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AFSPAN Work Package 7

Final report on aquaculture production and trade

Deliverable 7.3



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Abstract

The primary objective of work package 7 is to understand the global trade in and markets for aquaculture products, focusing on the small-scale sector and the effects of global trade and markets on enabling or preventing aquaculture from achieving its food security objectives.

The two activities undertaken in the work package were firstly - a review of primary and secondary information on production and trade in aquaculture products over the past decades has been completed by the University of Stavanger. The results are summarised in the report on aquaculture production and trade (deliverable 7.1).

Secondly, an analysis of trade and trade regulations as drivers of change was carried out by the University of Portsmouth in association with case study partners. The analysis focused on trade and trade regulations as drivers of change in the aquaculture chain and consequences on food security, poverty reduction and nutrition. The work had three components: 1-Presentation of major trade and trade regulations dynamism over the last ten years; 2-Analysis of the way trade and trade regulation is perceived as signal by key actors of the aquaculture chain and 3-Assessment of the effect of trade and trade regulation on poverty, food security and nutrition. The framework was described in the report on case study methodology (deliverable 7.2).

An overview of the main results of this work package is presented in this report. A synthesis of the case study reports will be provided as an annex of final project report.

Introduction

Aquaculture's contribution to world fish supplies has increased rapidly over the past decades. Today, over half of fish consumed globally originate from aquaculture from low-level extensive subsistence farming to highly sophisticated intensive recirculation systems. Fish and fish products constitute a major source of income, food and recreation in the global economy. Fish products are thus essential to enable food security and poverty alleviation and to continue to provide over 1 billion of the world's poorest people with their main source of protein and more than 4.3 billion people with about 15 percent of their average per capita animal protein intake (FAO, 2012). The international trade, and resulting trade regulations, will play a key role in maintaining and expanding employment and economic growth, as well as ensuring food security. It is estimated by the FAO (2012) that around 55 million people are engaged in the primary sector of fish production, with artisanal fisheries and small scale fish farming accounting for over 90 percent of total employment in the fisheries sector. Indirect employment along the fish supply chain is estimated to support the livelihoods of up to 820 million people or around 12 percent of the world's population (FAO, 2012).

Aquaculture production and trade

The international trade of seafood has grown rapidly over the last few decades, enabled by a corresponding increase in the global supply of seafood. The availability of seafood has more than doubled over the last 40 years as the total supply of seafood increased from 65.3 million tonnes in 1970 to 148.9 million tonnes in 2011 (FAO, 2012). Seafood supply originates from two main production technologies, namely capture fisheries and aquaculture. Until the 1970s, aquaculture was relatively unimportant as a source of seafood supply. Since then, however, there has been a virtual explosion in the use of aquaculture as a seafood production technology. In 1970, fish farming was limited, with a harvested quantity of about 3.5 million tonnes representing 5.1% of the total seafood supply. In 2011, farmed fish made up 40.6% of the total seafood supply with a production of 60.4 million tonnes. Capture fisheries production, however, has fluctuated between 90 and 100 million tonnes in annual landings, with no obvious trend since the 1980s. Consequently, the only reason why global seafood supply has continued to increase since 1990 is increased aquaculture production. Aquaculture growth has been sufficient not only to maintain but also to slightly increase the global per capita consumption of seafood (FAO, 2012).

The international trade in food products is dominated by fish and fish products. The combined effect of productivity and market growth has made aquaculture the world's fastest growing animal-based food sector of the last decades (FAO 2006). Fisheries supply, on the other hand, is not expected to increase very much, as the majority of fish stocks are either fully exploited or over-exploited (FAO, 2012). The world may thus be fairly close to extracting as much seafood as possible from ocean capture fisheries. It is estimated by FAO (2012) that around 40 percent of fish output is traded internationally. Tveteras *et al* (2012) suggest that as much as 78 percent of fish products are subject to international trade competition. Despite economic instability in many countries, increasing prices and strong demand in developing countries pushed volumes and values to the highest levels reported in 2011. The increasing importance of aquaculture in global seafood supply helps explain the export-orientation of the seafood

industry. As in other food-related value chains (Barrett et al., 2012; Bellemare, 2012) the combination of (i) the significant investments needed to start up aquaculture production and (ii) limited domestic markets for aquaculture products (due for example to purchasing power constraints in developing countries, but also because of the size of domestic population and other factors) provide incentives for the industry to adopt a global outlook on marketing of seafood products.

The increase in international trade has been facilitated through technological innovations which has both significantly increased productivity and decreased production costs. This has created economies of scale throughout the supply chain, with reductions in transport costs promoting the international trade in fish products. Progress in storage and preservation has continued, allowing a wider range of seafood products to be traded. Freezing technology has improved to such an extent in recent years that many product forms can be frozen twice, allowing products to be processed in locations with competitive advantages in processing fish rather than in locations close to where the fish is caught. Lastly, the improved control in the harvesting process in fisheries and throughout the production process in aquaculture has enabled producers to better target the needs of the modern consumer and to further innovate in the supply chains. Increased trade has seen markets expand, with once regional markets changing to global markets. Furthermore, an increasing number of producers now have access to global markets, increasing trade competition in export as well as import markets. Growth in developing countries has also increased demand for fish products, and as a result there is a declining import share for developed countries, despite growth in total values of seafood exports from developing to developed countries.

The primary objective of work package 7 was to understand the global trade in and markets for aquaculture products, focussing on the small-scale sector and the effects of global trade and markets on enabling or preventing aquaculture from achieving its food security objectives. Specifically, the first task undertaken addressed the international trade of seafood products and the extent to which international trade make all parties better off, or creates winners and losers? Although the theory of comparative advantage concludes that trade leaves no country worse off in the aggregate, international trade can and does generate winners and losers within a given country. For that reason, there is cause to be concerned about the food security of individuals in food-exporting developing countries. To shed light on whether developing countries lose out in terms of food security when they export to developed countries, study of the international trade of fish and seafood between developing and developed countries was undertaken. Specifically, the evolution of trade flows – values, quantities, and prices – between developing and developed countries was investigated.

As with food in general, there is disagreement about whether the benefits of exporting seafood outweigh the costs for developing countries. One reason for that disagreement is that the lens used to investigate this issue differs radically among studies (Béné et al., 2009). In particular, the focus of the studies that argue in favor of trade tends to be aggregate flows measured in monetary value (Valdimarsson and James, 2001; Bostock et al., 2004; Thorpe, 2004; Kurien 2005). The studies that argue against trade tend to be micro-oriented and to focus on socio-economic variables for specific sub-population (Sauper, 2004; Ruddle 2008), with Béné et al. (2009) as a partial exception, looking at trade for a subset of African countries. By distinguishing among values, prices and quantities, we contribute a different insight to this debate.

The impact of seafood trade on food security creates further controversies because it is perceived to move large volumes of fish of high nutritional value from poor (i.e., developing) to rich (i.e., developed) countries. Indeed, in 2010, developing countries accounted for only 23% of the value of global imports of seafood while they accounted for 50% of the value of global exports of seafood. We refer to this concern as the *seafood trade deficit* throughout this paper. On the one hand, from a food security perspective, this could be interpreted as a substantial problem, as it might mean that poor countries are deprived of sorely needed proteins (Swartz et al., 2010). On the other hand, this could be interpreted as contributing to poverty alleviation due to the increased earnings and purchasing power resulting from export growth. Béné et al. (2009) provide an overview of the literature on these different perspectives on seafood trade. Thus, while the increase in trade flows is indisputable, the effect on poverty reduction, via economic growth, of those trade flows is contentious (Ravallion, 2004; Edward, 2006). Moreover, there are growing concerns that economic growth might have adverse effects on income distribution and equity (Basu, 2006; Goldberg and Pavcnik, 2007).

The contribution made in this work package, to the above mentioned research, is to use data on the prices and quantities of traded seafood to shed light on channels through which the seafood trade could contribute to or undermine food security. The picture that emerges suggests that the quantity of seafood exported from developing countries to developed countries is close to the quantity of seafood imported by developing countries from developed countries. What takes place is a quality exchange: developing countries export high-quality seafood in exchange for lower-quality seafood. This result is consistent with Bennett's Law, which states that as people become wealthier, they substitute away from low-quality foods toward higher-quality foods, and it suggests that the international trade of seafood does not pose a threat to food security.

Case studies – Trade and trade regulations as drivers of change

Introduction

The primary objective of this task was to focus on the analysis of trade and trade regulations as drivers of change in the aquaculture supply chain and consequences on food security, poverty reduction and nutrition. The tasks carried out in order to address these issues were: presentation of major trade and trade regulation dynamism over the last ten years; analysis of the way trade and trade regulation is perceived as a signal by key actors of the aquaculture supply chain and an assessment of the effect of trade and trade regulation on poverty, food security and nutrition.

Case studies were undertaken in Bangladesh, Brazil, Chile, China, India, Kenya, Nicaragua, Philippines, Uganda, Viet Nam and Zambia. The objective was to review the extent to which trade and trade regulations help or hinder aquaculture in achieving its food security objectives. The desk study undertaken in the earlier task already reported on international seafood trade and food security suggests that increasing trade between developing and developed countries in fish products should not affect food security and should contribute to economic growth and wellbeing in developing countries. The case study countries were chosen to review the extent to which increasing trade and trade regulations help or hinder aquaculture development, food security, poverty reduction and nutrition.

Production, trade and trade regulations

The production of aquaculture products is increasing in all of the case study countries. Most case study countries produce low value species for domestic markets, with tilapia also produced in large numbers in some of the case study countries. This production is largely small-scale subsistence farming with some products for sale in local consumption centres (e.g. local markets). Larger scale farmers, producing the same low-value species are also able to target larger national markets. Most fish is unprocessed and offered in fresh whole fish form, with minimal processing (such as smoking, pickling etc.). In some countries access to supermarkets is limited due to the lack of processing and certification procedures.

Most of the case study countries have also diversified to produce at least some higher value species such as shrimp. The production of higher value species is destined for export markets, although in some countries, the majority of these higher value species are consumed in national markets, such as the Philippines.

Some countries, like Viet Nam, have great potential for fisheries both fresh and saltwater. The favourable conditions for the development of fisheries and aquaculture create abundant supply of aquatic animal food and raw materials for the seafood processing industry serving the domestic demand and exports. In the last two decades, the sector represents an important source of economic growth, employment, nutrition, and foreign exchange. Developing countries contribute almost 90% of global aquaculture production and aquaculture contributes significantly to GDP and foreign exchange earnings in many low-income countries. In many developing countries, aquaculture has had significant positive effects on rural and urban food supply and on income and employment. However, increasing demand for fish in global markets and the complex networks that affect the supply and price of fish are influencing aquaculture production both at international and national levels. The products of carp in India represents both an important activity for ensuring food security and also export earnings are increasing through the production of higher value species like shrimp for export markets. Aquaculture, during the past three decades witnessed a great expansion. The total production increased from 0.37 million tonnes in 1980 to 4.43 million tonnes during 2012–2013. Adoption of modern farming techniques and assured higher profit margins in carp culture over the agricultural enterprises has attracted farmers to fish farming. Freshwater aquaculture has further witnessed diversification through the incorporation of high valued species like freshwater prawn (scampi).

Chile is a clear example of export orientated production. While some production is available in local and national markets, around 80% of production is exported. This tends to consist of high value species, like salmon, trout and shrimp, which are processed and exported as both fresh and frozen products. The aquaculture sector in Brazil was also created as an export orientated industry, producing high value species like shrimp, with companies becoming vertically integrated to control all stages of the production process from culture to marketing. However, access to export markets became difficult, as a result of increasing trade regulations in the main markets. Thus a higher share of production is now consumed in national markets with a declining share available for export markets. This is detrimental to the sector which had invested in production for lucrative export markets, like the USA and Europe.

While output has increased in all case study countries, in some countries like Kenya production remains very low and almost all is consumed in local markets. Technical know-how and market orientated production are significant limiting factors. While trade regulations are currently limited for national markets, significant investment would be required to increase export potential, which currently does not exist.

The next section will detail the trade regulations that are in place in the case study countries, in particular those relating to export markets. The first task in the work package suggested that the international trade of fish products should not make food deficit developing countries worse off in the long run. Therefore, increasing export opportunities should have a positive effect on fish producing developing countries.

Trade regulations

Aquaculture production in all of the case study countries is subject to trade regulations. The extent of the regulations imposed was found to be largely related to end markets. For example, more restrictive trade regulations were found in case study countries where destination markets were in developed countries. The main trade regulations related to food safety and quality control. However, international buyers often set specific requirements and high standards regarding product quality, presentation, labelling, weight, etc. Due to costs related to meet these criteria, aquaculture farmers prefer to seek opportunities in the domestic market, including developing niche products to meet local demands. This has been reported in the case of Brazil and Viet Nam, although Viet Nam continues to pursue high value opportunities in export markets. Conversely, evidence from Brazil suggests that trade regulation have become a significant hindrance on producers and that routes to export markets as a result had been almost closed. Instead, producers prefer to develop domestic niche markets rather than pursue export opportunities.

In most of the case study countries, there are trade regulations in place to stimulate both national and international trade. Bangladesh, for example, undertook a number of initiatives towards trade liberalisation and trade promotion to stimulate exports and encourage investment in export-oriented activities. The major objective of these reforms was removal of anti-export bias, introduction of incentives for exports and facilitation of participation in global labour market. The policies of trade liberalisation were implemented through reduction of tariff rates, elimination of quantitative restrictions and reduction of tariff dispersion. This has resulted in the following developments: (i) Increased market access of foreign products through reduction in tariff rates; (ii) Accelerated growth of exports from the country; (iii) Increased volume of foreign direct investment (FDI); and (iv) Participation of a growing number of Bangladeshi workers in the global labour market. The export policy during the 1990s had introduced important structural shifts in the export pattern of the country in terms of both products and markets. Export of fish has been playing an important role in the export sector performance of Bangladesh in recent times. Frozen fish and shrimp, dry fish, crabs and other fish products are the export items in the category of fish, the export of which has reached USD639 ml in 2013 from USD147.6 ml in 1991.

Barriers to trade have in part been liberalised in developing countries through the GATT and now the WTO. As such traditional barriers to trade such as tariffs and quantitative restrictions have been partly liberalised, although technical measures are becoming a particularly important issue for developing country exports. The last decade or so has

seen a proliferation and strengthening of sanitary and phytosanitary (SPS) standards and the hazard analysis and critical control point (HACCP) standards in industrialised countries. These standards continue to evolve internationally, nationally and within individual supply chains. As fresh food categories such as fish and seafood products are subject to greater food safety scrutiny, they are more likely to be affected by regulatory measures. The traditional methods of preservation and processing practiced in developing countries are challenged by the requirements of international-standard quality measures for fish and fish products. Noncompliance with HACCP and SPS standards often leads to bans and/or rejection by importing countries, causing massive losses to exporting countries. Exports of fish products continue to remain vulnerable to regulatory barriers in foreign markets. For example, the European Union (EU) ban on Bangladesh shrimp in 1997 remained in effect for 5 months and was a serious setback to fish exporters and people whose livelihoods depended on the industry. In 2002, Bangladesh suffered a 10% loss in shrimp exports because of perceived quality differences, causing a loss of USD30 million.

Another threat is the imminent withdrawal of the Generalised System of Preferences (GSP) treatment some developing countries receive in the EU, although export orientated developing countries have made considerable headway in HACCP implementation.

In general, regulations concerning food health and safety are becoming more stringent and enforced in importing countries, especially the EU market. Consumers are not only requiring greater assurances about food safety but also about the environmental and social impacts of production. Market access is thus becoming difficult except for the very largest producers, and often small-scale farms may lack the technical knowledge and financial depth to adapt their production. Despite these difficulties, meeting such standards is becoming a prerequisite for access to most importing countries.

Market signals

The analysis of market signals was undertaken through face to face interviews with key actors along the fish supply chain in the case study countries to assess how market signals have acted as a driver of change in aquaculture production, processing and marketing. In other words, are producers market orientated and in a position to change production, including product differentiation, such as fresh vs. frozen, whole fish vs. portion etc. in line with market demands.

What are the key market signals perceived by fish farmers?

Change of occupation

There were two main responses regarding change of occupation to aquaculture. Those in countries like Viet Nam, Chile and Bangladesh cited the potential to export to main markets and the economic benefits that would bring. Smaller scale farmers largely moved from the agriculture sector as fish farming was seen to be more lucrative (with better market options).

Species selection

This is largely dependent on whether the producer is export orientated or producing for domestic markets. Export orientated producers are market led, they produce what is demanded. They have capital backing and are purely profit driven. Small scale producers, producing for local markets tend to produce what they can e.g. access to seed, feed and technical know-how. Those producing for larger domestic markets are somewhat more market orientated but limited through technology, for example.

Production level – quality and quantity

How the production level is defined depends on scale of operation. Larger export producers e.g. Chilean salmon producers are market led. They produce the quantity, quality and produce type that is demanded in markets. They are able to do so through investment in the supply chain to ensure they are meeting market demands. Production is less coordinated for small scale producers, especially those without access to markets, selling through traditional street vendors. Here, production in terms of quantity and quality is variable and not coordinated with market demand, where such demand exists. There is often a meat bias in favour of fish, as meat products are less perishable.

Innovation and sustainable production

Innovation can occur and be as rewarding to very small scale producers as well as large scale export orientated producers. Innovation in the small scale sector may be feed ingredient selection, use of fertilisers, broodstock selection for higher survival rates of fry. Medium scale producers innovate to increase productivity and gain market share in domestic markets. Larger scale producers, like Chilean Salmon farmers have become vertically integrated and invest in research and improve their production process, or develop new product types to develop niche markets. In export markets, often big supermarket chains dictate quantity and quality of production, traceability, MSC labelling etc. Only larger scale producers are placed to deliver on these strict requirements. However, some countries, like Bangladesh have demonstrated the rewards of putting in place national legislation to ensure that farming operations, especially new farms, meet requirements for export markets.

Are market signals well received? Could they be better perceived?

In general, the extent to which market signals are received depends on the route the harvested fish takes to market. Some producers sell their products directly in markets and thus are positioned to react to changes in preferences, or if other sellers selling similar products are more successful than they are, they are well placed to see what product types are demanded. Often, producers sell direct to processors, and the processors determine the product type. However, often producers and processors are not able to react to changes in consumer preferences if they do not have the know-how or facilities. For example, most fish in developing country markets is sold fresh, not because that is the product type demanded, but because there is often a lack of freezing facilities limited by cost. Often processing plants do not meet the required status to export into developed markets and process products using out dated techniques.

It should be noted that the extent to which market signals are received by producers depends on the scale of production and also the species produced. For example, in

Chile Salmon producers are all large producers and their companies entered the business seeking to diversify their investment portfolio, from other companies in the fisheries sector. The main drive for this was to increase capital, wealth and company value. Salmon producers chose the species based on market information related to volumes and prices, their profit expectations and as these are species (Atlantic salmon, Rainbow trout and Pacific salmon) with highest growth rate. Production levels in the beginning were defined by the need to increase market share and in search of economies of scale. The product quality standard is set by the markets and is generally related to product size, colour and shelf life.

In general, it can be deemed from the case study reports that market signals have acted as drivers of change. However, the extent to which this happens is dependent on scale of production and the strength of the supply chain. There is also a distinct difference in relation to markets signals and trade and trade regulations, based upon product destination. Those best placed to receive and act on market signals are larger, vertically integrated farms that export to the main markets in the EU and the USA. At the other end of the scale, small scale subsistence farmers, who might not have contact with processors, sellers etc are unable to react to market signals and may not be aware how they could.

However, in some developing countries no thorough analysis of the demand for fish products is undertaken. Given fish products are so important in the overall national Poverty Reduction Strategies, there is a need for analysis of the national and international market situation and the relationship between exports and imports of fish of various kinds and what is the real demand of fish. To be effective market players, poor farmers need access to services for (1) technical knowledge, (2) market access/information and (3) credit and finance. While rich farmers essentially do not need credit, small farmers cannot handle credit very well because of interest rates, the need for collateral, and the conflict between repayment schedules and the seasonality of income.

In some countries, notably Viet Nam, Chile, the Philippines it is noted that information on main market characteristics changes and competitions in both domestic and international seafood industry will be well anticipated and integrated in the development strategy at all levels in the production chain and also in the sectors development strategy.

Also, market information systems have contributed significantly on better perception of market signals. Mobile phone and internet systems have developed rapidly in some developing countries, such as Viet Nam, over the decade that helps producers and processors/exporters make smarter decisions. Flexible local networks connecting producers, traders, the public sector and consumers help them quickly find and use the information they need.

Trade, poverty, food security and nutrition

Aquaculture continues to grow around the world in both developing and developed countries. Aquaculture represents an important economic activity in all of the case study countries, but the extent to which it has helped food security objectives, nutrition and poverty remains unclear. The trade of fish products can lead to food security and poverty reduction in all contexts, from small scale subsistence farmers to large scale export orientated producers. In the first context, this is because subsistence farmers can trade fish for other products, or feed their families and communities. In the latter context, the same thing happens, only on a scale where economic earnings from exporting large quantities of high value fish products drive economic growth. However, in some countries increased economic growth has not lead to significant reductions in poverty.

Assessment of value added in aquaculture products indicates that more value is added in aquaculture sector compared with fisheries, where production in terms of quantity and quality is variable. For example, in Chile, value added per tonne was on average 82 percent higher than for capture fisheries. Aquaculture in Brazil is exhibiting strong signs that production will exceed that of fisheries in the coming years. While average annual growth rates for fisheries have reached 1.7% from 2002 to 2012, aquaculture has by grown 11.6%. Fisheries continue to have a significant impact on generating jobs and income in coastal communities in Brazil.

Aquaculture has had a strong impact on the national *per capita* intake of fish products in developing countries. Although per capita consumption is estimated to be still be low in some countries, it has increased significantly over the past two decades. The rise in imports is also the result of a higher demand of fisheries products that cannot be met by domestic production. In general, aquaculture products tend to compete with wild products, as quantity and quality tend to be higher. There are, however, some exceptions. For example, in Kenya per capita consumption of fish products is increasing, but the gap between production and consumption of domestic products is increasing, and the import of fish (at lower price) is increasing to fill the gap. This is in part because aquaculture products are not strong competitors for wild products and there is not a strong bias towards fish production in the country.

Trade regulations have in some cases positively affected national production. In Bangladesh, for example, regulations derived from national development strategy aims to promote the sustainable production of fish that meet standards for export markets. Despite intense capital requirements to achieve export status, the portion of exports relative to domestic markets continues to increase.

Conclusion

The combined output of fish products continues to grow around the world. International trade has increased competition and regulations relating to trade have changed in the last decades. The national regulations include the national standard of environment impacts of aquaculture, quality and safety control, market access permits, etc. It has helped to improve the quality and safety of the fish products, and brought along social and economic benefits. The regulation of international markets differs from country to country. The EU and the USA are the main target markets for export orientated producers. The regulations largely focus on quality control, traceability and sustainable development. For some producers, market signals are well perceived and guided by the practices of aquaculture. The organisation of market and production are effective in response to market changes. However, others are not well placed to react to market signals.

Aquaculture has also led changes in the patterns of fish consumption in some countries. In Brazil, consumption that was once sporadic, over the weekends or during holidays has become common place with a greater supply and better distribution canals driven by expansion of aquaculture in all parts of the country. Fish is also starting to compete in some regions where previously there had been a strong meat bias. Today, due to the higher prices of wild-caught marine fish compared to farm-raised tilapia, and the better freshness, many consumers have shifted their eating patterns to aquaculture products.

It is evident that government in most fish producing developing countries realise the potential of aquaculture to contribute towards food security, poverty alleviation and economic growth. Development plans and legal frameworks have been institutionalised and continue to be updated to conform to current developmental and sustainability concerns in managing aquatic resources. There is a need, however, in some countries to ensure that government policies, development plans and domestic regulations orient producers towards commercialisation rather than subsistence activities though sustainable fish trade. Increased product diversification and improved targeting of diverse markets from capture fisheries and aquaculture needs to be encouraged, including the development of a range of higher-quality products for the poor. However, this should not be cumbersome and prevent market access. For example, market access for Vietnamese seafood exports has been affected by the rigorous and ever-changing standards. Compliance with these standards has placed a heavy burden on Vietnamese producers and exporters, which are mainly small and medium-sized enterprises. The cost of compliance has also reduced the competitiveness of Viet Nam's seafood industry. The findings of the study suggest that changing food safety regulations in the developed markets (particular in the EU, the US, and Japan) had brought about effects on the trade flow of seafood. Maintaining the competitiveness of small-scale fish producers and processors requires government policies and support designed to minimize the cost of compliance with international standards

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