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**Supply Chain Management at Humanitarian Organizations**  
**A Structuring Framework for Sustainable School Feeding**

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# **Supply Chain Management at Humanitarian Organizations**

## **A Structuring Framework for Sustainable School Feeding**

### **Abstract**

School feeding is an established developmental intervention that simultaneously addresses multiple objectives including education, nutrition, and value transfer. These complex programs, traditionally run by international organizations in low income settings, have had a substantial impact in many areas. Following a recent rethinking of the intervention by the World Bank and WFP, however, the focus has shifted to emphasize the development of long-term, sustainable solutions using local resources, local capacity, and community participation. This new focus on sustainability requires new solutions and alternative program designs. Supply chain management, which is critical to program delivery, is a key factor in developing a sustainable approach to school feeding.

We propose a theoretical framework that identifies the main internal and external factors of school feeding supply chains and which connects these factors to the objectives and performance measures of sustainable programs. The framework is based on logistics and supply chain management theory as well as on actual school feeding practice, including expert feedback.

This paper contributes to humanitarian logistics research in the area of development aid logistics and program transitioning, with a focus on intervention sustainability. It provides a comprehensive introduction to school feeding as a form of humanitarian intervention as well as a discussion of relevant supply chain issues. The framework in this paper makes it possible to identify issues related to sustainability within school feeding supply chains and serves as a starting point for addressing these issues with further research and changes in program design.

**Keywords: Humanitarian logistics, Development aid, School feeding, Framework**

## **1. Introduction**

Hunger, malnutrition, and a lack of education are some of the key challenges facing many nations today (United Nations 2000). One way to address these challenges is through school feeding, an established developmental intervention that simultaneously addresses multiple objectives such as education, nutrition, and value transfer. Providing students with a daily meal encourages school participation and improves cognitive abilities (Bundy et al. 2009). Furthermore, school feeding can act as a form of value transfer, thus assisting both poor families and hungry children. School feeding programs have been in existence for almost 50 years, operating in different geographical regions and in different program models.

Traditionally, school feeding programs have been run by international organizations, with the World Food Programme (WFP) being the most significant of these. The long-running WFP program currently feeds around 22 million beneficiaries in 62 countries (WFP 2011b). School feeding has achieved significant impact in terms of educational and nutritional benefits (WFP 2009). Typically, internationally run school feeding initiatives were based on food aid that relies on external commodities - for example, wheat and corn produced in the developed world. The resulting dependence on external support makes the programs unsustainable, since these programs obviously cannot continue to run if the international organization withdraws its support.

Ideally, school feeding programs would be only temporary interventions by humanitarian organizations and would be, in the long run, transformed into sustainable local programs. In this context we define sustainability as a well-functioning model with no or very limited reliance on external support. A recent review of past experiences by the World Bank and WFP's led to a significant rethinking of the school feeding strategy (Bundy et al. 2009). The new strategy aims to develop long-term, sustainable solutions using local resources, local capacity, and community participation. This change is in line with a general rethinking of humanitarian and development aid

following critiques on long-term aid effectiveness (Riddell 2007). Sustainability based on local ownership and commitment of recipients is seen as a key factor for ensuring lasting impact.

The new focus on sustainability requires innovative solutions and alternative program designs. Supply chain management is a key factor in this redesign, due to its importance for program delivery and performance. School feeding is a complex form of intervention and includes various flows of products, information, and money between the involved stakeholders. A significant shift in the approach to school feeding thus entails major changes to the supply chain design, as well. Compared to international organizations, local institutions and partners operate under different conditions and often lack certain skill sets, such as procurement. The transition to local program integration and involvement of local stakeholders, including producers, also increases program complexity. Attaining a sustainable program and supply chain setup takes time and preparation. To ensure successful implementation, therefore, it is necessary to develop a structured transitioning process between the international organization and local lead institution. Supply chain costs are a major portion of school feeding budgets; commodity and transportation costs account for as much as 80% of total expenses (Gelli et al. 2011). But budgets are constrained, and programs are often simultaneously trying to expand coverage to more schoolchildren. Increased efficiency is therefore a key target for improvement. Effectiveness, however, is equally important. Both high-level output (i.e., adequate coverage of beneficiaries with appropriate food that meets nutritional needs) and sensible targeting of schoolchildren in need are necessary to maximize impact.

This research topic is positioned in the evolving field of humanitarian logistics, which deals with providing goods and services to beneficiaries in a humanitarian setting (Thomas and Kopczak 2005). Humanitarian logistics is a relatively new field of research. The existing academic literature does not contain any research on school feeding supply chains. To date, research in this field has primarily focused on disaster relief logistics, with only limited contributions on longer-term

development logistics; this was highlighted by a recent review of humanitarian logistics by Kovács & Spens (2011). They identified a need for research of humanitarian supply chain design including local sourcing, capacity building, and community participation for sustainable long-term development. The aim of this paper is therefore to explore the relationships of school feeding supply chains that are relevant to achieving program sustainability. Specifically, we identify the critical factors of school feeding supply chains and discuss how these can be linked with the objectives and performance of sustainable school feeding.

The research presented in this paper is part of a longer-term project on supply chain management within humanitarian organizations. The study of longer-term humanitarian logistics interventions, specifically sustainable school feeding supply chains, was motivated by an exploratory field trip to Lao PDR, discussions with practitioners, and a review of the available literature. School feeding is a complex intervention, and supply chain management forms a significant component. Therefore, a supply-chain oriented framework was developed to provide a tool for holistic analysis of key school feeding factors. The unit of analysis for this research is the school feeding supply chain. Multiple sources of input, both theory and practice, were considered. The combination of pertinent strands of academic literature, practical insights, and feedback from experts (particularly from WFP and the Partnership for Child Development) allowed us to develop a framework of the main internal and external factors of school feeding. The framework was subsequently applied to the case of the Laos school feeding program, thus highlighting the benefits of the framework's use.

This paper contributes to the existing body of humanitarian logistics research in the area of development aid logistics and program transitioning, with a focus on sustainability of interventions. Specifically, it provides a thorough background on school feeding as a form of humanitarian intervention and discusses relevant supply chain issues - topics that have been neglected in the past. Taking a supply chain perspective as our focal point of analysis, we develop

a framework that makes it possible to identify the various levers within school feeding supply chains that impact sustainability and thus long-term viability. The development of such a framework is a necessary step for academics and practitioners seeking to understand the strategic choices for more sustainable program design. The framework enables proper data collection in the field and prioritization of actions to be taken by decision makers. Simultaneously, it serves as a basis for the OM/OR community to analyze school feeding and build quantitative models to further investigate trade-offs in supply chain design.

The paper is structured as follows. Section two provides an introduction to school feeding as a form of humanitarian intervention and to relevant supply chain issues. Section three presents the basis for the research framework and the development of the framework. Section four illustrates the application of the developed research tool. Section five concludes with a discussion of first findings and an outlook for further research.

## **2. Background on School Feeding as Humanitarian Intervention**

### 2.1 Context of School Feeding

School feedings can be broadly defined as the provision of food to schoolchildren. It is an established developmental intervention that can take various forms, depending on the exact objectives, design, and institutional arrangements of the individual program (Bundy et al. 2009). Inadequate access to nutritional food is a significant impediment to children's learning ability. Furthermore, a school meal provides a strong incentive for households to send children to school in contrast to sending them to work. In the developing world, an estimated 66 million primary school-age children attend school hungry, and 67 million do not attend school at all. Humanitarian school feeding programs can be found in Latin America, Asia, and above all in Africa. For example, WFP runs 35 programs in Africa out of 62 programs worldwide (WFP 2011a).

Multiple objectives can be addressed simultaneously in school feeding programs. Traditional objectives for such programs include improved education and nutrition as well as value transfer to poor families in order to create a safety net effect (Bundy et al. 2009). Specifically, improved education means an improvement in both school participation (i.e. enrolment, attendance and dropout numbers) and school achievement. These goals may be combined with an effort to create more equitable access to education, by increasing school participation among girls, orphans, and other vulnerable children's groups. Improving nutrition and general health is another important objective: school feeding programs can improve nutritional status and general health conditions, especially if coupled with complementary initiatives such as deworming. Finally, school feeding programs provide a value transfer to the families of schoolchildren; this frees up income that the household can invest in productive assets. This effect can also provide a safety net in times of a crisis. Additional, more recent objectives include increased program sustainability and local development by employing local ownership and local resources (Espejo et al. 2009, Sumberg and Sabates-Wheeler 2011). Sustainable or home grown school feeding models aim to achieve a fully functioning system with decreased external dependency. Local development is promoted based on the premise that when food supplies are locally purchased, additional benefits for local farmers and local economies are generated.

The various actors or stakeholders in school feeding programs include development partners (i.e. international humanitarian organizations), relevant ministries and other government agencies, local communities, and private sector partners. (International) humanitarian organizations are often large, diversified multinational organizations. They can be further divided in three categories: United Nations (UN) organizations, international organizations, and non-governmental organizations (NGOs) (Thomas and Kopczak 2005). Key international players in school feeding are the UN World Food Programme and NGOs such as World Vision and Catholic Relief

Services. Other organizations, such as UNICEF, are active in related fields such as improvement of school infrastructure. Program funding and contributions from involved stakeholders can vary substantially. Potential sources for funds and resources include the national government budget, development partners, the private sector, and local communities. Funding levels and timing can be issues for program delivery.

The design of a school feeding program can vary. One key aspect is targeting – that is, the selection of the intended beneficiaries (Gelli 2010). There are four types of targeting: universal coverage, geographical targeting, school-level targeting, and individual targeting. Universal coverage aims to reach all public schools in a country, whereas geographical targeting limits the program to specified area(s), such as districts or states. School-level targeting aims to benefit all children at selected schools, while with individual targeting, only selected children receive food assistance. Targeting has implications for program cost and implementation; furthermore, depending on the chosen approach, ethical, political, and practical questions may arise.

Another important consideration in the design of a school feeding program is the modality, or delivery format, of the food (Bundy et al. 2009). School feeding may include in-school meals and snacks and/or take-home rations. In-school feeding is typically provided in the morning or at lunch time to provide energy for the school day. Snacks are normally ready-made, high-energy, fortified snack biscuits. Schools meals have to be prepared either on school premises or nearby, and can be served as breakfast and/or lunch. Take-home rations are normally larger quantities of food that are provided at certain times of the school year and that are conditional upon enrolment and attendance of the family's schoolchildren – for example, a bag of rice provided on a bi-annual basis. Take-home rations are intended for the entire family and thus serve as an important incentive for school attendance. This also allows individual targeting; for example, special rations can be handed out to girls as an incentive to increase girls' school participation. The food basket

refers to the detailed composition of foods in the chosen modality. Parameters for food baskets are size of ration, nutritional value, shelf life, fortification with micronutrients, and supply sources.

Selection of an appropriate program design and institutional arrangements entail many choices, as well (Bundy et al. 2009). Operating models can be characterized in terms of the centralization or decentralization of program management, procurement, distribution, and monitoring. Furthermore, these activities can be performed in-house or by a third party. In addition, an operating model can include an explicit local production component, typically aiming at local smallholder farmers.

The program design and choice of objectives will have an impact on the performance of school feeding programs. A key aspect is program efficiency and costs. School feeding costs have been systematically reviewed for different countries and modalities, including an identification of potential cost determinants (Gelli et al. 2009, Galloway et al. 2009). Relevant cost factors are modality, composition and size of rations, number of beneficiaries, and number of feeding days per year. The country context of the program, i.e. logistics infrastructure such as roads, availability of logistics services, and general security, also has an impact on costs. There is some evidence that school feeding programs perform well on the various objectives, but data, long timeframes, and interdependencies with other factors make holistic evaluations difficult (Gelli 2010). For example, school feeding needs to be part of an overall plan to improve education that also includes teachers and infrastructure as well as policy and organization. If no coordinated action is taken, the start of a school feeding program can also have negative effects; for example, a resulting increase in enrolment can lead to classroom crowding, thereby reducing the quality of education.

## 2.2 Evolution of School Feeding Programs – Sustainability and New Issues

School feeding has traditionally been offered as a food aid program run by international organizations (Bundy et al. 2009, WFP et al. 1999). Organizations such as the World Food

Programme, Catholic Relief Services, and World Vision operate programs in various countries with standards driven from headquarters and program management performed in the respective organization's national office. The main objectives of such programs are education and nutrition. The school feeding supply chain delivers foodstuffs, often coming from abroad, to schools in target regions. Implementing partners may be used for program delivery and, depending on the local context, there can be varying degrees of government involvement. Although some local staff and partners are employed, the program mainly functions with external support, external input, and external funding. Program sustainability is low due to this heavy external dependence.

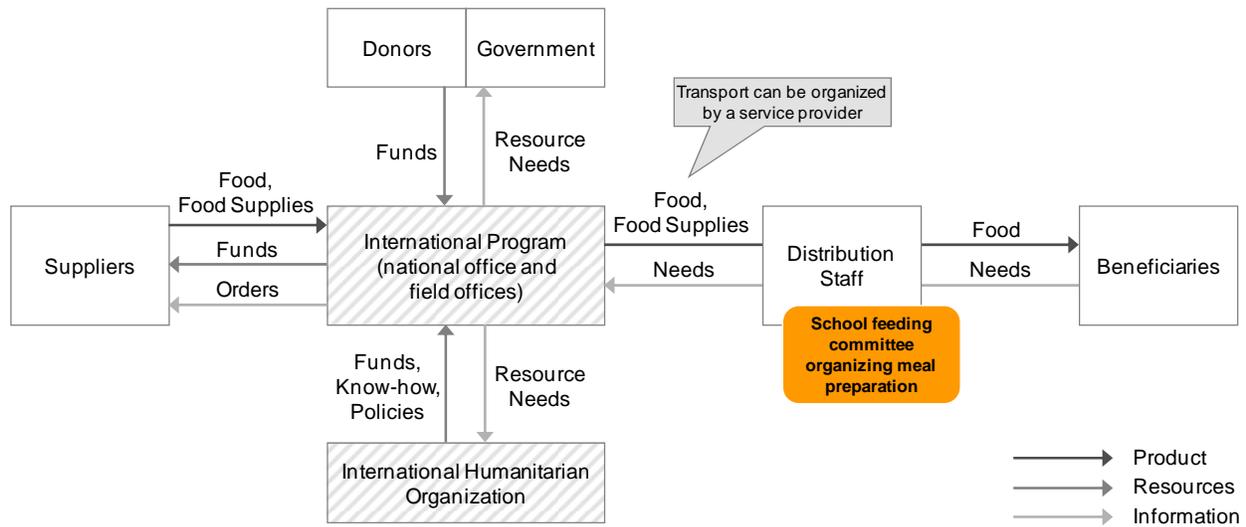
Local and sustainable school feeding, in contrast, is a localized program run by a local institution (Bundy et al. 2009). Sustainable school feeding often starts as a traditional program and is, especially in early stages, regularly supported by international humanitarian organizations. Ideally, sustainable design will be fully incorporated from the beginning. Program management is under the control of a local unit, such as a government department within a ministry (e.g. ministry of education). In addition to the established objectives, sustainable school feeding aims to reduce external dependency by improving program performance and achieving localization. This means that less external funding and know-how is required. Localization can also reduce a program's vulnerability to external influences, such as exchange rates and global supply chains. Rising commodity prices can be dealt with more easily, as well. A valuable add-on can be local development through local sourcing and local production (Espejo et al. 2009). Strategic sourcing of food supplies from local smallholder farmers and supplier development measures may lead to additional value creation for local communities. To link smallholders' supply with schools' demand, various models, including contract farming and direct procurement, may be used. Additional supply chain characteristics, such as availability of local producers and supply quality, are relevant. In practice, local sourcing and production have been implemented only in pilot cases.

### 2.3 Exemplary School Feeding Supply Chains

In the following sub-section three typical supply chain models are presented. The models are simplified depictions of country cases and highlight the key relationships of the supply chain - that is, the product, resource, and information flows between the supply chain actors. In-depth information on program models and relevant supply chain aspects can be found both in case studies of school feeding programs (Upton et al. 2007, Buhl 2010) and in formal evaluations of existing school feeding projects (WFP 2010).

The first model is an international (central) school feeding supply chain (see **Figure 1**); an example of a program typifying this model would be the traditional WFP program in Laos. Located at the center of this supply chain is the international program: the staff and resources at the national office and the field offices of the organization. The national organization has strong links with its international headquarters, from whom they receive know-how, policies and funds and to whom they report on their local situation. The organization also has a relationship with its donors and with the government, who provide funds and receive requests of resource needs. The government might also offer political support. Another link connects the program with suppliers, who can be international, regional or local producers, or intermediaries such as markets. The program sends orders and funds to its suppliers and in exchange receives food supplies or prepared foodstuffs. Food or food supplies are then delivered to the last mile of the supply chain. Deliveries are often monitored by the staff of the school feeding program and may be aligned with the school terms. The transport is normally organized by a transport provider, but the organization might also have its own logistics infrastructure such as trucks and warehouses. The distribution staff, who are often volunteer-based community members (e.g. a school feeding committee), organizes the actual meal preparation and distribution to beneficiaries (schoolchildren). Schools and distribution staff record current needs based on enrolment numbers and report this information back to the national

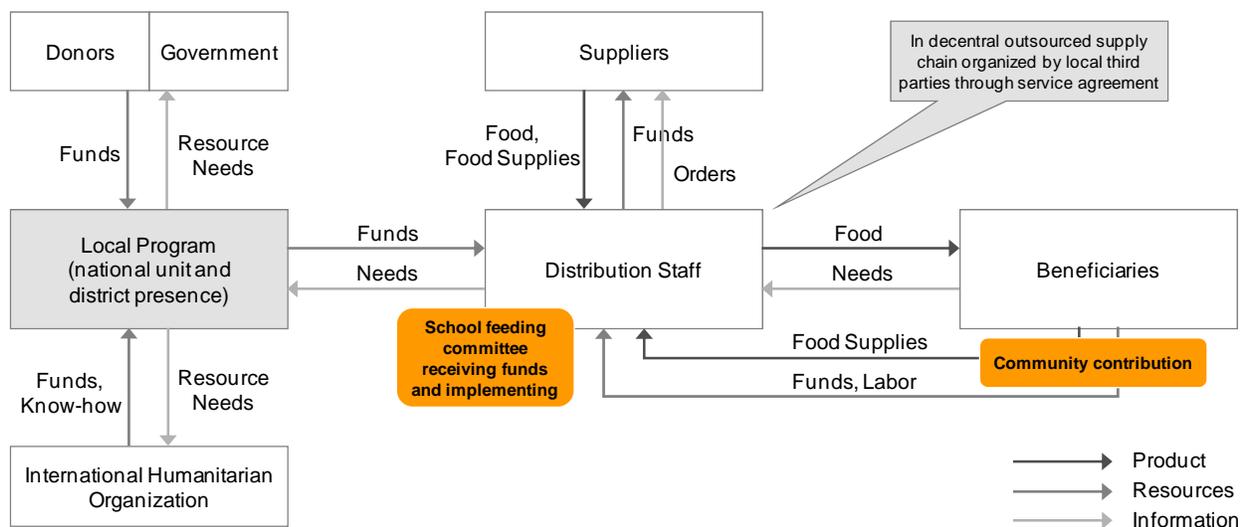
office. This supply chain is characterized by a limited number of suppliers in various locations, which can potentially result in long transport distances. Furthermore, this model requires centralized and sophisticated procurement and distribution. The managing organization has a high control over the supply chain of the program.



**Figure 1: International (central) school feeding supply chain**

The second model is a decentralized school feeding supply chain (see **Figure 2**), such as the national school feeding program in Kenya. At the center of the supply chain is the local program - for example, a unit within the ministry of education plus a few regional offices. The local program might also have relationships with an international organization that supports the program with know-how, capacity building, and funds. The local program has similar relationships with donors and other government units. The main difference between the centralized and decentralized models is that in the latter, the distribution staff at the local level (for example, the school feeding committee) plays a key role. The distribution staff receives funds from the program, buys food supplies or prepared food directly from suppliers, and implements the program. Local communities often contribute to the program as well, either through labor (for example, volunteers for meal preparation), funds (sharing of program cost), or food supplies (for example, fresh fruit).

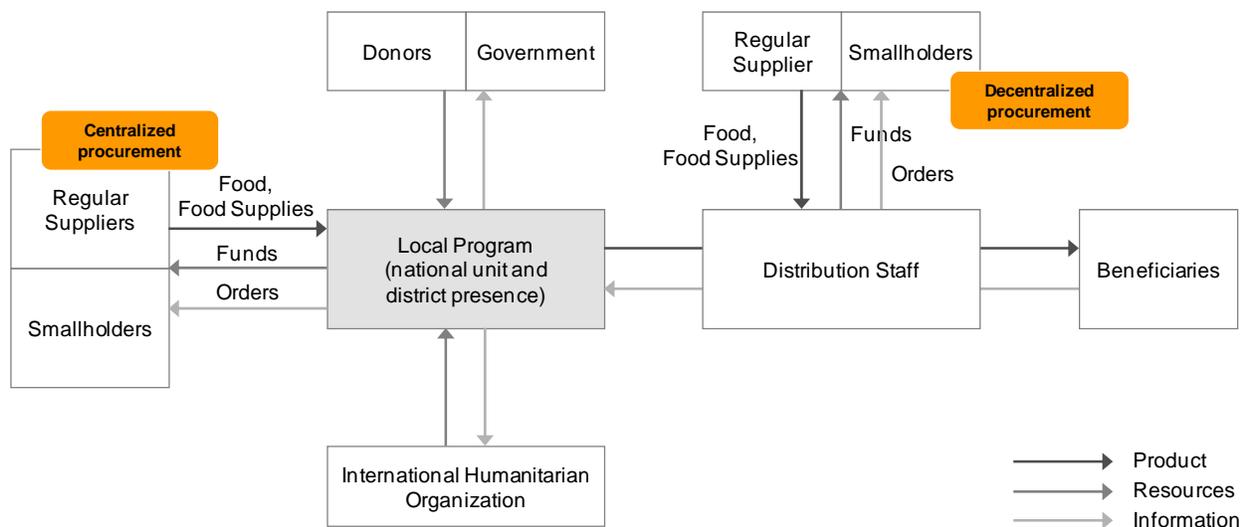
The decentralized supply chain has many different suppliers, since sourcing is done for each school individually. This increases complexity and results in many small-scale transactions. Because suppliers are located locally and regionally, transport distances are relatively short. Procurement and distribution are therefore decentralized and simple processes. However, this model also results in a lower degree of control over the supply chain of the program, for example in terms of product quality. In the decentralized, outsourced model, the setup is similar. Here the distribution staff would be a local third party that has a service agreement with the program.



**Figure 2: Decentralized school feeding supply chain**

The third model is a school feeding supply chain with sourcing from smallholders (see **Figure 3**). This model has already been implemented in some pilot programs such as those in Zambia or in national programs such as Brazil. The setup can be centralized or decentralized. There are two main sources of supply: regular suppliers and smallholder farmers. A key component of this model is strategic procurement, either directly, through contracts from smallholder farmers, or from intermediaries such as farmer associations or traders. Procurement processes are designed to favor smallholders. Smallholders furthermore receive agricultural support to increase their productivity and quality by, for example, receiving seeds and tools. Several sourcing arrangements are possible

and may include contract farming or base contracts with pre-negotiated prices. Due to seasonal harvest variations, smallholders will often not be able to supply the whole program throughout the year. Regular suppliers are therefore often necessary, as well; they provide a base supply and can offer back-up supplies in case of delivery failures by the smallholders. A smallholder-based supply chain is characterized by participation of a greater number of suppliers. In addition to some local and regional regular suppliers, a relatively large number of smallholder farmers may be needed to supply the program, since smallholder farmers have low production volumes.



**Figure 3: School feeding supply chain with sourcing from smallholders**

### 3. Theoretical Framework

#### 3.1 Basis for Framework

The primary goal of the framework is to describe the main relationships of school feeding supply chains that are relevant to achieve sustainability. The framework offers a structure to describe the main internal and external factors of school feeding and to link them with the objectives and performance of (sustainable) school feeding. As traditional school feeding programs are established interventions, the focus of this framework is on the new elements and relationships required to achieve sustainable programs.

To guide the development of the framework, the following subsection outlines a number of questions that the framework intends to address. The first area of focus is the sustainability of school feeding programs: How do external factors influence objectives and performance? What are specific key external factors? How do internal factors influence objectives and performance? What are specific key internal factors? What is the relationship between internal and external factors? Are there combinations of factors that show differences in performance? What are the key aspects that characterize sustainable programs?

The second focal area is local production and sourcing from smallholders: What approaches exist to organize local production, and what are respective costs and benefits? What specific factors are relevant for local production? Are there combinations of factors that show differences in performance? What determines the right level of local production, and what trade-offs exist?

The framework is based on multiple sources of input. In addition to supply chain management theory, both practical insights (see Section 2) and insights from related fields must be taken into consideration, as well, due to the and cross-disciplinary nature of the topic.

The humanitarian context has a significant impact on supply chain performance and is an important factor to consider when designing school feeding supply chains. In general, the field of humanitarian aid can be characterized as a particularly challenging and complex working environment involving many stakeholders and difficult conditions (Thomas and Kopczak 2005, Van Wassenhove 2006). As most humanitarian interventions operate in developing countries, significant challenges can arise from volatile political and economic conditions, which are often combined with distinctive cultural and socioeconomic factors. Additional complexity arises from the diversity of actors, donor expectations, and funding structures (Balcik et al. 2010). This complexity has been increasing both globally and nationally, resulting in an growing need for coordination and a clearer definition of roles (Riddell 2007, Fengler and Kharas 2010).

Humanitarian logistics have several distinctive features (Van Wassenhove 2006, Long and Wood 1995); these include the fact that the driving motivation is a humanitarian goal through an effective response to a need situation. Supply chain relationships in a humanitarian setting are more complex than in other settings (Oloruntoba and Gray 2006, Adivar et al. 2010). Uniquely, in a humanitarian context, the customers (i.e. the donors) are not the actual consumers (i.e. the beneficiaries). Operational difficulties may arise from demand uncertainty; this is true to a greater degree in disaster relief (Beamon and Balcik 2008). Operating conditions are challenging, as well, with limited logistics infrastructure and high staff turnover (Balcik et al. 2008).

Organization models, competences, and design are important considerations for school feeding programs, especially during the localization process (Ketchen and Hult 2007, Santos and Eisenhardt 2005). Furthermore, there are certain critical success factors in managing humanitarian aid supply chains (Pettit and Beresford 2009). Strategic planning, inventory management, transport and capacity planning, information management and technology utilization, continuous improvement and collaboration, human resource management, and supply chain strategy have all been identified as important factors. Supply chain performance and measurement of efficiency and effectiveness is a key issue for school feeding and humanitarian operations in general (Beamon and Balcik 2008). Objectives and performance criteria may differ from the commercial world and are often more complex due to the presence of multiple stakeholders (Moore 2000).

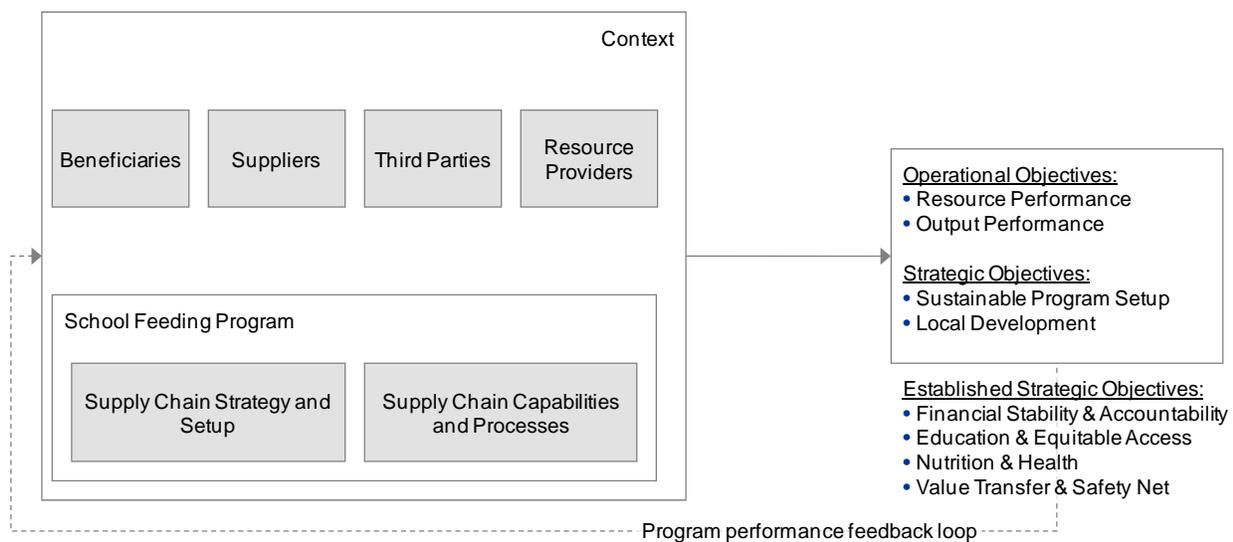
### 3.2 Overview of Theoretical Framework

Several frameworks have been proposed to link program factors to performance indicators. In the context of performance measurement in public and nonprofit organizations, Poister (2003) presents a program logic model that links resources, program activities, output, and outcome while taking into account external influences and customers. A similar model, showing the external and

internal factors affecting the objectives of field vehicle fleet management in humanitarian operations, was proposed by Pedraza Martinez et al. (2011). Mentzer et al. (2004) present a general theory of logistics, explaining organizational performance with resources and logistics capabilities. Here, a link between environmental factors, resource management, and logistics capabilities is proposed as a driver for performance. Key capabilities according to this theory are demand management, supply management, information management, and coordination. From a more practical perspective, the World Bank and WFP propose a framework to systematically assess the quality and the potential for sustainability of school feeding (Bundy et al. 2009). This tool was developed in light of new research and thinking about sustainability. The first part looks at the current status of school feeding as characterized by the key determinants context and program design. The second part outlines five standards of good practice that a quality program should fulfill: strong policy frameworks, strong institutional structure and coordination, stable funding and planning, strong community involvement, and sound program design and implementation.

However, the existing frameworks do not take a full supply chain perspective and therefore do not consider all of the aspects necessary to achieve cost-effective and sustainable programs. The framework proposed in this paper consists of factors characterizing the school feeding supply chain and objectives related to program performance (see **Figure 4**). Diverse factors, both within and outside of the control of the humanitarian organization, can impact school feeding. These external and internal factors affect the objectives and performance of the school feeding program, which is shown by an impact relationship. The operational objectives are directly linked to the program and include resource performance (efficiency) and output performance (effectiveness). The strategic objectives have a longer-term dimension. A key long-term focus is sustainability, i.e., sustainable program setup with a reduction of external dependency and local development

entailing economic impact beyond pure school feeding. Established or traditional strategic objectives have to be fulfilled by sustainable programs as well, but are not the focus of this research. However, they have to be considered as tradeoffs might exist with sustainability objectives such as local development. School feeding programs are not static, but develop over time; it is therefore also necessary to consider the dynamics of factors and objectives. This is reflected in a feedback loop connecting program performance with internal and external factors. The details of the framework will be presented in the following subsections.



**Figure 4: Overview of theoretical framework**

### 3.3 External Factors

External factors include beneficiaries, suppliers, third parties, resource providers, and context. The beneficiaries are schoolchildren, including their families, and are characterized by their level of food security and poverty. Food security can be defined as adequate physical and economic access to food (FAO 1996). This includes nutritional deficiencies, for example micronutrient deficiencies, as well. The needs of beneficiaries (i.e. demand) are the key driver in humanitarian logistics; demand uncertainty is a possible issue, for example, due to movements of people and other factors affecting participation (Beamon and Kotleba 2006, Oloruntoba and Gray 2009). The beneficiaries

and their situation are a key factor to consider in the program design of school feeding, such as when deciding what product or food modality is provided in what model. The particulars of each situation determine the willingness or the incentives needed for beneficiaries to participate in school feeding and also define the potential for community contributions.

Suppliers can be international producers, local producers, or intermediaries. Managing supply in developing countries and humanitarian settings with a particular focus on local suppliers can lead to additional challenges (Kovács and Spens 2011, Balcik and Beamon 2008). Key elements of supply are level of product availability and local agricultural capacity, which are determined by local market conditions. The local conditions include the level and quality of agricultural production throughout the seasons, access to external sources, and the resulting availability of goods and pricing. Also relevant is the degree of exposure to potential supply shocks. The suppliers determine the sourcing options for the school feeding program, including the potential for local sourcing. The costs are influenced by production volumes and economies of scale, which tend to be low for smallholder producers.

Third parties include service providers and other partners; the key characteristics are level of service availability and quality. Use of third parties and outsourcing can offer benefits in terms of costs or delivery effectiveness, making this a relevant option in the context of developing countries and non-profit organizations (Sohail et al. 2004, Santos and Eisenhardt 2005). The impact of third parties is driven by the availability and quality of (logistics) services, which could allow more outsourcing or partnering and a more efficient supply chain design.

Resource providers can be international organizations, donors, local governments, or local communities. Key considerations in this respect are resource consistency and adequacy. Resource providers are the “customers” in a humanitarian setting; of these, donors are the main source of funding (Edwards and Hulme 1996, Moore 2000). Timing and sufficiency of resources (funds and

know-how) are important aspects. Furthermore, special processes, funding cycles, and earmarking can all constrain the program's use of resources and thereby decrease its overall efficiency and effectiveness. Ideally, funding is stable and unconstrained, but this can be challenging to achieve, since resource providers often operate with timeframes and processes that differ from those of the specific program. Additional international support, such as capacity building, is beneficial, especially in the transition phase.

The context consists of several aspects, including operating conditions, the political situation, and institutional arrangements. Operating conditions refer to the level of logistical infrastructure, i.e., the quality of infrastructure and facilities (road, water, and air transport), and can pose a significant challenge in the humanitarian context (Balcik et al. 2008, Pedraza Martinez et al. 2011). The specific conditions determine the logistical solutions and efforts that will be needed to reach beneficiaries. The political situation is another key aspect of the humanitarian context (Tomasini and Van Wassenhove 2009). Political considerations can include government participation and support as well as political stability and security. Basic security and stability (i.e., a country free of armed conflict and possessing functioning public governance) are necessary for a well-running school feeding program. A supportive environment with appropriate government policies and initiatives is beneficial. Institutional arrangements refer to the relationships and roles of the involved stakeholders (Bundy et al. 2009, Lowndes and Skelcher 1998). These arrangements include goals, roles, and responsibilities for all actors. For program success, clearly defined relationships and an organizational home for school feeding (an established key unit) are required.

### 3.4 Internal Factors

The supply chain strategy and setup are the first internal factor of school feeding programs. The supply chain strategy and strategy processes are a key factor in humanitarian projects (Pettit and

Beresford 2009, Beamon and Balcik 2008, Moore 2000). The process for determining the appropriate program strategy starts with an analysis of beneficiaries' problems and needs. This is followed by a selection of beneficiaries (targeting) and product modality, including a selection of the food basket contents (Bundy et al. 2009, Gelli 2010). Targeting can be aimed at various levels, from universal coverage to individual targeting; each entails a number of tradeoffs in terms of cost, effectiveness, and equity (FAO 2001). Product modalities include in-school feeding or take home rations; this factor is directly connected to the food basket composition (quantity and nutritional value of food components). For program success, a context-specific assessment, appropriate objectives with proper targeting, and fitting modalities are all needed.

An additional aspect is the supply chain setup, which refers to the task of organizing the different parties involved in the supply chain (Ketchen and Hult 2007, Santos and Eisenhardt 2005). Key operational models are international, central, and decentralized supply chains; optionally, some supply chain execution functions, such as procurement and delivery to beneficiaries, may be outsourced (Gelli et al. 2010). A further consideration is possible community involvement - for example, contributions of labor for meal preparation or supplementary supplies such as fresh fruit (Kovács et al. 2010). Due to the tradeoffs between the different operational models, the supply chain must be appropriate and context-specific. In general, centralized programs allow better control, while decentralized programs can be more closely tailored to local needs. Community involvement in program setup and execution can increase local ownership, reduce costs, and increase participation.

Supply chain capabilities and processes are the second internal factor; this includes procurement, distribution, and management and support. Procurement capabilities are an important element for supply chain performance and success (Pettit and Beresford 2009, Mentzer et al. 2004). Procurement refers to sourcing processes, supplier management, and supplier development. Local

sourcing offers potential benefits for the supply chain, but implementation can be challenging (Kovács and Spens 2011). Standard procurement through tenders, for example, tends to favor large suppliers; smallholders might be excluded due to their lower production volume and the variability of supply quality. Strategic procurement and supportive actions - such as soft tenders with special criteria or contract farming - can be used to facilitate local production (Espejo et al. 2009). Suppliers can be also supported to increase their capacity through productivity enhancement measures, provision of storage solutions, improved organization, and financial support. Fortification of foodstuffs with micronutrients is another possible added measure. Procurement is a significant component of supply chain costs and has an impact on risks related to supply chain performance. It can be used to increase local sourcing and local market impact.

Distribution refers to all delivery operations (transport and warehousing) and may include meal preparation. Delivery to beneficiaries is a crucial aspect of humanitarian operations (Beamon and Balcik 2008) and requires transport planning and distribution capabilities (Pettit and Beresford 2009, Mentzer et al. 2004). Key considerations in this regard are organization of delivery (i.e., in-house or outsourced), delivery frequency, timing, type of distribution, and possible food preparation. These choices impact the efficiency and effectiveness of the supply chain. In-house resources and deliveries tend to be more effective, while outsourced elements can be more efficient.

Management and support refers to the human resources and tools used to facilitate the supply chain processes. Specific elements here are the capacity of program staff as well as monitoring, evaluation, and reporting measures. Information and human resource management are key performance drivers in this respect (Pettit and Beresford 2009, Mentzer et al. 2004); the skills of humanitarian logisticians are of particular importance (Tatham et al. 2010). Specific characteristics of human resources include staff quantity and quality (experience and skills). Together with

appropriate processes and tools for reporting, monitoring, and evaluation, this aspect of the supply chain should have a positive impact on overall efficiency and effectiveness, but may also generate additional costs.

### 3.5 Objectives and Performance

Objectives, and the subsequent perspective they provide on a program's performance, can be either operational or strategic. Operational objectives are short-term oriented and can often be directly measured with available data. Resource performance, a measure of how efficiently resources are used, is one important criterion for humanitarian operations (Beamon and Balcik 2008, Van Wassenhove 2006, Mentzer and Konrad 1991). This objective may include a localization of inputs by using local supply and local capacity. Community contributions can be an additional source of inputs. Operational performance can be measured by inputs used, such as purchasing volume, level of staff, level of overall costs, share of local supply and local capacity used, and share of contribution in-kind or cash from communities.

Output performance relates to the effectiveness of goal achievement (Beamon and Balcik 2008, Mentzer and Konrad 1991). It is a measure of the outputs achieved, including the level of output effectiveness. In the context of school feeding, output performance measures the quality and quantity of goods and services delivered to beneficiaries. Specific measures include coverage of targeted beneficiaries, feeding days covered, and output quality. A key consideration here is how well targets are defined (i.e. the selection of beneficiaries), as there are frequently difficulties in identifying and reaching the children most in need. In addition, some choices may require trade-offs with cost efficiency and equity considerations.

Strategic objectives are long-term oriented. Sustainability in program setup aims to achieve independence from external support, such as external structures, know-how, and funds.

Sustainability is a key issue for the (long-term) success of humanitarian operations and school feeding (Bundy et al. 2009, Riddell 2007). Sustainability can be measured in terms of the level of structures and resources used; specific factors include local commitment and ownership, local capacity within the local program, fitting institutional arrangements, and appropriate funding.

Local production and development have become a key objective in the design of sustainable school feeding programs (Espejo et al. 2009, Sumberg and Sabates-Wheeler 2011). Linking the demand of school feeding programs with local suppliers such as smallholder farmers can create additional benefits, such as increased income for local communities. These effects can be measured in terms of the sourcing volume, increased producer income due to greater demand, and increased productivity due to agricultural support.

Sustainable programs are expected to fulfill the established objectives of traditional school feeding programs, as well. Although they are not the main focus of this research, traditional objectives do have to be considered here, since the presence of multiple objectives may create conflict, leading to tradeoffs (Moore 2000, Beamon and Balcik 2008). For example, the achievement of other objectives, such as educational goals, may be compromised. This could be the case, for example, if the target area for the school feeding program is chosen on the basis of the area's agricultural potential rather than on the basis of educational priorities. Furthermore, focusing production through smallholder farmers can have implications such as higher program costs and more volatility in meal deliveries. A key issue that arises with some of the strategic objectives, such as nutrition and health, is the challenge of obtaining sufficiently large data sets (such as long-term anthropometric measures) to provide a solid factual basis for demonstrating cause and effect.

A general objective for humanitarian interventions is financial stability and accountability. The project is expected to demonstrate proper use of funds, since both the program and its umbrella organization are accountable to donors, beneficiaries, and the international community (Moore

2000, Thomas and Kopczak 2005, Moxham and Boaden 2007). Established objectives related specifically to school feeding include improved education, nutrition, and value transfer (see Section 2). Education and equitable access objectives are measured by the degree of impact a program has on school participation (enrolment, attendance, and dropout), school achievement, and enhancing school participation among girls, orphans, and other vulnerable children's groups. Nutrition and health can be measured in terms of nutritional status, cognitive improvements, and general health condition as well as any effects produced by using the school feeding program as a platform for add-on interventions. The value transfer and safety net objectives relate to the effect of the value transfer to the beneficiaries, which frees up income at the family household for other uses, such as investments.

### 3.6 Summary of Framework

The framework outlined above identifies the key external and internal factors of school feeding supply chains, focusing on those that are relevant to achieving program sustainability. The establishment of such a framework is a necessary step for an analysis of an intervention as complex as school feeding. By taking a supply chain management perspective and incorporating multiple inputs, the framework makes it possible to identify levers for improving the long-term performance of these programs. The framework clearly identifies the many factors at work in a school feeding program. The structure of the framework clarifies the many complex influences and interrelationships in school feeding; as such, it serves as a helpful tool and further analysis and action. The next section highlights how the framework can be used to provide improved insights for academics and decision makers in this field.

## **4. Application of Framework**

### 4.1 Introduction and Background: A School Feeding Program in Laos

The following analysis applies the framework developed above to the case of an exemplary WFP program in Lao PDR. The case data was gathered during a field trip to Laos in May 2010. The aim of the field trip was to explore supply chain issues in longer-term humanitarian interventions. The author was hosted by the local WFP country office and conducted interviews with organizations working to alleviate malnutrition in Laos, including UNICEF, FAO, WHO, and WFP. Five interviews (between 30-120 min each) were conducted with WFP; this provided a good foundation for understanding the local school feeding program. Interviews were informal and conversational and addressed various aspects of the program. Notes were taken during interviews. The interviews were supplemented by observations at meetings and by secondary data including reports by WFP and the World Bank (WFP 2009, 2011c, Bутtenheim et al. 2011). The collected data was integrated into a case description and analyzed along the framework.

Laos is a landlocked country in Southeast Asia and has been classified as a “Least Developed Country” by the UN. Despite strong economic growth, large parts of the population continue to live in poverty, especially in rural areas. WFP has been operating a school feeding program targeted at primary schoolchildren in remote areas of Laos since 2002. Initially, the program targeted the three northern provinces Phongsaly, Luangnamtha, and Oudomxay. In 2009 the program was expanded to three remote provinces in the south of Laos: Saravane, Sekong and Attapeu. In 2010, the program served 157,811 students in 1,565 schools and reached a total of 665,800 beneficiaries, including both students and families. In Laos, school meals are intended to improve school participation, i.e. increase enrolment and attendance, while reducing the gender gap. The program’s objectives also include improving learning capacity through improved nutrition.

## 4.2 Analysis with Framework

It is possible to identify both external and internal factors influencing the performance of the WFP school feeding program in Laos (see **Figure 5**). In terms of the external environment, the beneficiaries' needs are moderate, but their location in scattered and remote areas and the presence of various ethnicities increase the complexity of the logistical efforts required. For basic food commodities such as rice, good supply options exist locally. Product quality is somewhat unreliable; for example, rice quality is affected by limited, low-tech rice mill capacity. Local availability of special, fortified food commodities is limited; this creates a need for international sourcing, which in turn entails higher logistics costs. Securing supply from smallholder farmers is challenging because local production is subsistence-based and small-scale. Rice is the main commodity; its production primarily occurs in the lowlands during the wet season, which is threatened by droughts and floods, and supply in the highlands is limited. A number of logistics providers are present in Laos, but only few operate nation-wide and local transporters are limited in their capacity. Currently, the program receives substantial international support and funding. In-kind donations from the USA, in particular, make the transition to local sourcing and production more difficult. A positive factor is support from the World Bank to stabilize funding during the transition.

Another favorable aspect of the overall context is the availability of government support and its general stability. Further challenges arise from the local operating conditions, characterized by poor infrastructure and target areas that are difficult to access. The generally difficult conditions are reflected in the World Bank Logistics Performance Index, which list Laos at the low end of the ranking (Arvis et al. 2010). The only practical modes of transport are by road (truck), river (boat), or foot. Most roads are unpaved and can often handle only small trucks; furthermore, they are

frequently closed for repair or inaccessible during the rainy seasons. These operational issues increase costs and reduce effectiveness, as some areas may not be reachable at times.

The WFP's local and international offices, together with government involvement, have determined the school feeding strategy and policy. Targeting is performed annually, at school level, in the selected provinces. Key selection criteria include a willingness to participate and logistical accessibility, meaning that the school can be reached by truck or boat. The modality consists of daily fortified mid-morning snacks and bi-annual take-home rations of rice, canned fish, and salt. The combination of these two modalities as well as the necessary snack preparation (cooking) increases the complexity of the program and complicates distribution efforts. The setup of the supply chain for the school feeding program in Laos corresponds to the international model. The program is currently centralized, but is being transitioned to the local government, with more decentralization planned. The centralized nature of the program means that procurement and logistics activities currently take place on a larger scale. Communities contribute labor for meal preparation and support the school feeding committee. This contribution is beneficial, but the actual degree of participation varies from school to school.

The Laos program is characterized by sophisticated procurement capabilities; this ensures high-quality supply and well-organized logistics. After food supplies are received from suppliers, they are stored in central or regional warehouses delivered to communities via contractors on a bi-annual basis. The combination of daily preparations and bi-annual distributions creates some complications; these include stock losses and difficulties serving the right meal sizes throughout the school term. There is a forecasting process in place, but time lags in demand forecast can reduce cost efficiency. Reporting follows a standardized process, but data is not always useful for monitoring and preparing management actions. Visibility is particularly limited over the last mile of the supply chain at the school level, as there are only few contacts during the bi-annual

deliveries and possible field visits. The local program is run by experienced personnel with additional support from the global WFP resources. The knowledgeable team ensures smooth program execution. Additional staff comes from government resources - for example, for monitoring purposes. Furthermore, there is capacity building taking place at government counterparts, which will facilitate the transition to a local and sustainable program.

In terms of operational performance, the program is running well. The efficiency is at a satisfactory level, although costs are affected by general food price trends. The challenging logistics conditions and the low population density in rural areas limit the potential for cost improvement. Products such as rice are mostly sourced locally, but there is no special focus on smallholders. The program is effective in achieving good coverage and reaching targeted beneficiaries despite the difficult setting. Furthermore, the number of schools covered has been increasing in the last years. Some plan deviations occur, for example due to changes in enrolment numbers, and could be addressed with better planning and monitoring. The current system does not allow for full, school-level visibility and management information, as data is aggregated and mainly collected for yearly reporting.

School feeding in Lao PDR is currently not sustainable due to the program's heavy dependence on external resources and especially because of in-kind donations. Nevertheless, management of the program is in the process of being transitioned from WFP to the local government, with help from capacity building and transfer of experiences. Additional improvements to efficiency are also planned (for example, through ration adjustments), which will create a strong basis for the new program. Achieving a sustainable setup therefore seems to be feasible over time. So far, development on the local level has been only planned and not yet explicitly put in place. Plans for local development include sourcing from smallholders and local fortification. There is no information on how much local production is feasible for the program.

The program performs reasonably well on traditional strategic objectives. The international setup and strong policies from WFP headquarters have resulted in good financial stability and accountability. In terms of education and equitable access, the program has achieved improvements such as increases in enrolment over the years, even though the specific impact of school feeding is unclear. But other factors relating to school quality, lack of information, and other incentives can prevent school uptake. Only limited evaluations have taken place to assess increases in nutrition and value transfer.

External Factors	Beneficiaries	<ul style="list-style-type: none"> <li>• <b>Medium food security and poverty</b> (low socio-economic status, child malnutrition) of multiple ethnic groups, especially in remote regions</li> <li>• Sparse population</li> </ul>	Operational Objectives	Resource Performance	<ul style="list-style-type: none"> <li>• <b>Medium efficiency</b> with costs in line with budgets, increases due to food prices, currency effects</li> <li>• <b>Most supplies sourced locally</b>, but <b>in-kind donations</b> from abroad</li> <li>• No targeted local sourcing from smallholders but capacity building for transition</li> </ul>
	Suppliers	<ul style="list-style-type: none"> <li>• <b>Medium capacity</b> with functioning markets and some local production of commodities</li> <li>• Limited availability of special fortified food commodities</li> </ul>		Output Performance	<ul style="list-style-type: none"> <li>• <b>Increasing coverage</b> with 1,565 schools and 157,811 students assisted (665,800 beneficiaries incl. families) in 2010</li> <li>• <b>Some plan deviations</b> due to change in enrolment numbers</li> </ul>
	Third Parties	<ul style="list-style-type: none"> <li>• <b>Variety of basic logistics providers</b> present, but limited number of nation-wide transporters</li> </ul>			
	Resource Providers	<ul style="list-style-type: none"> <li>• <b>Medium-high resource consistency</b>, but USA donates in kind</li> <li>• Currently <b>WFP runs school feeding</b> and provides <b>substantial know-how</b></li> <li>• <b>World Bank incentive to change to local program and government support</b></li> </ul>			
	Context	<ul style="list-style-type: none"> <li>• <b>Appropriate government support</b> and security with strong government involvement and aligned policy</li> <li>• <b>Low-medium operating conditions</b> due to landlocked country, poor accessibility of remote regions (especially in rain season), lack of infrastructure</li> <li>• Possible complication from <b>upcoming change</b> to government</li> </ul>			
Internal Factors	Supply Chain Strategy and Setup	<ul style="list-style-type: none"> <li>• Objectives are to <b>increase school participation</b> (focus girls) and <b>nutrition</b></li> <li>• <b>Yearly targeting</b> of schools</li> <li>• Modality consists of <b>daily mid-morning snack</b> (fortified) and <b>bi-yearly take-home rations</b> (rice, salt, canned fish)</li> <li>• <b>International and centralized program</b> to be transitioned to government with more decentralization planned</li> <li>• <b>Community contribute labor</b> (cooking of meals and school feeding committee)</li> </ul>	Strategic Objectives	Sustainable Program Setup	<ul style="list-style-type: none"> <li>• <b>Currently high dependency</b> on <b>external resources</b> (funding and capacities)</li> <li>• Capacity building in preparation of transitioning to government</li> <li>• Focus on efficiency improvements through ration adjustments</li> </ul>
	Supply Chain Capabilities	<ul style="list-style-type: none"> <li>• <b>Sophisticated procurement capabilities</b> with <b>local/regional sourcing of commodities</b> and <b>international sourcing of fortified product</b> (plus in-kind donations for South), no agricultural supplier development</li> <li>• <b>Demand forecast</b> based on previous enrolment data and stock</li> <li>• <b>Well-organized logistics</b> with storage in <b>own</b> central and regional <b>warehouses</b>, <b>transportation via contractors</b> with <b>bi-yearly deliveries</b> to communities</li> <li>• Daily preparation of snack through community cook, bi-yearly distribution of ration</li> <li>• Yearly <b>standardized reporting</b>, <b>some monitoring</b> through web-based tool</li> <li>• <b>Experienced team</b> based in <b>central WFP office</b> and <b>regional offices</b>, supplemented with government staff, <b>capacity building</b> at government</li> </ul>		Local Development	<ul style="list-style-type: none"> <li>• <b>No local development</b> component yet</li> <li>• Plans for sourcing from smallholders and local fortification</li> </ul>

**Figure 5: International school feeding program in Laos**

#### 4.3 Insights from Framework Analysis and Potential of Framework Usage

The analysis performed above identified the levers impacting the performance and sustainability of the school feeding program in Laos and helped to explain the observed program performance. The findings indicate that a number of requirements have to be fulfilled to achieve program sustainability. The needs of beneficiaries are a key factor in program design and performance. A

good understanding of beneficiaries' socio-economic situation and nutritional status is necessary to develop and deliver appropriate school feeding. Furthermore, stable local funding, political stability and support, and available local suppliers are additional external factors to be considered.

In terms of internal factors, the lead organization running the school feeding program is a key determinant of a well-performing and sustainable model. The good performance of the program indicates that a capable team is providing a good foundation for a sustainable school feeding model. Here, the international setup with WFP, an experienced organization, is certainly beneficial. But the program's current structure also creates a high dependence on external resources, including both funding and know-how.

Both the framework itself as well as the insights revealed through its application serve as a starting point for addressing sustainability and performance issues. The framework can be used to determine the implications of alternative supply chain models. In Laos, the program uses a traditional, centralized model, thus creating a need for substantial sourcing and distribution know-how as well as some understanding of control, monitoring and evaluation.

The upcoming transition to a government-based model will place the program under local control, thus requiring an established local organizational structure and decision-making ability. The role of the local management team is to determine and execute the program strategy, including regular monitoring and evaluation. Certain aspects of the supply chain will have to be more localized, as well - for example, locating and using suppliers for fortified foods.

Localizing the supply chain is often accompanied by general program decentralization, which can increase local ownership of the program. In a more decentralized setup, responsibilities are shifted to the local level; as a result, less sourcing and distribution capacity is required at the program level. However, additional measures may be necessary to maintain the current high quality of the international WFP program; for example, strong guidelines for the individual program

implementers will be needed. Furthermore, there is a substantial need for control, monitoring, and evaluation to ensure process conformity.

A shift to local production via sourcing from smallholder farmers is also planned for the future. This will require sufficient local agricultural capacity, which will vary between food-secure areas with production surpluses and food-insecure areas where farming is still subsistence-based. The local smallholders should be able to deliver throughout the seasons in the required quality, but back-up suppliers and resources have to be available in case of non-deliveries due to seasonal variations or quality issues. Local sourcing from smallholder producers requires specific know-how and control - for example, in terms of product quality. This includes intensive supplier development and management to help smallholders improve their productivity and competitiveness. Especially in the beginning, additional resources will be needed to cover the higher sourcing costs. Another key issue is developing a sustainable business model that provides the right incentives to all involved parties; otherwise one party could leave an agreement, thus compromising stable supply. For example, a smallholder farmer may find it profitable to sell to the market and not to the school feeding program. It is important to consider that local development takes time; slowly increasing the local component therefore seems an advisable approach.

To properly address the multiple objectives and interdependencies with other initiatives, the government and relevant stakeholders need to take an active role in defining their priorities and actively manage all initiatives. A multi-sectoral approach involving relevant ministries and other government agencies, development partners, and private sector partners is advisable to ensure coordinated actions and to avoid friction.

In summary, the framework developed in this paper is a useful tool that allows academics and practitioners to analyze and improve school feeding supply chains in terms of sustainability. Other frameworks and tools used in practice have a different and narrower focus. For example, WFP

reporting focuses on an aggregated set of input and output measures and leaves out the specific situation at school level. The World Bank and WFP assessment tool, with five quality standards, is less operational and focuses on strategic aspects such as policy and institutional arrangements. By taking a full supply chain perspective, the framework provides an integrated analysis of the complex school feeding intervention leading to a better understanding of the cause-effect relationships and strategic choices in delivery models.

The developed tool facilitates further analysis of school feeding options and models by structuring the data collection process. Information on the identified factors will give a holistic picture of a school feeding supply chain. Data availability can vary greatly in practice. In the Laos case a lot of secondary data exists as a result of WFP reporting requirements. This secondary data makes it possible to describe internal and external factors, but complementary interviews are useful to capture all aspects such as supplier landscape (including smallholders), situation of beneficiaries, incentives for participation, costs of partners (such as communities and government), and information on supply chain capabilities. In terms of performance, management reports provide some information, especially operational data. There are more gaps on longer-term strategic performance. In general, international programs typically have higher accountability requirements and stronger processes for reporting and monitoring. For local programs data availability may be worse due to less and lower quality reporting.

The framework can be used post hoc, but also during or before a program is started in order to improve supply chain design. In a running program, the framework may help to identify pain points and bottlenecks that reduce performance. This tool can be also used for practical design changes and testing of program options. A comparison of different school feeding options based on the local context is useful, especially for decision makers, and can be used to implement cost-effective solutions. For the OM/OR community, the framework provides the data basis for

quantitative modeling of possible supply chain scenarios. Due to the limited data availability, long time frames, and delays between program actions and outcomes, system dynamics is a promising tool to gain insights into the various supply chain factors and processes progressing over time (Besiou et al. 2011). This method can address the mentioned difficulties by simulating key processes over longer timeframes based on a few selected relationships and data points.

## **5. Summary and Conclusions**

This paper analyzed the supply chains of school feeding programs with a focus on sustainability. A need for research was identified based on two perspectives. First, a significant rethinking of the established, high-impact school feedings has taken place, and a new focus on sustainability has emerged. Second, we identified research gaps in the fields of school feeding supply chains as well as supply chain management at humanitarian organizations in general, especially in longer-term aid interventions. A broad and exploratory research process was chosen in this paper, both due to the novelty of this topic and to ensure academic and practical relevance. We identified the critical factors in school feeding supply chains and linked them with the objectives and performance of sustainable school feeding. Supply chain management is a key factor in achieving cost-effective delivery of food to schoolchildren. Therefore, this paper used the supply chain perspective as the focal point in order to obtain a better understanding of the complex flows of products, information, and money among the parties involved. After providing a background on school feeding, we developed a theoretical framework that makes it possible to identify the key factors and interactions that impact both performance and sustainability.

The framework developed in this paper is a valuable intermediate step that provides a helpful explanatory structure for this complex field. It is based on multiple sources of input and combines pertinent strands of academic literature with practical insights, including expert feedback. The

applicability of the framework was demonstrated by the analysis of a school feeding country program in Laos. The framework serves both academics and practitioners in that it leads to a better understanding of school feeding factors and related trade-offs. The framework can be used to identify pain points and bottlenecks in running programs and to aid supply chain design by providing information on cost-effective solutions.

The findings from the framework application suggest that there is no single model of how to achieve a sustainable school feeding setup; rather, in practice, many different models exist. Appropriate models depend on the general context, the external factors, and the goals set for the program. These factors lead to differences in program performance between the possible supply chain configurations. Program strategy should therefore be designed to take into account the local situation and potential trade-offs. Furthermore, local supply chain capabilities are beneficial for program performance and sustainability.

Different approaches can be used to address the specific aspects of local production and sourcing. The appropriate approach and level of local sourcing depends on the situation, specifically on the number and capacity of local suppliers and on the food security status in the target regions, and must include a careful evaluation of trade-offs. It is possible, for example, that local sourcing is a feasible option in food-secure areas, while in food-insecure areas only limited direct local sourcing, ideally complemented with agricultural support, will be appropriate. Further trade-offs related to local sourcing are efficiency and effectiveness. Currently, there is no solid factual basis and methodology for determining the optimal level of local sourcing for school feeding programs; however, some countries fix a certain level - for example, Brazil requires 30% local sourcing.

The research presented in this paper has some limitations. The developed framework focuses on the main factors of school feeding with a focus on supply chain management. Other aspects of the complex school feeding system were not considered. Research from another perspective or

discipline might choose a different focus such as policy level, nutrition, or agriculture. Furthermore, it should be noted that humanitarian logistics is an evolving field and that only limited research exists, especially in the field of longer-term interventions. The factual basis for some key topics of school feeding is limited and evaluations of the effects of home-grown school feeding are just starting (Devereux et al. 2010, Masset and Gelli 2011). More validation of the framework and additional insights could be achieved with additional case studies. Especially for local production and sourcing, the amount of currently available information is limited, as projects of this nature are just now being piloted.

A number of future research opportunities exist. A possible follow-up to this research is an analysis of cases based on the developed theoretical framework. Both within-case analysis and cross-case analysis should yield additional insights into the cause-effect relationships between the factors and objectives of school feeding supply chains that are relevant to achieve sustainability. Specifically, local sourcing seems to be a promising avenue for additional research; for example, there is a current lack of information about the appropriate levels of local sourcing volume. Simulation methods such as system dynamics seem appropriate for such research questions, due to the complex and dynamic systems in the humanitarian world.

Another promising research area related to school feeding is the “greening” of the humanitarian supply chain (Sarkis et al. 2011). Potential issues in this regard are reverse logistics, use of non-degradable materials, and optimization of transportation needs. In practice, a few ideas are already being implemented; for example, in Kenya WFP is testing fuel-efficient stoves for cooking. Development aid and climate changes may seem separate topics, but for sustainable development an integrated approach is advisable and explicitly advocated in international processes, such as the United Nations Conference on Sustainable Development in 2012 (Rio+20).

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