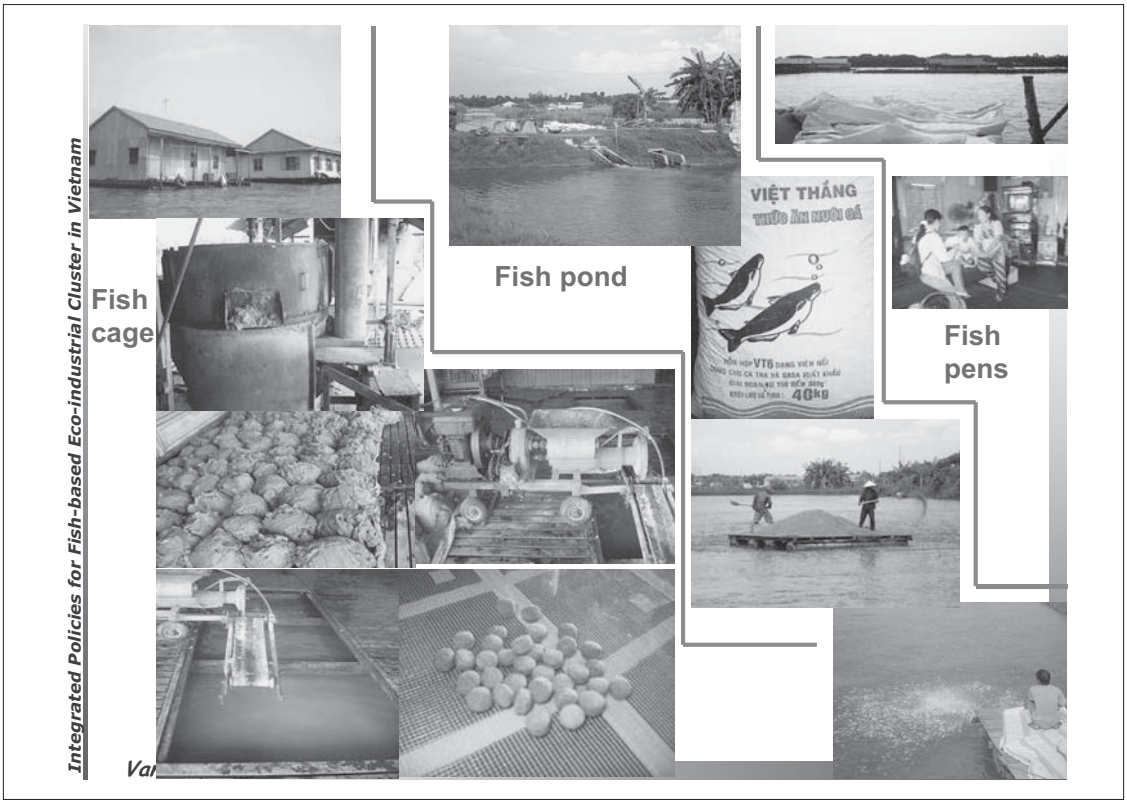

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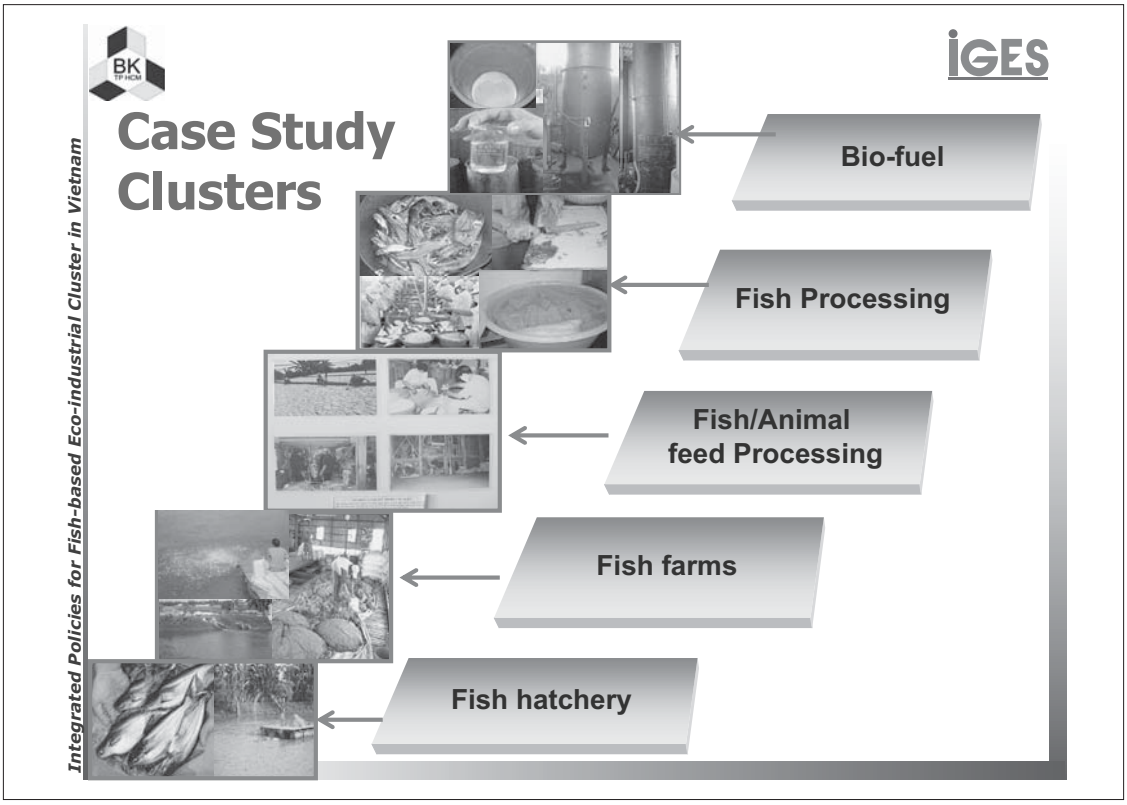

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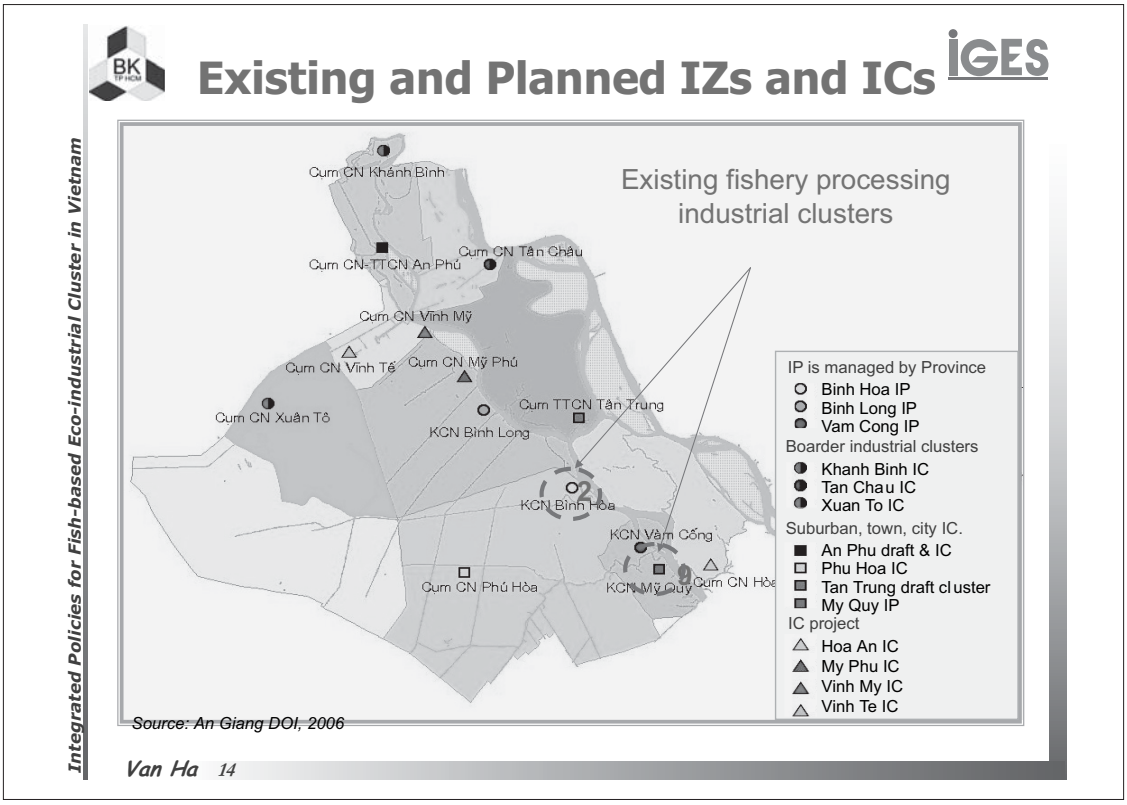

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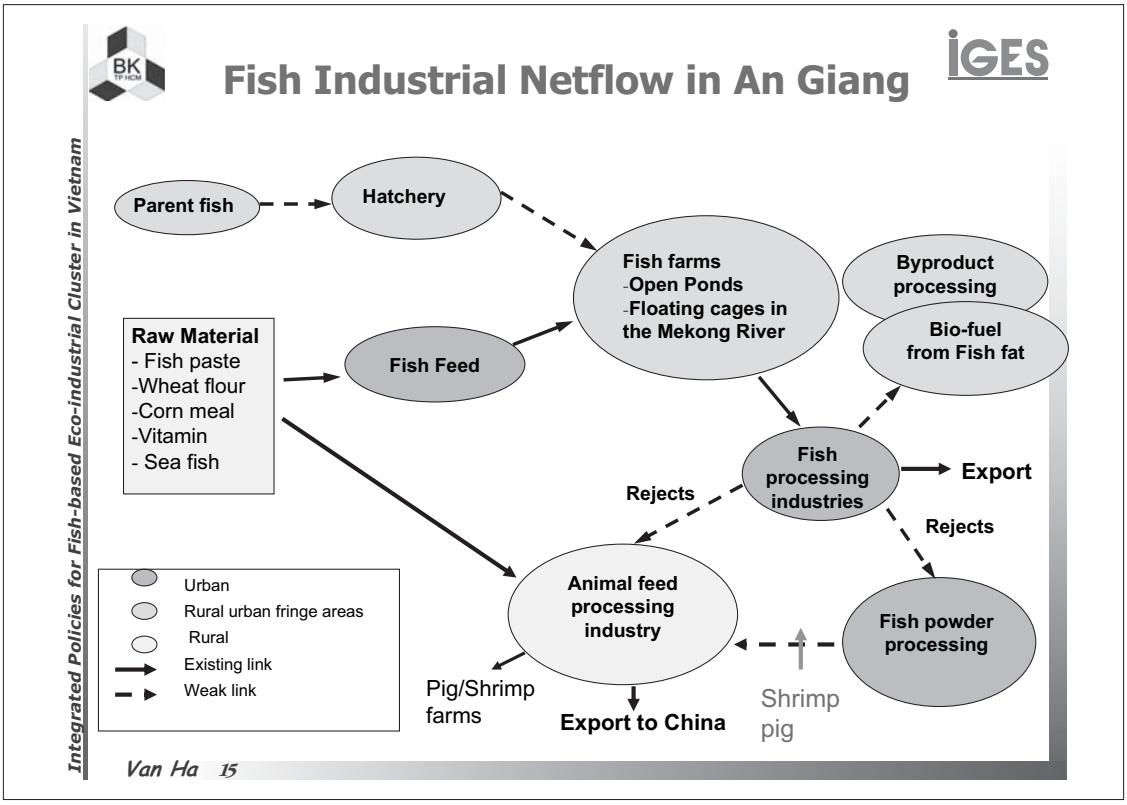

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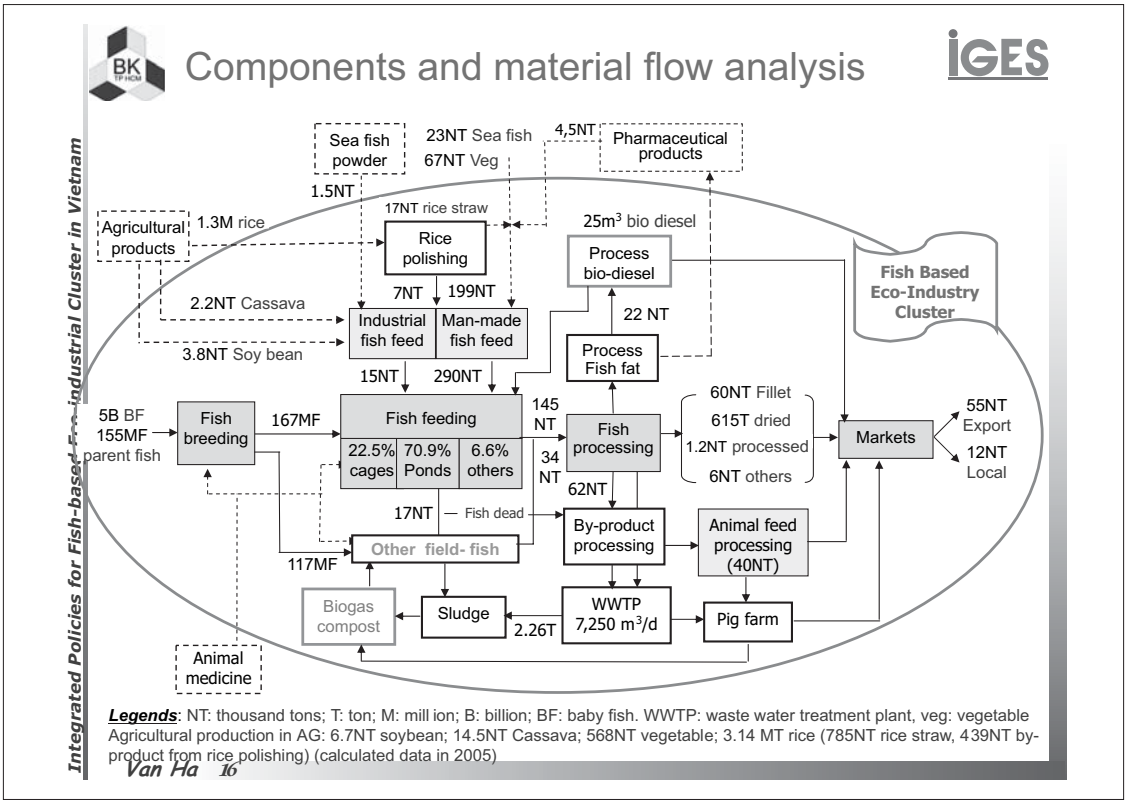

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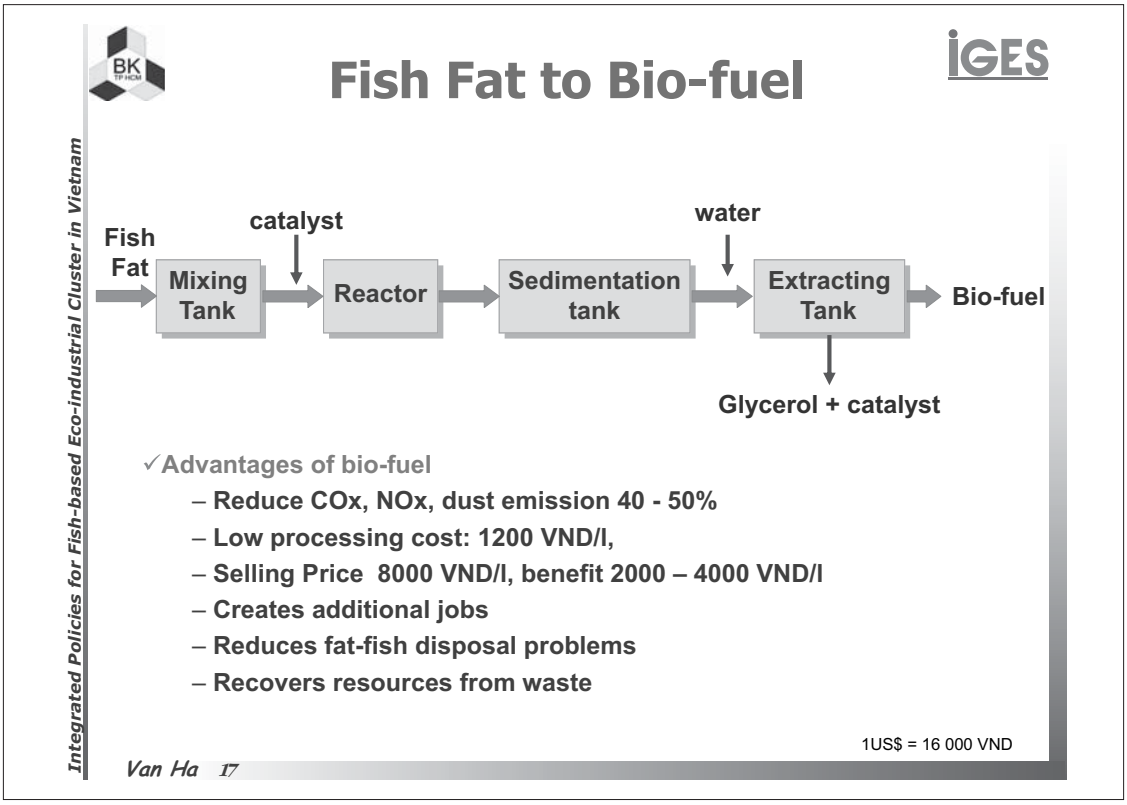

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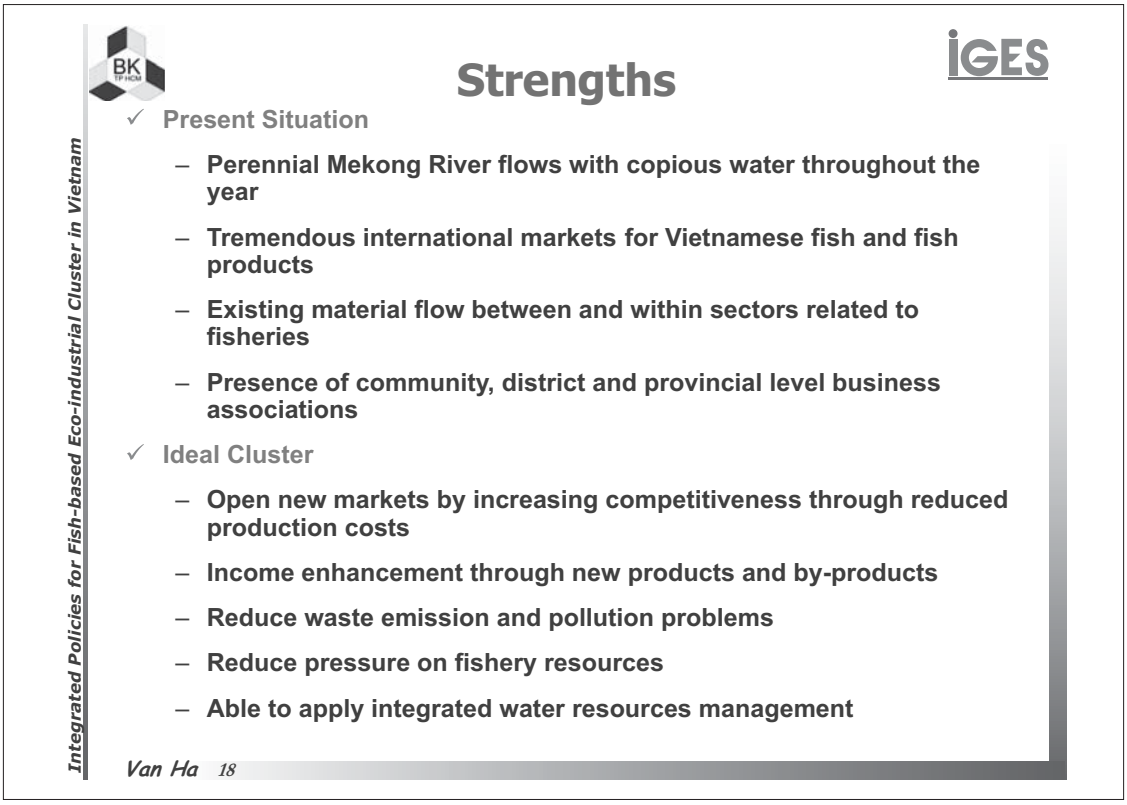

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Integrated Policies for Fish-based Eco-industrial Cluster in Vietnam

Weakness

- ✓ **Present Situation**
  - – **Unsustainable fishing practices**
  - – **Generate huge amount of wastewater and sediments discharged from fish ponds**
  - – **Environmental policies for wastewater treatment are weak, e.g., lack of environmental standard for wastewater from fish ponds, lack of implementation the rule of save 10% fish aquaculture area for waste treatment**
  - – **High risk of ground and surface water pollution**
  - – **Weak financial setup to invest and encourage the development of new industries and supply chains**
- ✓ **Ideal Cluster**
  - – **Additional markets developed through improved fish product range might result in over-fishing and increase pressure on water resources**

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Integrated Policies for Fish-based Eco-industrial Cluster in Vietnam

Opportunities

- ✓ **Present Situation**
  - – **Reduce pressure on natural fishery resources by reduce the amount of baby and mature fish catch.**
  - – **Produce high quality products and protect consumers' health.**
- ✓ **Ideal Cluster**
  - – **Increase efficiency of water use, centralized waste treatment systems and administrative and information systems**
  - – **Reduce waste emission to out side due to the close system as well as requirements of transportation**
  - – **Reduce the energy consumption by producing bio-fuel from fish fat and by increasing indirectly gas production from pig farms, located in or out side FEIC, by reuse rice straw for cooking man-made fish feeds**
  - – **Contribute significantly into environmental protection activities in local areas**

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Integrated Policies for Fish-based Eco-industrial Cluster in Vietnam

Potentials

- ✓ **Present Situation**
  - **Sustainable fisheries productions meeting requirements of international markets**
  - **Enhance development of local economy and stimulate the integration process into local, region and international economics.**
- ✓ **Ideal Cluster**
  - **Bring higher incomes efficiency by increasing fish products, product quality, product branch name, save energy,**
  - **Reduce cost of waste treatment,**
  - **Foreign exchange savings for government, e.g., save US$ 14million/year of subsidies for importing 1000 000 m^3 of diesel**
  - **Increase incomes from by-product processing (livestock feeds and glyceryl, etc).**

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Integrated Policies for Fish-based Eco-industrial Cluster in Vietnam

SWOP – Findings

Strengths
- Availability of adequate fresh water sources for fish cultivation
- Large number of SMEs of fish farms and processing with long experience
- Existing international markets
- Presence of active business associations and voluntary fish association
- Highly associate with strategy and development policies

Opportunities
- Create additional jobs in new industries in the fish supply chain
- Reduce fossil fuel consumption through use of bio-fuel derived from fish fat
- Reduce processing cost by exploiting the value wastes
- Extend FICS to shrimp and pig

Weaknesses
- Lack of policies adequately covering all issues of the Fishery sector
- Poor financial conditions to invest in new businesses
- Highly unsustainable fishing and waste disposal methods
- Lack of understanding and experience on EICs and specialist

Potentials
- Decentralize and establish small & medium bio-fuel conversion systems
- Provide wide range of fish products and increase the market share
- Income and livelihood enhancement, improved living conditions
- Provide interlinks between different sectors and aggregation

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Integrated Policies for Fish-based Eco-industrial Cluster in Vietnam

Industrial Policy

- ✓ Three major categories of industries.
- ✓ Industrial Policies address issues and concerns for these categories

Centralized Industrial Zones (IZ)

- ✓ Areas without inhabitants
- ✓ Clearly demarcated boundaries to provide services supporting the production
- ✓ Mainly for the manufacturing sector

Small and Medium Industrial Clusters (SMIC)

- ✓ Established in towns and rural areas
- ✓ Production enterprises in suitable models to stimulate development of private economic, small and medium enterprises, and rural industries

Trade–Village Industrial Cluster (TVIC)

- ✓ Groups of residents living in village have non-agricultural jobs and produce and trade independently
- ✓ Smaller production scale and poorer conditions of infrastructure and environment
- ✓ Further divided into 5 groups
  - Textiles, worm-silk, leather
  - Food processing and pharmaceutical
  - Waste recycling
  - Handicrafts
  - Construction materials

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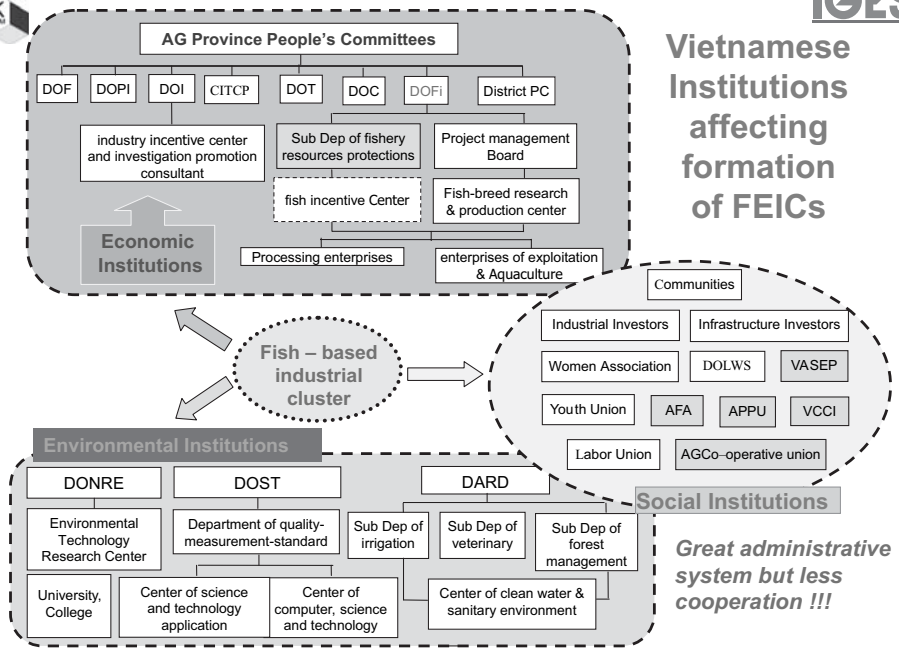
Integrated Policies for Fish-based Eco-industrial Cluster in Vietnam

Vietnamese Institutions affecting formation of FEICs



Great administrative system but less cooperation !!!

Legends: CITCP: Center of Investigate – Travel - Commercial Promotion, AFA: An Giang Fishery Association; APPU: Agifish Pure Pangasius Union; VCCI: Viet Nam Center of Commercial and Industry at Can Tho , VASEP: Viet Nam Association Seafood Exporting and Processing, DOLWS: Dep of Labor and Social Soldier

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Policies influencing FEIC

Integrated Policies for Fish-based Eco-industrial Cluster in Vietnam

Policies on	Central Gov.	AG Pro. Authority
Economy		
Promote Fishery industries	✓**Decree No. 59**/1999/CT-TT ✓Decision No.80/2002/QĐ-TTg ✓**Instruction No.24**/2003/CT-TTg	✓Decision **No.1848**/2006/QĐ-UB ✓**Decision No.669**/2004/QĐ-UB ✓**Decision No.859**/2006/QĐ-UB
Encourage SME & rural industry promotion	✓**Decision No.94**/2006/QĐ-TTg ✓**Instruction No. 24**/2003/CT-TTg ✓Decision No. 06/2003/CT-TTg ✓Decree No.134/2004/NĐ-CP ✓Decision No.132/2000/QĐ-TTg	✓Plan No. 43/2005/KH-UBND ✓**Decree No.35**/2003/CT-UB ✓Decree No.28/2005/CT-UB ✓Decision No.3368/2005/QĐ-UB
Promote investment, production and export	✓**Decree No. 26**/1999/CT-TT	✓**Decision No. 668**/2004/QĐ- U B
Environment		
Sustainable development **Solid waste** **Water and waste water** **Save energy and fuel**	✓**Decision No.153**/2004/QĐ-TTg ✓Decree No. 199/2004/TTg ✓**Decision No. 67**/2003/QĐ-TTg ✓**Instruction No. 06**/2003 &	✓**Decision No. 717**/2006/QĐ-UB ✓Decree No.34/2004/CT-UB ✓**Decision 2720**/2005/QD-UB ✓Decision No. **1582**/1999/QĐ-UB ✓**Decision 28**/2005/CT-TTg
Society		
Food safety, Agriculture, Husbandry **Vocational training**	✓**Decision No. 07**/2005 & 26/2005QĐ-BTS ✓Decision No.143/2004/QĐ-TTg	✓Decision No. 83/2005/QĐ-CT.UB ✓Decision No. 3458/2005/QĐ-UB ✓Document No.36

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Policies Influencing Fish Industries

Integrated Policies for Fish-based Eco-industrial Cluster in Vietnam

- ✓ Soft-loan for fish producers (interest rate: 0.45%/year)
  - – Loan up to 70% capital of fish cage with licence.
  - – 1 ha of fish breeding could loan up 50 million VND
  - – 1 ha of fish pond could loan 30 million VND, 5 times higher than limitation level issued by national bank's regulations
  - – Licence could be used for loan money
- ✓ One-stop certification (three days after application and low fee, 350 VND/ton)
- ✓ No tax applied for exploiting and using water resources and no income – tax
- ✓ Producers only submit land use tax (600 000 VND/year) and certification fee (150 VND/ton)
- ✓ Issue irrigation bonds to support developing fish/shrimp farms
- ✓ Set up financial supporting funds for fish processing industries
- ✓ Contingency fund for risk preservation based on the minimal exporting price 2.9 USD/kg fish fillet

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Policies enabling FEICs

- ✓ Policies encourage establishment and development of industrial clusters (2 levels of management IZ/ICs: provincial and District levels).
- ✓ Policies on local development master plan and develop fish industries,e.g., set up AG Department of Fishery in July, 2006
- ✓ Since 2005, applied "One-door stop" in administrative systems
- ✓ Promote to save energy applied 2005 – 2006
- ✓ Issue policies on Fishery product safety since 2005
- ✓ Policies on decentralization and encouragement on association activities

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Technologies favoring formation of FEICs

- ✓ Cleaner production for fish processing (focus on water, energy, by-products)
- ✓ Technologies stimulate reuse, re-cycle waste (bio-fuel, biogas, compost, dried-fat, alcohol, livestock, food additives)
- ✓ Clean production models for fish feeding (SQF 1000) and fish processing (SQF 2000), HACCP
- ✓ Technology development and transfer, e.g., aquaculture models applied for households have little capital, clean aquaculture and processing, cleaner production
- ✓ Shift from fish cage culture to fish pond culture
- ✓ Engineering for treating wastewater and sludge

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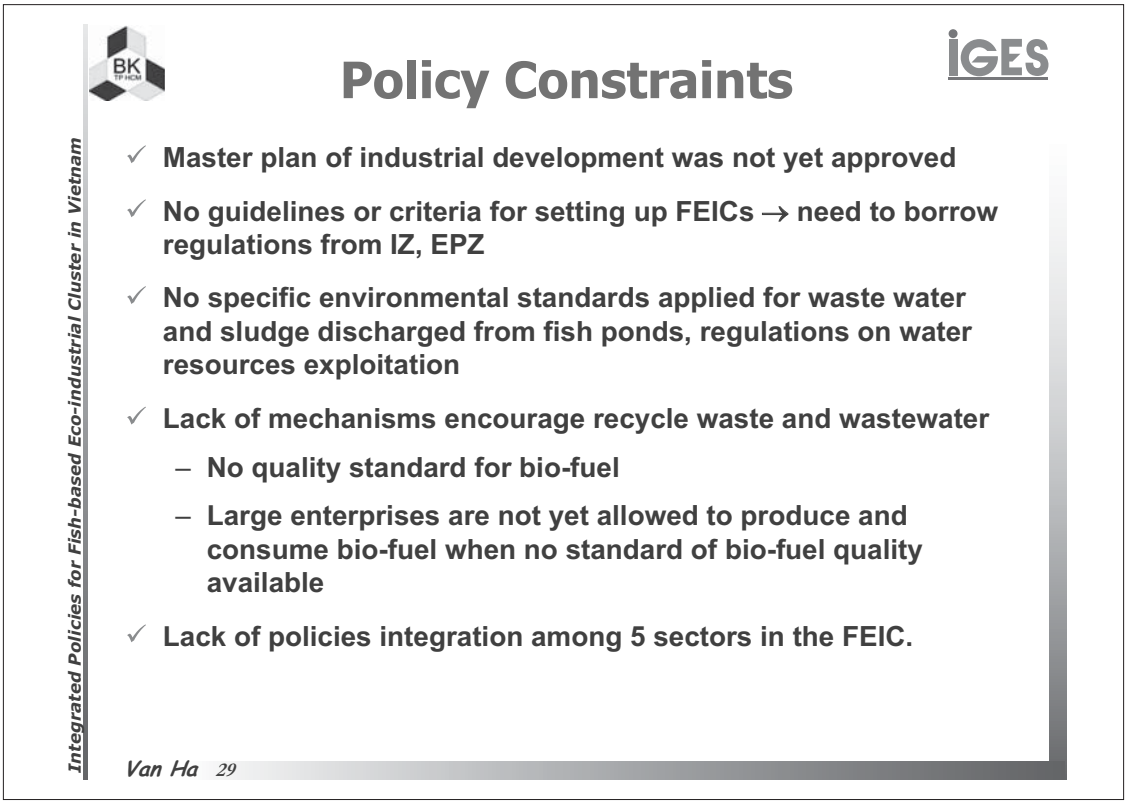

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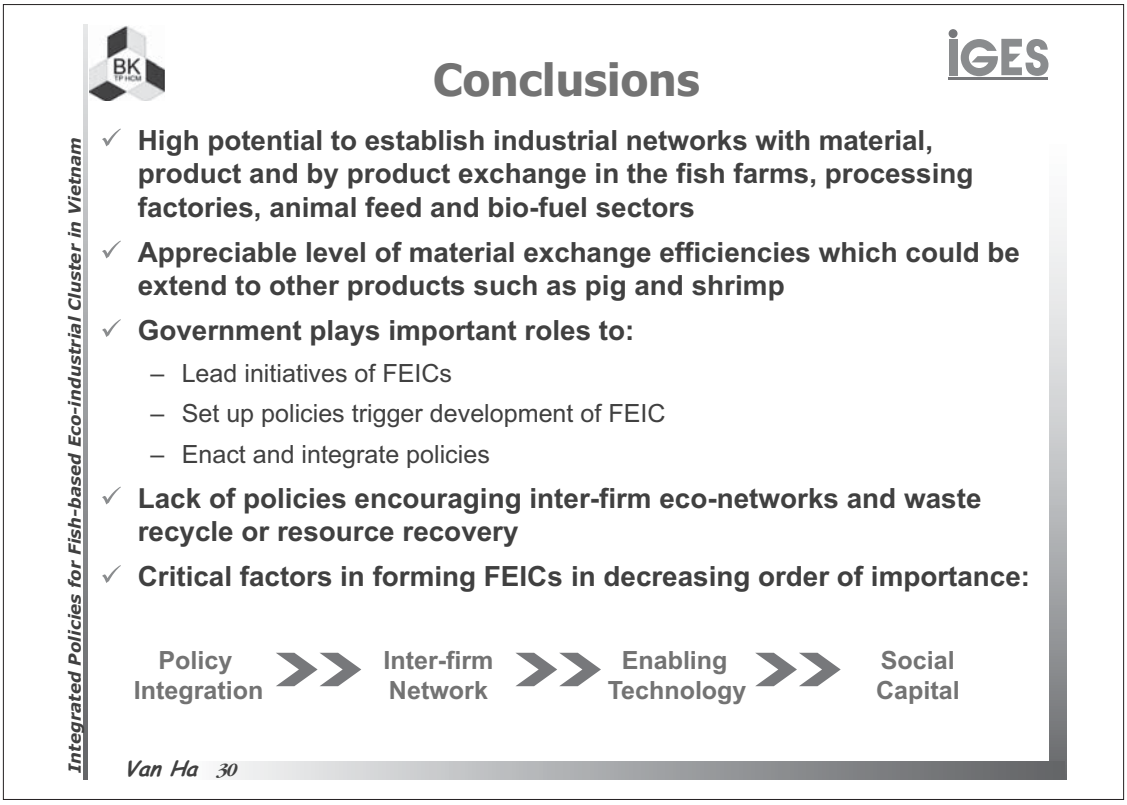

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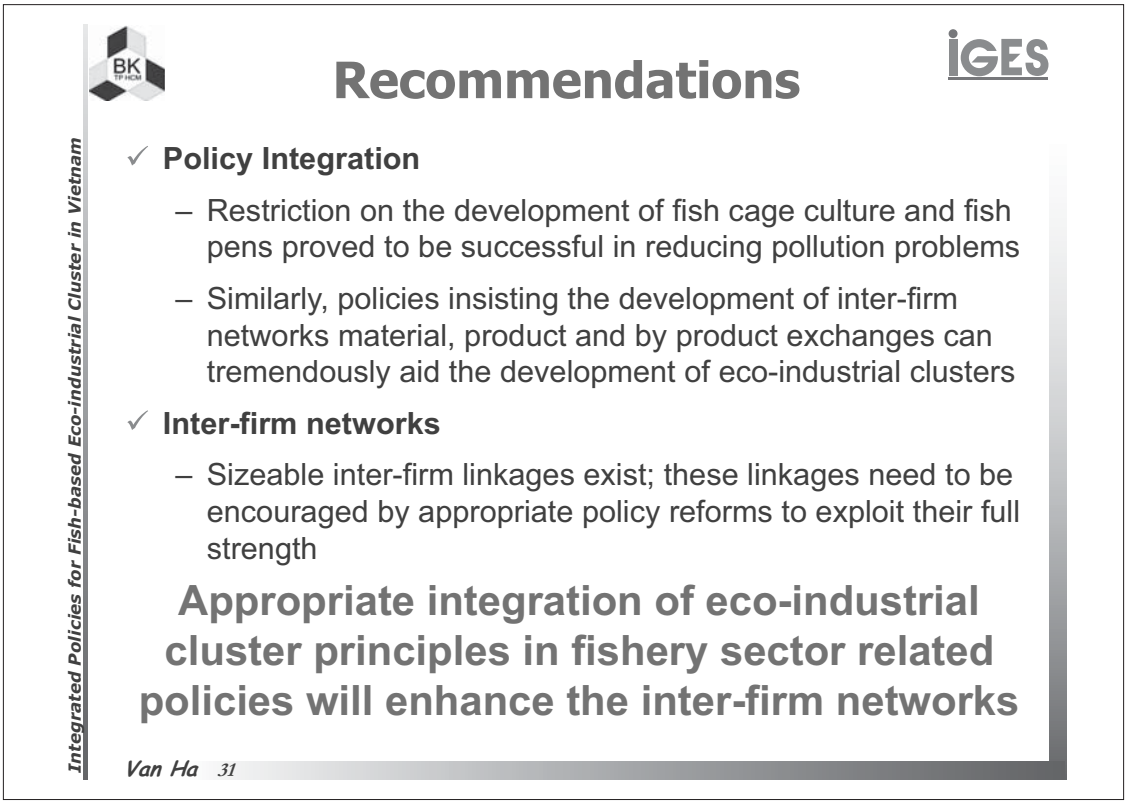
Integrated Policies for Fish-based Eco-industrial Cluster in Vietnam
Recommendations
✓ Policy Integration
– Restriction on the development of fish cage culture and fish pens proved to be successful in reducing pollution problems
– Similarly, policies insisting the development of inter-firm networks material, product and by product exchanges can tremendously aid the development of eco-industrial clusters
✓ Inter-firm networks
– Sizeable inter-firm linkages exist; these linkages need to be encouraged by appropriate policy reforms to exploit their full strength
Appropriate integration of eco-industrial cluster principles in fishery sector related policies will enhance the inter-firm networks
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