



Katalyst's Contribution to Systemic Change

– The Adopt, Adapt, Expand, Respond Cases



Systemic Change in Fish

Case Study number 9

Karen Smith
Dr. Ben Taylor

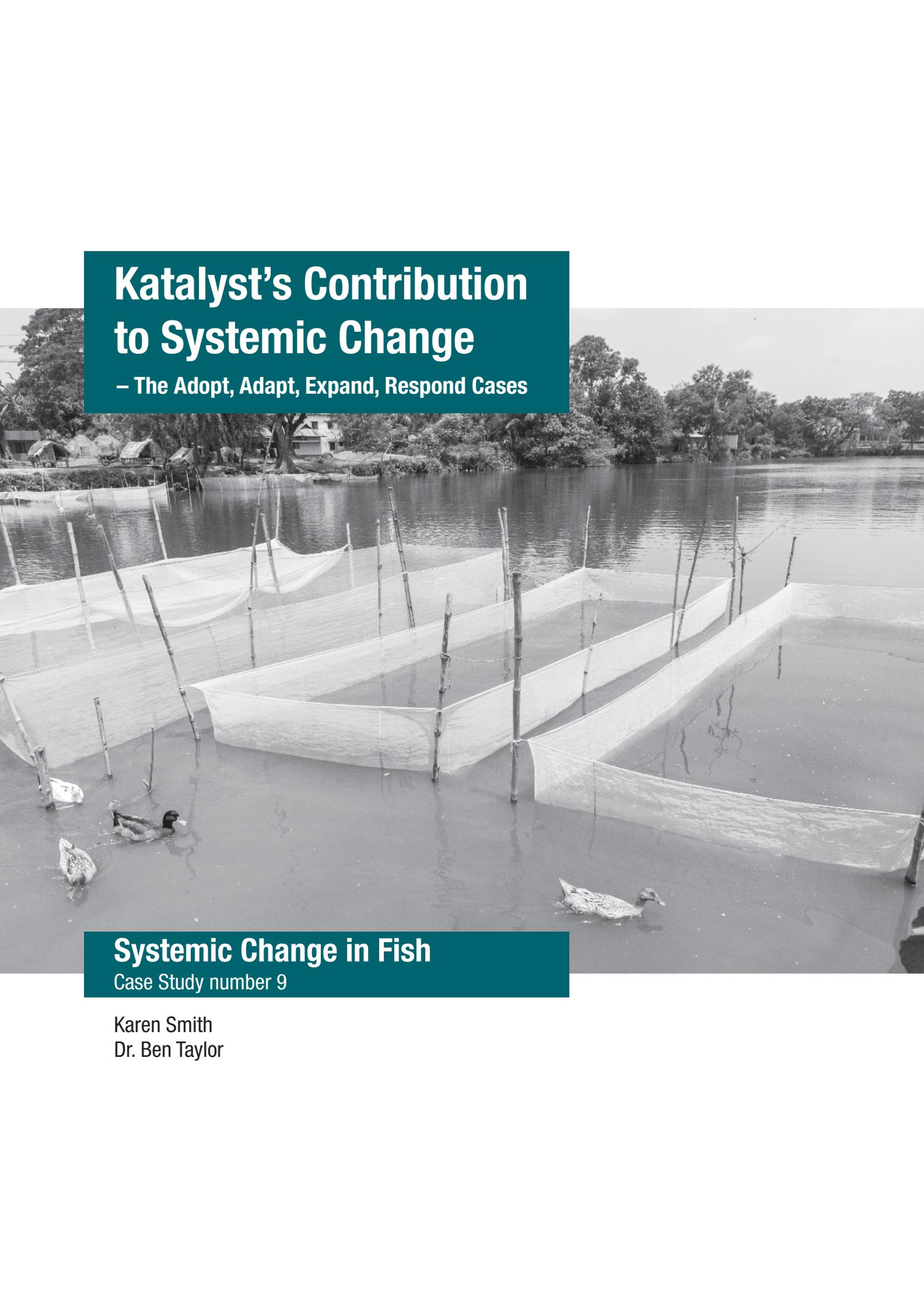


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**Katalyst's Contribution
to Systemic Change**

Introduction

Development programming is temporary in nature. External entities intervene in a system and change it with the aim of benefiting poor people. Throughout the history of development there have been temporary impacts on small numbers of people as, when funding stops, so does the impact of the change in the system. Katalyst's approach is different in that it explicitly targets large scale, sustainable – or *systemic* – change. These cases represent a significant milestone in the implementation of market development programmes. Katalyst, with the Springfield Centre, has played a leading role in developing thinking around what systemic change means. This suite of cases examines this concept across three sectors, demonstrating with different levels of complexity how a system can be changed to create sustainable impact at scale. Before engaging in the case material, however, it is important to clarify the *Adopt, Adapt, Expand, Respond* (AAER) framework as a means for identifying and defining systemic change so that this can be employed to understand how it has been facilitated in these sectors through the work of Katalyst.

What systemic change means

The first key concept defining systemic change is the identification of a system. M4P provides a useful framework for understanding a system which is seen as a series of interconnected supply-demand transactions which are supported by functions and governed by formal and informal rules (see Figure 1). **The supporting functions and rules are components of a system which affect the price, level, or quality of supply, demand or exchange in the core transaction.** The target group, which in the case of Katalyst is poor people, will always play the role of either supply or demand – as producers, consumers, rights holders, or

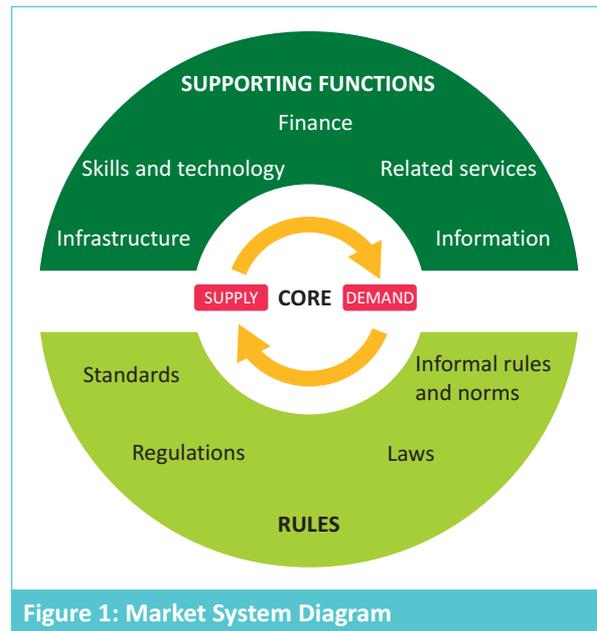


Figure 1: Market System Diagram

employees – in the core transaction of the principal market system, i.e. the system where the programme aims to improve outcomes for the target group.

The performance of the supporting functions and rules dictates the outcomes of the transaction. In order to change the way the system works for the benefit of the poor, one must change how these supporting functions and rules work.

The performance of each of the supporting functions or rules is, in turn, dictated by its own system – the supporting market system – which has its own supporting functions and rules.

The objectives of systemic change are defined relatively consistently as sustainable, large-scale change. However, while these goals are clear, consensus and clarity on what systemic change is, how to recognise it, and when intervention might be required, is notably absent. The Merriam-

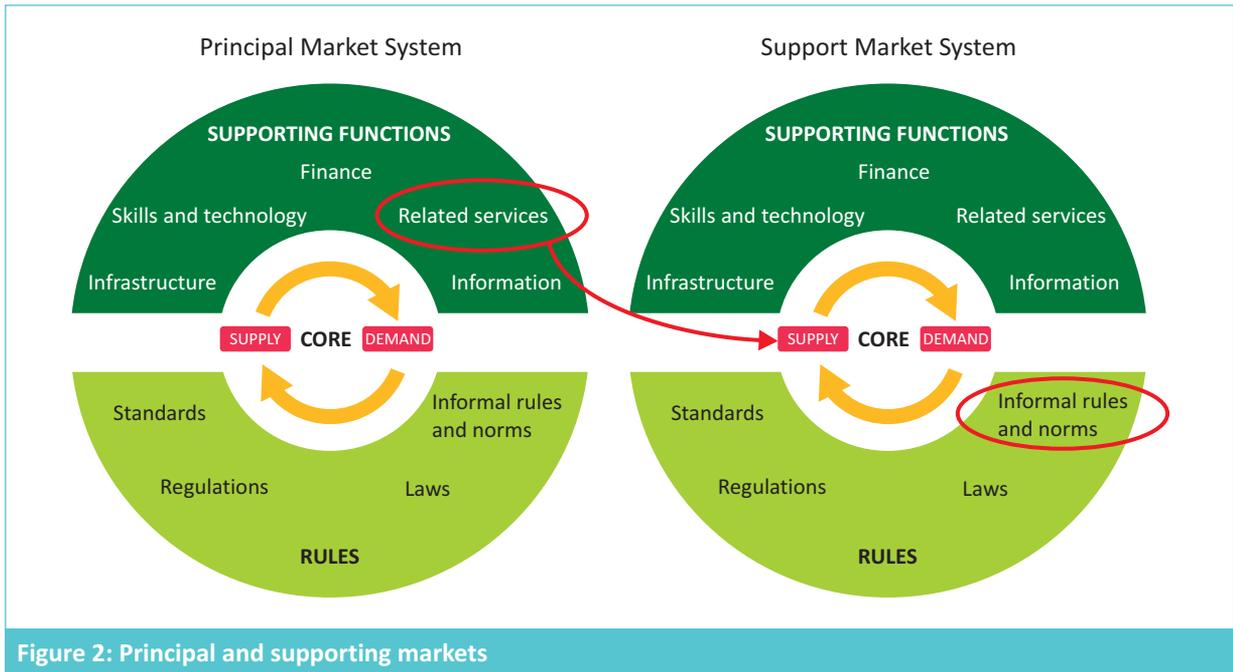


Figure 2: Principal and supporting markets

Webster dictionary defines 'systemic' as of or relating to an entire system and 'change' as to make someone or something different. New Philanthropy Capital's 2015 handbook introduces concepts of sustainability and the different components of a system, defining system[s] change as:

...an intentional process designed to alter the status quo by shifting the function or structure of an identified system with purposeful interventions...Systems change aims to bring about lasting change by altering underlying structures and supporting mechanisms which make the system operate in a particular way. These can include policies, routines, relationships, resources, power structures and values.

The M4P Operational Guide makes this more specific to development, using the objective of the change as part of its definition:

A change in the way core functions, supporting functions and rules perform, that ultimately improves the poor's terms of participation within the market system.

Definitions are inherently limited when they have to be applied in context and the real question that development programmes need to address is *what*

does systemic change look like and how do I know if it has happened?

Based on the goals of sustainability and scale of impact, the changes in performance of supporting functions and rules identified above must demonstrate:

- Uptake, ownership, and investment by relevant players within the system, in the absence of external involvement; a sustainable change in behaviour.
- Increasing impact over time; more benefits to more people in the target group.
- Changes in other supporting functions and rules to stabilise or augment the impact of the initial change.

Cognisant of the concept of systemic change, the Springfield Centre and Katalyst developed a simple conceptual framework which aims to capture these different dimensions. The framework, known as the *Adopt, Adapt, Expand, Respond* (AAER) framework or the *Systemic Change Framework*, can be used by a programme to monitor whether systemic change has happened, is happening, or requires further programme action in order to take hold. These case studies are presented through the lens of this systemic change framework, the four key components of which are explained here.

Adopt

In the first instance, the role of a programme is to identify what change is needed – which of the supporting functions and rules within a system are underperforming, how they might perform better, and what actions should be taken to bring that change about. The system is not generating this solution of its own accord and so programme intervention to instigate an innovation is necessary.

Adopt is a process whereby an innovation in the operation of one or more supporting functions or rules of the market system is introduced and ownership over it is gradually institutionalised within the relevant players in the system. This will involve different roles for different actors. In this phase, a programme will be testing and refining an innovation in partnership with one or more players whose incentives are similarly aligned should the innovation be successful. It may be the case that multiple models of innovation fail at this stage – constraints may be intractable or the barriers to opportunities being realised too significant to warrant further programme investment.

For example, a programme might want to change the way that farmers receive information – changing the way the function of ‘information’ operates. To do this, they might need to partner with radio stations, journalism training institutions, research institutions, and private advertisers. All of these players, whether they are programme partners or not, need to change their behaviour in some way in order for the new model to work.

By the end of the *Adopt* phase, a programme will no longer be providing support to the initial

partner or partners in the same way. However, as documented below, changes required to further expand or stabilise the impact of the initial innovation will require **actor level institutionalisation** among relevant players. Further programme involvement may be required and so that this transferal of ownership takes place.

Adapt

The *Adapt* component of the systemic change framework refers to sustained behaviour change by relevant actors. The players involved in the innovation – both those that were supported by the programme and those that weren't – must have accepted the different changes in their behaviour necessary for the model to work and incorporated them into their standard operations, in the absence of programme involvement, with independent investment of time, money, or other resources.

The process of institutionalisation – moving from *Adopt* to *Adapt* – needs to happen at the system level i.e. the functions which comprise the innovation need to continue to operate in this novel way after external intervention has ended. However, in practical terms, functions are comprised of a wide range of actors adopting a wide range of behaviour changes. Whether an initial partner, or an actor involved in the expansion or response component of the change, any shift in behaviour has to be institutionalised in order for it to be sustainable.

Expand

Expand is about pushing the boundaries of the innovation – more benefits for more people.

Change		Mechanisms
More People	More Benefits	
<ul style="list-style-type: none"> • New geographies • New segments of target group <ul style="list-style-type: none"> ▪ Income groups ▪ Marginalised segments: women, minorities etc. 	<ul style="list-style-type: none"> • Lower costs • Higher incomes from produce • Greater health or quality of life benefits • Better protection of future incomes through disease resistance or genetic diversity 	<ul style="list-style-type: none"> • Existing actors <ul style="list-style-type: none"> ▪ Roll-out • New actors <ul style="list-style-type: none"> ▪ New geographies ▪ Competition <ul style="list-style-type: none"> • Lower prices • Further innovation

The competition mechanism also has a dividend on sustainability, as an innovation becomes less dependent upon individual actors. If others are not imitating or emulating innovations that are seemingly successful and aligned with incentives to do so then it is indicative of a more fundamental problem with how the system operates including the information transmission mechanisms.

Having monitored the adoption and adaptation of a change in behaviour, a programme might need to re-engage in order to include new players or new areas in an innovation. It may be that the concept is proven and so the risk for a private sector partner is lower, or it may be that the programme initially targeted easier to reach areas and so heavier programme involvement is required in order to push impact into more marginal areas. Different partners also have different needs determined by their capacities, and so the type of programme support might also differ from that in the initial innovation.

Referring again to the earlier example of intervention in the information function, a behaviour change may have been sustainable with the programme partners – for example a radio

station and a research institution – and with all of the other players who needed to change their behaviour, such as journalists, training providers, and advertisers. However, the impact from that single radio station might not be reaching as many people as it could and so it might be necessary to partner with other players – whether they are radio stations and research institutions or perhaps other relevant players – in order to expand the benefits of the model to more people.

Respond

The *Respond* component of the systemic change matrix examines whether other supporting functions and rules are changing in response to the behaviour change that has been assessed through other components. It assesses what changes are happening and the degree to which they are supportive of or obstructive to the desired impact. If impact could be increased by responses within supporting functions and rules that are not happening organically then this represents an opportunity to increase the scale of impact. As such *Respond* is an important aspect of systemic change for both sustainability, through creating resilience of change, and scale, through realising opportunities for increasing impact.

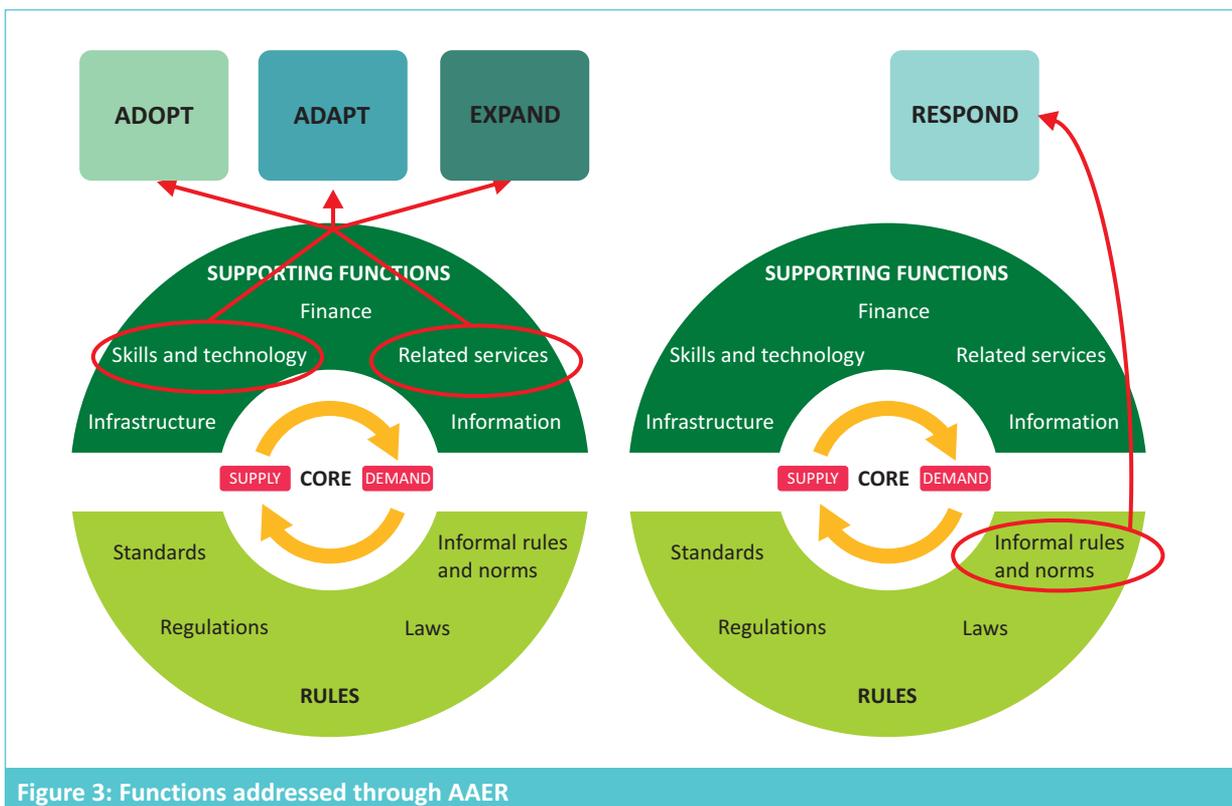


Figure 3: Functions addressed through AAER



Adopt, Adapt, and Expand represent changes in the operation of one or more initial supporting functions or rules which are part of a programme's vision for how a sector might work better to improve outcomes for the target group. *Respond* represents changes in other supporting functions or rules which reinforce or enhance the changes from the initial innovation.

In the example here, a range of players altered their behaviours and have helped to change the *skills and technology* and *related services* functions. However, if the growth in benefits to and numbers of the target group are to continue to expand from these changes, it may be that informal rules and norms need to change the way they work too.

Employing AAER

In summary, then, there are two roles of the AAER framework. Firstly, it is an articulation of the programme's vision. If a programme aims to bring about systemic change and the AAER framework helps articulate what it looks like, then a programme should be able to articulate how they can realistically expect the system to change in each of these components, before intervening.

However, systems are dynamic and complex and plans are rarely borne out in reality. As a second and on-going use of the framework, then, the systemic change matrix is used by the programme as a tool for monitoring, reflection and guidance to action.

Structure of the cases

The case is structured as follows. Firstly, the market system for pond fish is analysed, demonstrating position of the target group within the sector and the supporting functions and rules affect outcomes. The focus for the remainder of the case is then placed on the fingerling market system as a crucial input to the pond fish market where much of Katalyst's work has taken place. Within this supporting system, the symptoms and underlying causes of underperformance are examined in detail. Subsequently, the AAER framework articulated in this introductory chapter is employed to examine exactly how and why Katalyst intervened in the sector, how this evolved overtime, and the ultimate impact that it had on the overall pond fish market system. The learning from Katalyst's work in the sector is then analysed to assess wider relevance to the development field.

9 CHANGING THE FINGERLING MARKET SYSTEM





CHANGING THE FINGERLING MARKET SYSTEM

Introduction

Katalyst has been working in the freshwater fish sector since inception, recognising the strength of the market both domestically and for export potential, as well as the opportunity to increase incomes of poor people involved in the industry. Initially the programme took a regional approach (Phase 1, 2003 – 2008) and Faridpur was selected as an underdeveloped target area which had potential to increase the productivity of small farmers. The outcomes of this work are described in the 2007 case study *Accelerating Growth in the Pond Fish Sector* (de Ruyter de Wildt, 2007).

In reviewing Katalyst’s sector priorities for Phase 2, which ran from 2009 – 2013, it was clear that aquaculture remained a strong candidate. In line with the new country-wide approach for the programme, the scope of the fish sector was expanded to all regions and built on research that showed that specific high value species could yield the greatest economic benefits for small fish farmers.

This case study examines a number of

interventions from Phase 2, detailing their outcomes and the subsequent strategic decisions shaping further work in Phase 3. Data are also drawn from a number of impact assessments and intervention reports from both phases.

The case is structured as follows. The overall market for farmed fish is described briefly before focusing in on features and constraints of the fingerling supply market. The symptoms and underlying causes of underperformance are identified, narrowing these down to the functions of hatchery management, brood stock supply and the marketing of aquaculture information to farmers. The section ‘From analysis to intervention’ describes how the programme intervened to achieve systemic change by developing the functions through interventions in *Adopt*, *Adapt*, *Expand*, and *Respond* components of the framework, with associated results achieved at each stage. Finally some sector specific lessons are drawn out.

The overall market

The fishing industry is an integral part of Bangladeshi culture, as reflected by the saying “Machhe Bhate Bangalee” (“Rice and fish make a Bengali”). As Katalyst conducted their analysis of the sector at the beginning of Phase 2, Bangladesh was the 5th largest producer in the world, although China dominated with nearly 70% of global production (FAO, 2014). In 2009 the fish sector overall accounted for 4.73% of GDP and generated 4.04% of export earnings (Department of

Fisheries, 2009), and was one of the fastest growing sub-sectors of agriculture in the country. Globally, the fishing industry, particularly in Asia, has had strong and steady growth and continues to intensify and expand to meet demand; between 2000 and 2012, for example, worldwide food fish aquaculture production expanded at an average annual rate of 6.2% from 32.4 million to 66.6 million tonnes (FAO, 2014).

The aquaculture sector in Bangladesh offers good income and employment opportunities for poor farmers. The Department of Fisheries (2009) estimated that 12.5 million people were dependent directly or indirectly on fisheries and associated activities for livelihoods. In addition to the economic benefits of fish farming, it is significant that Bangladeshis gain 56% of the protein in their diet from fish (FAO, 2014) and farming families will typically eat the smaller, less marketable fish that they produce.

The fishing industry is sub-classified as either capture or culture (e.g. harvesting from the wild vs farming) and as either marine fishing or inland fishing (aquaculture). The marine sector benefits large numbers of marginal fishermen, but the impact of increased marine capture depletes fish stocks to the detriment of the environment. Inland capture was also suffering from depleted stocks and regulatory restrictions, depressing margins. Of the four sub-sectors, aquaculture was identified to be the most relevant to Katalyst's objectives, since it was growing at a faster rate than traditional capture and was essentially inclusive in nature.

The change in the shape of the Bangladesh aquaculture industry from 1980 can be seen in Figure 1 below, with the total production in 2012 exceeding 1.7M tonnes.

Katalyst's definition of the target small and marginal fish farmers was those holding or accessing 0.5 to 2.49 acres of land. Research showed that a typical small pond fish farmer generated an income

of USD285 per year per acre on average from fish farming (BCAS, 2009). Compared to other agricultural value chains, the proportion of profit retained at producer level is relatively good.

Small pond fish farmers typically do not incur significant fixed costs; they either own ponds of their own or pay to lease them. A farmer prepares a pond and will source fingerlings and provide feed and sometimes aqua chemicals to culture the fish until they reach a marketable size. The cost of feed is the greatest outlay in production, and human resource can also be a relatively high cost.

Small farmers tend to farm 'extensively', whereby the fish feed from natural sources. 'Intensive farming' utilises fish feed to increase productivity, but is not as accessible to small farmers as costs are higher; a 'semi-intensive' approach is a more viable alternative for these farmers to increase yields. Whether taking an extensive or intensive approach, aquaculture can be conducted with either one species (monoculture) or with a variety of breeds (polyculture) to maximise the utilisation of pond resources. Intensive farming is more likely to be monoculture, but there is no fixed approach for any one species.

Farmers will access information on aquaculture practice from a wide range of sources, e.g. from their neighbours, input suppliers and the hatcheries where they buy fingerlings. The government provides fishery extension officers, but these resources are very thinly spread. Traditional extensive farming is much less profitable than more advanced intensive

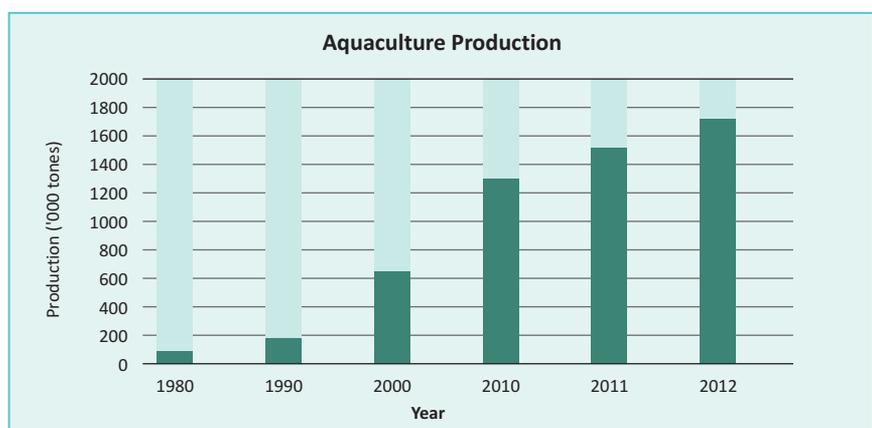


Figure 4: Bangladesh Aquaculture Production 1980 vs 2012 (FAO.org, 2016)



cultivation, but knowledge on how to use intensive methods is not well disseminated. Farmers can fall victim to problems caused by overstocking, e.g. leading to wholesale losses due to disease, if they lack the necessary agronomic expertise.

Katalyst's Phase 2 engagement in the pond fish market centred predominantly on the input supply chain rather than in forward marketing, as this was where the greatest challenges and opportunities lay. Small farmers are generally able to sell their produce for a fair price, although price crashes can cause losses where one year's strong prices for a particular breed led to oversupply in the following year.

In consultation with industry experts, the programme determined that a critical aspect of the aquaculture market that affected marginal farmers was the choice of species which they farmed. Some work had successfully been conducted in Rangpur and Dinajpur in Phase 1 introducing tilapia as a more profitable fish breed. Two other relatively new species (pangus and koi) have also become increasingly popular cultivated pond fish in Bangladesh. The three breeds are collectively classified as "high value species" (HVS)

due to the greater profitability that can be obtained as a result of their shorter farming cycles, which mean that farmers can produce 2 or even 3 cycles per year, as well as faster growth rates and lower mortality rates than traditional breeds. Farming of HVS has spread across the country since their introduction, and in 2012 the production of these three species accounted for 22 percent of overall fish production (DoF, 2012). The species proved more popular in districts such as Mymensingh, Syhlet, Chittagong, Comilla and Bogra, but they were not yet common choices for smaller farmers. Katalyst chose to focus on the promotion of these three HVS to best improve the livelihoods of aquaculture farmers.

Following an M4P approach, Katalyst mapped the supporting functions and rules that determine the terms of the main transaction involving poor people in the pond fish market, focussing on their role as producers rather than consumers and employees. The programme identified a number of salient demand-side factors which were preventing Bangladesh from capitalising on the growing international demand for fish: the species of fish currently dominating production were not suitable for the export market; Bangladesh was not

price-competitive in the cultured fish market; and poor information flows up and down the value chain made it hard for exporters to source the right supply.

These demand-side issues were not, however, as pressing an issue for small farmers, and the overall demand curve for the pond fish market, as discussed earlier, was broadly one of growth. It was on the supply-side that Katalyst found the more significant weaknesses in performance that restricted the profitable opportunities for small farmers, and so these were the focus of their attention. One such challenge was that of access to affordable capital by small fish farmers; such farmers are high risk clients for the formal financial sector, and borrowing is limited to family or moneylender sources. However, the key area constraining performance lay in the functions of input supply, both in the quality of feed and chemical inputs and in the quality of the basic fingerlings that farmers could acquire. While Katalyst undertook interventions to address the production issues of fish feed and aqua chemicals, the focus of this case is on the more extensive work conducted to improve the function of fingerling supply.

Fingerling market performance

In seeking the key constraints that prevented small farmers from fully benefitting from HVS production, Katalyst found the issues regarding fingerling supply to be the most critical. The fingerling market is illustrated below, and is a supporting market to the principal cultured fish market. In order to improve the opportunity for small farmers to benefit from HVS cultivation, it was predominantly weaknesses and opportunities in the functions and rules in this market that Katalyst needed to address.

There were three primary aspects to the underperformance in fingerling supply as discussed below.

Symptoms

Lack of access

The poor performance of the hatcheries resulted in inadequate supply of fingerlings which meant that those farmers wishing to cultivate HVS found

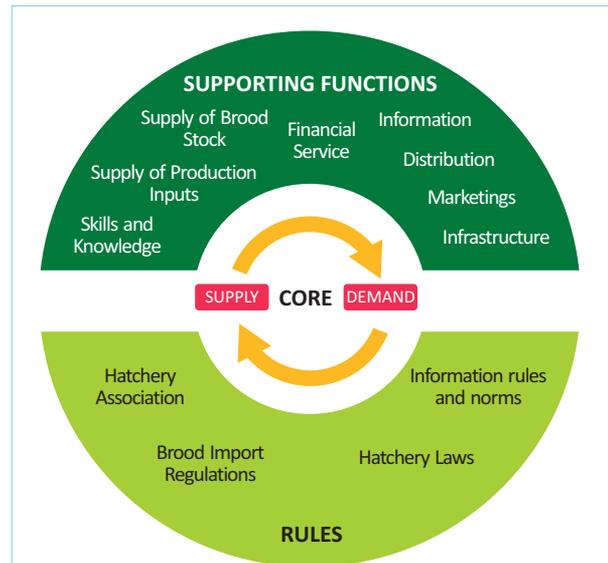


Figure 5: Pond fish market system

it difficult to source the raw materials required. Strong industry growth meant that the supply of HVS fingerlings was lagging behind demand and therefore pushing up prices beyond the reach of smaller farmers.

Lack of quality

The performance of fingerlings was low in terms of both mortality rates of the spawn produced at the hatcheries, the mortality rates of fingerlings and also the overall size and health of the farmed fish. Small farmers could experience expensive failures in their fish farming if they were unfortunate in purchasing such poor quality inputs.

Lack of use

The overarching symptom of the problem, i.e. the failure of small farmers to benefit from the opportunity presented by HVS production, was that they were not choosing to farm these species and instead preferred to continue with cultivating traditional fish breeds, such as local carp, with which they were more familiar. Despite the growing production levels of HVS nationally, the benefits of these species in terms of higher levels of profitability were not being accessed by small farmers.

Small fish farmers perceived that HVS required greater investment in feed and aqua chemical inputs for successful production, and this is true of

an intensive farming approach which commercial farmers adopt. The risk reward ratio was therefore considered to be higher than for traditional species. This risk was exacerbated by the variable quality of fingerlings as described above, but also the erratic quality in feed and aqua chemical inputs, a problem that Katalyst identified and pursued as a linked intervention to improve local input manufacturing.

In summary, small farmers were less likely than their large counterparts to recognise the benefits of HVS farming, and those who engaged were less likely to see a profitable outcome due to poor knowledge of optimal production methods and poor raw materials.

Underlying causes

The HVS fingerling market had a number of supporting functions that were not operating to their full potential and were perpetuating the lack of uptake and cultivation challenges experienced by small farmers. To fully understand the issues faced by hatcheries in producing good quality fingerlings, Katalyst commissioned a study in 2011. There were found to be a number of root causes which constrained performance and these are outlined below.

Hatchery management

Firstly, there was a dearth of technical and management know-how amongst hatchery owners and staff which was leading to numerous production problems (water quality, brood, feed, and disease management). Katalyst's research into the ownership and management of hatcheries showed that most commercial hatchery owners and employees lacked adequate understanding of good breeding practices. Furthermore, 45% of the hatchery owners had received no formal technical training or had just attended a short course and nearly all employees were unskilled labourers. Underlying capacity gaps in hatchery management were magnified by the adherence to poor advice of local "doctors"; nearly all hatcheries had such a doctor acting as a technical adviser, reflecting the strong cultural roots of the fishing industry. The advice being given by such doctors, however, was based on tradition and found to be limiting, if not

detrimental, to production. In addition, public sector sources of support and information were inadequate as exemplified by the lack of any industry guidelines to assist hatcheries.

The negative impacts being seen as a result of these poor practices included brood fish yielding fewer eggs, poor egg fertilisation and as a result, a higher mortality rate for farmed fish as well as stunted growth. These failures were all linked to a lack of effectiveness of the supporting knowledge and skills function on the supply side of the fingerling market, which hampered HVS market potential.

Brood stock supply

Secondly, there was a lack of adequate new brood stock to replenish old material and often stock came from a single source, perpetuating inbreeding problems. The Bangladesh Fisheries Research Institute (BFRI), which is responsible for fisheries research and its coordination, was the only source of pure brood stock in the country available to hatcheries, and only at very small scale. There was also a very small number of vertically integrated firms that imported brood stock, but their dealers only sold to large, commercial farmers.

One of the symptoms of the poor technical performance discussed above was that none of the hatcheries surveyed understood the protocols required to maintain strong brood stock and avoid genetic problems. Advances in fish breeding, such as innovations to improve size, taste, speed of growth, disease resistance, etc., were neither being developed in-country due to a lack of foresight and investment by the public sector, nor exploited from external sources. The weakness in the sourcing function for brood stock was an integral contributor to the quality problem.

This function was further constrained by gaps in public sector support, i.e. in the "rules" governing the market, which needed to be amended and implemented to facilitate the ease of importing brood stock. One of the major contributing factors to the lack of impetus on private sector access to new and improved technology lay with poor

industry coordination, and Katalyst identified this as another function to be addressed in support of the need for better brood stock sourcing.

Aquaculture information marketing

The lack of uptake of HVS cultivation by poor farmers was as a result of their limited understanding of the opportunity it offered. This knowledge shortfall was caused by underperformance in the marketing function, and was the key reason limiting the demand-side of the fingerling market. Small farmers needed to be incentivised and educated to break with traditional approaches to cultivate in a more commercial manner. Poor pond management, untreated disease or incorrect use of inputs could lead to costly problems. Information on optimal use of inputs and cultivation practices was not consistently available from any one source, and so farmers would turn to knowledgeable neighbours or retailers for help, or remain unaware that some of the methods that they were using did more

harm than good. There was an opportunity among a range of private sector players in the pond fish sector, including hatcheries, input suppliers and small traders such as patilwala (fish seed traders), to increase their efforts in marketing HVS to stimulate demand among the less commercial and less accessed small farmer community.

In order to facilitate a systemic change in the fingerling market which would yield the desired uptake and performance improvements in HVS cultivation among poor farmers, the three salient supporting functions that Katalyst sought to transform were therefore: knowledge and skills with regard to fingerling production; brood stock supply, alongside supporting legislation; and informational marketing of HVS to small farmers. Katalyst's farmed fish sector vision was that "small fish farmers will increase their incomes by diversifying into more profitable species and practices".



Systemic change in the fingerling market

The aquaculture sector has been a key area of interest for Katalyst for over a decade. The problems of lack of access, lack of quality, and lack of use in the fingerling supply market were interrelated and required analysis and coordinated attention. Would encouraging small farmers to try farming new species risk expensive failures when their ambition exceeded their understanding of best agronomic practices? Could hatcheries successfully develop better technical management practices to produce healthier, higher quality fingerlings and win the confidence of farmers? Would input companies see the commercial benefits of targeting the small farmer market with information-based sales techniques?

From analysis to intervention

Defining the innovation: Increasing access to, and quality and use of, HVS fingerlings

The analysis of the pond fish sector in Phase 2 gave clarity to the systemic changes needed to increase the benefits to small farmers. Katalyst took a three pronged approach towards facilitating the desired systemic change: to increase the quality of HVS fingerlings by improving the function of brood stock sourcing to hatcheries; to improve the management of the hatcheries through a more effective knowledge and skills function; and to increase small farmer knowledge of effective and profitable HVS cultivation via better marketing of the benefits of HVS farming by private sector actors in the value chain. The challenge was to institute a new configuration of better operating

functions to ensure that change was both sustainable and impacted large numbers of farmers.

ADOPT: Piloting

The hatchery research Katalyst conducted revealed that all but one of the hatcheries surveyed had suffered inbreeding problems for HVS. The hatchery businesses were noticing losses as a result of farmers switching to other species when their fingerling growth was poor. Although some hatchery owners replaced their broods annually, they tended to use the same sources (e.g. government research centres, local sources) and lacked essential management protocols, and so the genetic stock was not being expanded. In order to achieve higher quality seed it was clearly essential to find new sources from outside the country. Although a small number of private companies, operating exclusively through their own dealers, brought in brood stock from abroad, this was at low volumes and was only accessible to larger, more commercial farmers. Katalyst's research showed that hatcheries were also keen to import, but no investment was available from public sources to assist with the process, unlike in other countries with significant fishing industries, where research and importation facilities and public sector culture of brood stock were commonplace.

In order to catalyse the essential inflow of new seed, the decision was taken to undertake a pilot intervention with 14 hatcheries to import of brood stock from optimal quality sources to capitalise on the results of international research and development of HVS genetics. Katalyst facilitated this process by identifying the best providers, arranging buying trips and sharing some of the costs. The hatcheries shared some of the new stock with Bangladesh Fisheries Research Institute (BFRI) so that they could develop the genetic

quality of the species and also make this brood stock available to other hatcheries. This was to not only encourage private sector investment and access to improved brood technology but also to engage and build the capacity of the public sector as an important resource for the industry.

Katalyst had also identified that beyond the quality of the fish seed, the hatcheries had poor technical knowledge and management skills which compounded the issues of nurturing healthy fingerlings. The hatchery study conducted in 2010 in three selected districts (Mymensingh, Comilla and Bogra) highlighted numerous specific areas where a lack of both business skills and technical knowhow was impacting production. Katalyst needed to identify how to change the way in which the knowledge function operated in order to upskill the hatcheries, not only as a one off exercise, but in a manner that meant that independent service provision would be available thereafter to sustain quality in the industry. Bangladesh Fisheries Research Forum (BFRF), a member-based platform for the industry, and BFRI, were both engaged as suitable partners, having both the incentives to support the development and growth of the industry and national reach, as well as experts from the two international institutions in Vietnam and the Philippines, to design and deliver training to 45 hatcheries on essential components of hatchery management including brood management, hatching practice, selection of brood, pond-based breeding, hormone mixing and feeding practice. A hatchery management manual was designed and 1,500 copies disseminated.

Katalyst also analysed the flows of information in the fingerling market between private sector actors in the value chain and the farmers, to understand how to transform the marketing function to increase small farmer uptake of HVS production. The prime candidates seemed to be the feed and aqua chemical companies, who had both the capacity and the incentive to impart knowledge on cultivation techniques and the utilisation of their products. The logic was that companies would see the benefits of “information marketing” by resultant increases in input sales.

An intervention was designed with five input companies, selected according to their capacities, interest and geographical coverage, utilising a range of channels to deliver information to farmers such as training for sales personnel, dealers and lead farmers and demonstration plots. The training incorporated agronomic information that would improve cultivation practices. However, analysis of the uptake revealed that 38% of the farmers were large farmers (farm size of 1 to 2 acres), 32% were medium farmers (farm size of 50 decimal to 1 acre) and only 30% were small farmers. Katalyst concluded that while their endeavour to improve the marketing function had benefited some of the target group, a revised strategy would be required to expand the impact of the function to a greater proportion of poor farmers.

Results – Proof of Concept

The aim of these initial interventions was to test that Katalyst’s logic worked in practice as evidenced by the response from their partners. If these partners changed their behaviour in the ways envisaged, were there signs that the resultant changes in functions would lead to increased productivity for small farmers?

As a result of Katalyst’s support and facilitation a number of hatcheries took part in visits to international research centres to procure high quality brood stock. The list of partner hatcheries selected for the pilot was based on the recommendations in the hatchery research report; 6 visited Vietnam in August 2011 and 8 visited the Philippines in September of the same year in order to purchase tilapia and pangus. M.O. Hatchery was one of the group involved in the import pilot. Their agents were so impressed by the Vietnamese koi they saw on the trip, which has a better flavour than the Thai koi and is a bigger breed, that they arranged to import some of these as well. Two other hatcheries followed suit and the success of this venture led them to promote the species more widely in Bangladesh through BFRI exhibitions and seminars.

The objective of the import strategy was ultimately to see an improvement in fingerling quality. Katalyst reported that the hatcheries who had

One of the hatcheries that took up Katalyst's offer of support to import fresh brood stock was the Fishtech Hatchery, located near Mymensingh. They took part in the initial visits and bought both tilapia and koi, as well as benefitting from the technical training. As a result the hatchery has expanded from a customer base of 200 to a forecasted 5,000 this year.



Mr Jahirul Islam showing the tilapia spawn being taken for hormone treatment, an important aspect of mono-sex tilapia brood development.

imported stock in the initial tranche saw a reduction in mortality rates of the fish fry from 40% to under 5% and that farmers also benefitted from reduced mortality rates of the fish produced from these fingerlings from between 10 – 20% (depending on the species) to under 5%. These benefits were recorded as reaching over 55,000 farmers at an average income saving of approximately USD30 per farmer.

As defined in the opening section of these case studies, the components of systemic change are non-linear. The subsequent sections, therefore, do not necessarily follow chronologically or in isolation. In attempting to broaden the impact of a change in a sector, new partners will have to transition through adaptations of the original model and in increasing the resilience of a change by observing and facilitating the response of other supporting functions and rules.

ADAPT: Institutionalisation of change

Katalyst worked in collaboration with partners in the fingerling market to capitalise on incentives that contributed towards the desired vision of a better functioning system. Sustainable change in the functions can be recognised when these partners independently pursue a new practice once the programme has disengaged.

Results

The introduction of sourcing brood from abroad for hatcheries was part of a behaviour change necessary to see an improved function based on an understanding of the science behind fish breeding.

At the end of Phase 2, Katalyst commissioned another study (Innovision, 2013) into the HVS to better understand the specific informational needs of small farmers and to target interventions more effectively. A wide range of respondents were sought including the farmers themselves, hatcheries, feed producers, intermediaries and government fisheries officers. BFRF proposed to Katalyst that further trainings should be developed, extending to more regions. This signalled that the desired improvement in the knowledge and skills function was being seen; the provision of training was independently being pursued by BFRF and was in demand from hatcheries.

BFRF conducted a training needs assessment with over 300 hatcheries and, following this, designed and promoted a fee-based training programme, targeting businesses from “two tiers”, i.e. both formal and informal players, to ensure appropriate levels of content and diversity of outreach. A total of 136 hatchery owners, technicians and managers were trained, representing a significant proportion of the estimated 350 hatcheries which were breeding HVS across the country.

Partly as a result of the training activities, BFRF have reviewed their organisational mandate and plan to become more commercial based on a ten year plan, offering courses at profit-generating rates. This signals that the organisation has fully embraced the innovation of technical training provision to hatcheries. A further indication that the hatchery

training innovation has been fully embedded by BFRF is that they plan to offer training on 8 more species including catfish, crab and eel.

For this innovation to be sustained then hatcheries have to be willing to pay for the training. To date (December 2015) BFRF have charged a USD25 fee, which is a less than commercial rate, but an indication that the course was perceived to offer value and hatcheries are willing to invest in their businesses.

EXPAND: Greater benefits to more people

When change in performance of a function means that the associated benefits are derived by a greater number of people or that these benefits become greater, then the function is in the Expand phase of systemic change. For this expansion to be sustainable it needs to be self-driven by the relevant actors. However, it can also be the case that programme intervention can facilitate expansion which will subsequently contribute to ownership (or adaption) and it is this path that Katalyst was following to catalyse change in the sourcing of brood stock, for example.

It was clear at the end of Phase 2 that the programme had achieved results in terms of enhancing the sourcing function, but the change in practice was not yet fully sustained or scaled and needed further support to reach more people. A workshop for stakeholders (hatcheries, researchers, government agencies and fish farmers) was held in November 2012 to share the lessons learnt in brood import and also the results the farmers achieved in cultivating the fingerlings. The original partner hatcheries were keen to have a second trip to import new brood when it needed replenishing after three years. However, at this stage they did not feel they had the capacity to do it alone and so Katalyst and BFRF once again stepped in to assist the process in 2014 (Phase 3). By providing support at decreasing levels, e.g. from paying 85% of the initial importation trip costs to paying 50% the second time, the project kept the momentum of the change in practice moving but were ensuring ownership was being shifted to the hatcheries.

Following the introduction of higher quality brood stock as part of the improved sourcing function, farmers who grew the newly imported koi reported positively. 142 hatcheries bought fingerlings to develop further Koi brood stock from the three importing hatcheries, thereby expanding the benefits of the improved brood quality to greater numbers of farmers. It is a feature of koi that it is possible to do this, i.e. develop brood stock from fingerlings, whereas for other species, such as tilapia, this is not possible as only male fingerlings are sold.

Despite a lot of interest exhibited by small farmers following the pilot to better market HVS through the feed and aqua chemical companies, Katalyst's research found that they still saw HVS as too expensive for them to farm. Although there was high productivity potential with HVS farming, higher investment is needed in inputs (fingerlings, feed and aqua chemicals), requiring capital investment that was beyond the capacity of small farmers. In order to expand the benefits of improved marketing to the targeted small farmers, the programme needed to find another more appropriate strategy.

Katalyst consulted their technical advisers who proposed two HVS cultivation methodologies which were better suited to the resources of small farmers:

- “green pond technology”, an approach for tilapia farming that requires no commercial feed and relies on effective pond management; and
- “semi-optimal feeding” which incorporates the use of feed for polyculture, with shorter cycle fish added to the system and a reduction in feed (and therefore cost) required compared to intensive farming.

The programme took these ideas to the input companies but the bigger companies were not interested since they were focussed on the larger, more commercial farmer market segment. Instead, Katalyst negotiated to test the promotion of these two methodologies through 11 hatcheries who had been involved with the programme's brood importation pilot. In order to ensure that an



appropriate cohort of small or marginal farmers was selected, the Progress out of Poverty Index (PPI)¹ was used, whereby a farmer who had access to less than a 50 decimal pond area, and a PPI score of less than 58, was deemed to be part of the target population.

The improvements in the informational marketing function to encourage the new HVS cultivation methodologies were very positive with farmers involved reporting greater profits, and the sale of inputs also increased; successful adoption of implementing the innovative cultivation techniques through training had been achieved. Katalyst estimated that through patilwala and hatchery training, as well as other farmers learning from their peers, over 10,000 farmers have realised an average annual increase in income of USD130 per farmer.

Having established that the two innovative, low cost approaches to HVS farming were viable among small farmers, Katalyst shared the results of the pilot with a number of smaller feed and aqua chemical companies; larger input firms being less interested in the small farmer market segment. A number of these companies were enthusiastic to

¹ The Progress out of Poverty Index® (PPI®) is a poverty measurement tool for organisations and businesses with a mission to serve the poor.

Sohel Ahmed is a fish farmer who received training from Fishtech, switching from traditional carp to tilapia and koi four years ago. He now farms koi and tilapia in three of his four ponds, recognising that he benefits from being able to farm two cycles per year and that they are more resistant to disease than the carp. In the last season he made a profit of USD1,800, a significant increase over his original farming income.



Mr Ahmed does not buy from other hatcheries as he believes that he gets better fingerlings from Fishtech.

test the novel approach to marketing HVS products to small farmers, including specific labelling aimed at small farmers on their products. In terms of the systemic change Katalyst were trying to bring about, working with input suppliers can be seen as a variant of the initial innovation to facilitate increased benefits of informational marketing via hatcheries.

As a result, a new intervention was introduced in Phase 3 as part of the project's fish sector strategy. Two feed producers were selected, and since one of these, Uttara, was already conducting marketing campaigns in Jessore, Katalyst suggested they focussed on the north as a new region for the information-based marketing trial. The tactics adopted by Katalyst were to "buy down" the risk for partners such as Uttara to encourage them to innovate – in this case to take on the risk of venturing into a new geographic area. On a 50:50 cost share basis, Uttara trained 130 dealers (both their own and independent dealers), provided informational materials and also adapted the labelling on their pack. These dealers typically served 50 – 100 local farmers and were therefore able to impart HVS cultivation knowledge to them directly. Uttara also trained 1600 lead farmers who could share good practice in their localities.

Katalyst also identified two aqua chemical companies, Fishtech and SKF, who were interested in the small farmer market. These companies already had their own marketing tools, but the development of the informational content was supported by Katalyst. At the time of writing, there have been over 300 training sessions delivered by Katalyst partners to small farmers (aqua chemical and feed companies and 57 hatcheries), and a further 100 planned in the year ahead.

Results

Actor level institutionalisation

Since the expansion of the reach of the marketing function to small farmers is being scaled from an initial pilot, it is too early to be able to identify institutionalisation of this innovation among the relevant actors (input companies, hatcheries and small farmers). However, an early signs assessment recorded that the uptake of the

agronomic information accessed by farmers was 96% which is a promising indication. Furthermore, SKF achieved a 90% increase in their aqua chemical sales from USD33,000 in 2013 to USD62,500 in 2014 which they attributed to their involvement in providing training to small farmers and dealers. The company stated that they intended to increase the reach of the trainings to further geographical locations.

However, institutionalisation of the new approach to sourcing has been evident in the independent actions of the hatcheries. The second round of importation visits in 2014 saw many of the hatcheries now seeking brood stock from new sources beyond the first visit and also buying new breeds. For example, hatcheries successfully imported and developed Snakehead in 2015, which is another high value species. This can be seen as an expansion of benefits to farmers in the increase of choice of HVS available to them.

Impact level change – contribution to poverty reduction

There are multiple dimensions which affect the overall impact of change in the Expand component of systemic change, and quantification is challenging. For example, there are farmers affected by the direct interventions (e.g. cost shared brood import) in order to facilitate expansion of the impact of the original innovation. There are those impacted indirectly, such as farmers within the networks or the farmers who attend a training or workshop and improve their productivity as a consequence. There are also farmers who benefit because they are reached by players that have been influenced by Katalyst's interventions, such as the hatcheries introducing Vietnamese koi.

In terms of HVS importation from Thailand, Vietnam and the Philippines, a total of 51 hatcheries were involved: 20 importing koi; 16 importing pangus and 19 importing tilapia. The enrolment of district-level hatchery associations with a newly formed national association, making the regulatory aspect of the import process easier, should result in further expansion of brood stock imports and the associated benefits reaching a

greater number of small farmers. It is too early in the production cycle to measure results for all species since fingerling development from the new brood stock can take years, but Katalyst reported that in 2015, 22,000 farmers were benefitting from koi production and realising an average of USD430 additional income.

In terms of the imparting knowledge to farmers via marketing and embedding agronomic information in products, in 2014 SKF, Fishtech and 32 hatcheries conducted a total of 142 training sessions and reached 204 nurseries, 227 fry traders and 145 input dealers. These private partners also trained around 6,000 farmers. An early signs assessment at the end of 2015 recorded that 11,000 small farmers had increased their incomes by USD250 on average as a result of their improved farming practices.

RESPOND: Making change stick

For the functions addressed by Katalyst to sustainably serve the poor in the market, the changes need to be made resilient to future

externalities. It was apparent after the initial pilot of brood stock imports that a standardised process was needed for hatcheries to follow to embed and regulate the improved function. Katalyst facilitated a meeting between the DoF, hatcheries, BFRF and BFRI to discuss the best way to achieve this. As a result some colloquial guidelines were transformed into a more formal checklist that the Department of Fisheries (DoF) could use to regulate the import process. The DoF also suggested that a hatchery association needed to coordinate licensing and Katalyst facilitated the formation of the Central Hatchery Association to serve as an apex organisation for regional associations to coordinate buying trips and arrange import paperwork. The latter was a significant hurdle to accessing brood stock from abroad, particularly for the smaller, less professional hatcheries.

To further protect and secure brood stock quality, local technologies need to be developed for the Bangladeshi industry, rather than be dependent on external research. BFRF, as part of their mandate to



increase quality in the industry, have been working on a “brood development programme”, making genetic modifications and exploring cryogenic sperm as a breeding option for hatcheries. The DoF is also investing in a brood development programme, which is now entering its third phase. Improvements to the research and development function in-country complement the brood import intervention, and enhance the potential for Bangladesh to pursue competitive advantage in the pond fish industry, providing a robust basis for future sector growth.

Results

Actor level institutionalisation

The ownership of the concept for national coordination and a sign of adaptation of the function was witnessed by the commitment of a number of hatcheries to mobilising the idea of a membership organisation from a concept to reality in a span of three months after meeting with the Director General of DoF. These hatcheries pay a fee of approximately USD120 annually to the association which signals the value they perceive in membership.

In terms of public sector institutionalisation, the DoF now has a standard operational procedure for imports, captured in a reference manual, which consists of a permission letter for hatcheries and testing of the brood stock by BFRI. This process will be embedded in the Hatchery Rules which support

the Hatchery Act and further protection for the integrity of the industry will be provided by the introduction of quarantine regulations which are currently being drafted.

Impact level change – contribution to poverty reduction

None of the interventions undertaken by Katalyst can be isolated from the context of the systemic constraint they addressed. The intervention in information-based marketing creates the foundation for increased demand and ultimately outreach for greater numbers of small farmers, as well as protects these farmers from the risks of trying new species by providing the right kind of technical information. In tandem, the improvement in fingerling input quality through better genetic stock and hatchery management consolidate the productivity benefits that farmers can achieve.

The new import process was successfully used by hatcheries in 2015 to import a novel species, Snakehead, to Bangladesh. The coordination of imports by the Hatchery Association means that now hatcheries can pool their orders, achieving economies of scale, and reducing costs by sending a smaller team for procurement. This improved mechanism for industry coordination also enabled the hatcheries to advocate for their needs, for example in winning a labour hours case against the Ministry of Labour in the high court.

Figure 6: Timeline of interventions in the pond fish sector

COMPONENT	INTERVENTION	Year					
		11	12	13	14	15	16
ADOPT	Brood import (1)						
	Hatchery management training (1)						
	Aquaculture information marketing to farmers via input suppliers						
EXPAND	Brood import (2)						
	Hatchery management training (2)						
	Aquaculture information marketing of techniques for small farmers via hatcheries						
	Aquaculture information marketing of techniques for small farmers via hatcheries and input suppliers						
RESPOND	Hatchery Association and Brood Import Guidelines						

The impact of this on small farmers can only be measured once the fingerlings are available on the market and fish subsequently produced, but in principle the introduction of better industry coordination and regulation by the public sector can be seen to be supporting access to new, better quality, brood stock.

Summary of impact and specific lessons

Katalyst have undeniably changed the shape of the HVS fingerling market, leading to the long term potential for increased productivity and returns for hundreds of thousands of poor farmers. They have done so in a sustainable manner where the system is robust and the changes they have facilitated will continue to adapt to external factors.

A major lesson from the pond fish sector is that a multi-actor approach can be used to instil change in a market function. One of the key challenges faced by Katalyst in ensuring that small farmers benefitted from farming unfamiliar HVS was to ensure that they had access to the necessary

agronomic advice. The DoF cited the risks of poor pond management, particularly with regard to overstocking by farmers who would often attempt to farm five times as many fish than was safe to do, and not understanding how to manage the consequences of disease and potential catastrophic losses, as being their greatest concern for aquaculture. The research Katalyst conducted showed that farmers accessed information from a wide range of sources. The strategy the programme adopted was to leverage all the channels possible (e.g. via patilwalas, hatcheries, input suppliers, dealers, lead farmers) to increase the reach of the information to as many farmers as possible, but also to prevent the chances of miscommunication by multiple iterations of the same messages. Where hatcheries could reach a smaller number of local farmers with direct advice, input suppliers via dealers and demonstration plots could reach a much greater number through various informational means. In terms of sustainability, Katalyst use a “training of trainers” approach to ensure longevity of the intervention.

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Lessons for Policy and Practice

Katalyst have undeniably changed the shape of the HVS fingerling market, leading to the long term potential for increased productivity and returns for hundreds of thousands of poor farmers. They have done so in a sustainable manner where the system is robust and the changes they have facilitated will continue to adapt to external factors. There are some important lessons to be drawn from the case for the development sector.

1. One function, many forms: there may need to be different approaches to addressing a single systemic constraint in order to expand impact

A major lesson from the pond fish sector is that a multi-actor approach can be used to instil change in a market function. One of the key challenges faced by Katalyst in ensuring that small farmers benefitted from farming unfamiliar HVS was to ensure that they had access to the necessary agronomic advice. The DoF² cited the risks of poor pond management, particularly with regard to overstocking by farmers who would often attempt to farm five times as many fish than was safe to do, and not understanding how to manage the consequences of disease and potential catastrophic losses, as being their greatest concern for aquaculture. The research Katalyst conducted showed that farmers accessed information from a wide range of sources. The strategy the programme adopted was to leverage all the channels possible (e.g. via patilwalas, hatcheries,

input suppliers, dealers, lead farmers) to increase the reach of the information to as many farmers as possible, but also to prevent the chances of miscommunication by multiple iterations of the same messages. Where hatcheries could reach a smaller number of local farmers with direct advice, input suppliers via dealers and demonstration plots could reach a much greater number through various informational means.

2. Direct activities can help secure buy-in and make markets if they are part of a realistic systemic vision

In high-value fish species markets did not exist in the sense that there was neither the supply nor the demand. The logic for intervention here was based on solid analysis of how the growth of these markets had real potential to deliver significant benefits to the programme's target group. However, the process of market creation is slow which increases the incentive for a programme to take more direct action, rather than rely on facilitation.

A programme might have examined the market information function to see why domestic hatcheries weren't sourcing improved species from abroad. Instead, Katalyst decided to directly support hatcheries and create the required international connections to improve the brood stock. There is an inevitable risk in doing so; a trade-off between speed of impact and distortion of the market system. Katalyst's success in taking some more direct measures across sectors was based on a few key factors.

In some cases, Katalyst took direct action which was seen as a one-off which was necessary in order to stimulate the market. In other cases, Katalyst were directly performing what might be seen as a recurrent function, but they did so with a realistic

² Interview with consultant, DoF, Dhaka, 15/03/2016

view as to which player might perform that role in the longer term. With the brood stock import, Katalyst supported individual hatcheries and, although this led to increased profits and built technical capacity, the programme was needed to support them further to repeat this a second time, albeit with reduced input from Katalyst. While hatcheries were increasingly demonstrating buy-in, the benefits to the rest of the system from the high-value species meant that this continued direct action was justified.

3. Adapt to learning

While Katalyst's understanding of the overall market system gave them a clear direction for how and when to intervene in different aspects of the market, it is not possible to predict exactly how the market, its functions and its rules will or will not react to change. Katalyst's monitoring system, together with the informal data collection methods engaged in by the team to allow continued evaluation of the sector, meant that the strategy could be adapted continuously. This monitoring did not supersede the analysis of the innovation that was necessary to address the underperformance of the market, but it did allow for adaptation which meant that the impact could be broadened, deepened and stabilised so that the change was significant, large scale, and sustainable.

The success of the initial model for reaching and benefitting farmers with agronomic information

through input marketing in terms of profitability and institutionalisation by firms was shown by the monitoring system not to be impacting sufficient numbers of poorer, target farmers. As such the intervention modality was modified.

These examples show that AAER is an important tool for planning, as well as for providing a vision of what systemic change looks like, and a framework for assessment of whether or not it is happening

4. Understanding systemic change

Finally, the case study has demonstrated the utility of AAER in understanding systemic change. Programmes are organised in different ways and even within Katalyst, the definition of an *intervention* is not always equivalent between sectors or across phases. Nevertheless, AAER shows how a range of different supporting functions and rules are changing, the sustainability of that change and whether it is impacting on sufficient numbers of the target group. AAER should not be used, then, for the assessment of whether a product, a service, or a pre-determined behaviour is changing and being replicated. It's about understanding what change needs to happen for your target group and changing the functions and rules in different ways so that it can have a greater impact on more of them. These functions and rules may change independently but observing these changes and the impact they have on the system is a key role of a market development programme.



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