Designing Post-Disaster Supply Chains: Learning from Housing Reconstruction Projects

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ABSTRACT

Post-disaster housing reconstruction projects face several challenges. Resources and material supplies are often scarce, several and different types of organizations are involved while projects must be completed as quickly as possible to foster recovery. Within this context, the chapter aims to increase the understanding of relief supply chain design in reconstruction. In addition, the chapter is introducing a community based and beneficiary perspective to relief supply chains by evaluating the implications of local components for supply chain design in reconstruction. This is achieved through the means of secondary data analysis based on the evaluation reports of two major housing reconstruction projects that took place in Europe the last decade. A comparative analysis of the organizational designs of these projects highlights the ways in which users can be involved. The performance of reconstruction supply chains seems to depend to a large extent on the way beneficiaries are integrated in supply chain design impacting positively on the effectiveness of reconstruction supply chains.

INTRODUCTION

In contrast to the developments in increasing the accuracy of forecasting a number of natural disasters, the aftermath of these events, particularly the part related to disaster relief operations, often remains very problematic. The increased frequency of both human and manmade disasters which implies that more resources have to be allocated more efficiently, more frequently and sometimes more unexpectedly, has resulted in increased complexity in the delivery of humanitarian assistance (USAID, 2002; EM-DAT, 2008). Complexity is further increased by the large growing number of organizations, both governmental, and non-governmental, which are nowadays devoted to providing humanitarian assistance. Another novelty is that emergency relief efforts rarely remain within the boundaries of single countries. In most cases, multi-country collaboration is required, adding thus global implications in the development of relief efforts.

Given that logistical efforts account for a very significant portion of the humanitarian aid spending (van Wassenhove, 2006), many researchers are pointing out the crucial importance of having an efficient and effective logistics system. But as Kovács and Spens (2007) argue when it comes to humanitarian aid, there is an important distinction to be made between logistical activities that pertain to 'continuous aid work' vs. 'disaster relief'; or, as van Wassenhove (2006) points out, slow-onset vs. sudden-onset disasters. Yet, distinct phases can also be seen within disaster relief, such as preparation, immediate response and reconstruction (Kovács and Spens, 2007). Whilst the focus in the immediate response phase is one of time efficiencies, the later reconstruction phase has a longer-term focus and thus, deals with more predictable demand and the possibility to plan for constant schedules (Maon *et al.*, 2009; Taylor and Pettit, 2009).

The reconstruction phase of disaster relief operations is at the heart of this chapter. In particular, the chapter sheds light on two major European-based reconstruction housing programmes with the aim of increasing the understanding of the overall supply chain design. The chapter starts with a review of relief supply chain literature, with particular emphasis on supply chain design and performance in post-disaster reconstruction. Next, the research methods of the study are presented, followed by empirical evidence from the housing reconstruction programmes. The chapter ends with the key findings and conclusions.

EMPIRICAL BACKGROUND

The chapter reports the findings of a comparative analysis of two studies of reconstruction housing programmes. Study 1 is based on a European Housing Reconstruction Programme in the Kosovo, while study 2 sheds light on a similar Housing Reconstruction Programme in the Former Yugoslav Republic of Macedonia (FYROM).

Study 1: Housing Reconstruction in Kosovo

Kosovo is located in the central Balkan peninsula in Southern-eastern Europe. It is a landlocked region and borders the FYROM to the south, Albania to the west and Montenegro to the northwest. For many decades it was an autonomous part of Yugoslavia, but after 1989 conflicts between Kosovo Albanians Serbians started which were continued until 1999 when NATO forces bombed Serbia. The end of the Kosovo conflict revealed a typical complex emergency situation characterized by refugees and a large-scale destruction of houses. An estimated 120,000 houses out of a total of over 250,000 were damaged or destroyed. The European Union played an important and multifaceted role in Kosovo's reconstruction particularly through the European Agency of Reconstruction (EAR). According to the EAR (EAR, 2002), 41,000 were less badly damaged, 32,000 were seriously damaged (41-60% of the house damaged) and 47,000 were very seriously damaged (61-100% of the house damaged) - most of these houses were effectively destroyed, with often not even a sound foundation remaining. This large-scale destruction, as well as the need to rapidly re-house families in Kosovo urged for increased efficiency in the reconstruction effort. Without the return of families from temporary accommodation to their homes, normal life could not have resumed in Kosovo. Several issues added to the problem. For example, large-scale refugee returns (mostly Kosovo Albanians) from late spring 2000 (100,000 estimated by UNHCR until the end of the 2000) added to the complexity of the situation. In other words, while demand is rather predictable in reconstruction, reconstruction supply chains that deal with post-military conflicts need to take the potential of renewed hostilities into account (Taylor and Pettit, 2009). Problems related to property rights also appeared. Many families who have had their homes damaged or destroyed were not in the most vulnerable category of beneficiaries, but lacked the resources to fully pre-finance their speedy reconstruction. In addition, given that the Housing Reconstruction Programme 2000-2001 targeted approximately 12,000 homes, the houses that would be assisted in reconstruction needed to be selected carefully. Finally, the damage assessment conducted by International Management Group (IMG) in 1999, revealed problems in the supply of housing materials. On the one hand there was an urgent need for the procurement of timber, roof tiling and other materials for the rehabilitation of private dwellings and some public buildings. On the other hand several problems were reported with respect to supply imports, such as embargo problems, closed borders and delays in deliveries.

Study 2: Housing Reconstruction in FYROM

The FYROM is a landlocked country located in the central Balkan peninsula in South-eastern Europe. It declared independence in 1991 after the disintegration of the former Yugoslavia. The country is bordered by Kosovo to the northwest, Serbia to the north, Bulgaria to the east, Greece to the south and Albania to the west. FYROM's Housing Repair and Reconstruction Programme started in June 2001, a few months after the conflict between Ethnic Albanian armed groups and Government forces which took place in the Northwest (Tetovo) and North-East of Skopje (Skopska Crna Gora).The conflict caused extensive damage to buildings in former conflict areas, including buildings of particular religious and historical significance, as well as housing infrastructure, in particular in the north regions of the country and also in other parts of the country (Kumanovo, Arachinovo, Bitola). The levels of damage to individual houses varied considerably, with many being in the more lightly damaged categories. After the end of the conflict there was an urgent need to start quickly on repairing / reconstructing the houses damaged by the conflict thereby facilitating the return of the displaced persons, to re-establish normal living conditions and to rebuild confidence between the ethnic groups. An initial assessment carried out in the Tetovo area (April 2001) indicated about 190 houses of the first phase of conflict to be repaired/reconstructed. The assessment on the Northeast of Skopje (Skopska Crna Gora) was delayed due to the need to clear the area of mines. The 190 damaged

houses in the Tetovo area accommodated about 1,500 people. The estimated 250 houses damaged in Skopska Crna Gora accommodated about 2,000 people. Implementation of the EC/EAR House Repair and Reconstruction Programme started in September 2001 and was undertaken in different phases and under different budget lines. In total, 1150 houses were reconstructed (or scheduled to be reconstructed) with a cost of approximately €7.5 million. The programme was initially implemented by the Commission Services with support from the existing operational centers of the European Agency for Reconstruction and the relevant national and/or local authorities. In addition, "Grant contracts" with NGO implementing partners were signed with the selected NGOs being responsible in managing assistance allocations to beneficiaries and also undertaking technical assessments and materials' voucher allocation. Moreover, NGOs were involved in the provision of technical advice and labor support quality control and monitoring of reconstruction work; and management of any works and supply sub-contracts.

SUPPLY CHAINS IN RECONSTRUCTION

Humanitarian logistics and relief supply chain management distinguishes between disaster relief with all its complexities (upon man-made or natural disasters or a combination of both) and development aid. Yet also within disaster relief, several phases are set apart: (a) the preparedness phase with its measures to prevent disasters or to prepare populations and international humanitarian organizations for an effective response to them, (b) the immediate response phase, from search and rescue operations to actual disaster relief, i.e. any activities related to providing for beneficiaries, i.e. the population affected by a disaster, and (c) the reconstruction phase. Often neglected in humanitarian logistics literature (to the extent that authors such as Long, 1997, and van Wassenhove, 2006, do not even mention it), reconstruction is the time when infrastructure and housing in the disaster area is rebuilt, people resettled etc. Reconstruction and restoration thus concludes immediate "emergency" response in a cycle of reaction and recovery (cf. Maon *et al.*, 2009). But as Pettit and Beresford (2005) pinpoint, reconstruction does not only indicate recovery and rehabilitation but is intrinsically linked with preparedness activities. This is especially the case in disaster-prone areas such as earthquake zones due to tectonic faults, or areas with cyclical disasters such as cyclones, hurricanes and annual floods. Yet while literature has considered post-disaster prevention since the Indian Ocean tsunami in 2006 (Beresford and Pettit, 2007; Banomyong *et al.*, 2009), research on reconstruction has remained scant. What is more, reconstruction suffers from a lack of funding, as donors tend to emphasize immediate relief.

Construction supply chains have been characterized as *converging* (several supply lines coming together at site), *temporary* (set up on a project basis, though project as well as supply chain members can come together for several projects in a row), and following a *make-to-order* principle (Vrijhoef and Koskela, 2000). These converging supply chains may be better described as an extremely complex construction supply network with a main contractor at the construction site (logistically to be seen as a hub), with links to the client, main supply agencies as well as design and specialist management services (Dainty *et al.*, 2001). Vrijhoef and Koskela (2000) further distinguish four focal areas of supply chain management in construction: (a) on-site activities, i.e. project management and the coordination of all supply lines at the construction site, (b) supply chain design with a focus on cost efficiencies in setting up the supply chain, (c) a transfer of activities away from the construction site to more prefabrication of materials and components in earlier echelons, and (d) integrated management of the site and the converging supply chains. Saad *et al.* (2002) add the focus of relationship management and partnering, i.e. a move away from traditional arms-length and short-term relationships in construction as a result of a new supply chain orientation even of public sector clients (such as the UK's Ministry of Defence), though even follow-up studies found little evidence of this being put in practice (cf. Briscoe and Dainty, 2005). Reconstruction supply chains observe similar focal areas and related challenges. They are in effect converging temporary supply chains that follow a make-to order principle. These issues are of importance in the design of reconstruction supply chains. At the same time, the convergence on site is a matter of not only bringing together different

construction companies (and their related supply chains) but also, different humanitarian organizations involved in a reconstruction programme.

Relief supply chain design needs to be flexible enough to "evolve from an initial emergency response to an ongoing reconstruction operation" (Maon *et al.*, 2009). Yet reconstruction poses new questions for relief supply chains. Contrary to the agility maxim of immediate relief (cf. Oloruntoba and Gray, 2006), the reconstruction phase can indeed be planned more in advance (Taylor and Pettit, 2009) and thus, focus more on cost as well as time efficiencies. Rather comparable to other construction projects (see Fearne and Fowler, 2006), reconstruction supply chains are designed for temporary purposes, though without a potential reassembly of the same supply chain members for further projects. In the humanitarian context, the cost efficiency focus alongside long-term goals of reconstruction is related to the development side of humanitarian aid, filling what Oloruntoba and Gray (2006) call the transitional stage of a relief to development continuum. Measuring the performance of reconstruction supply chains thus, differs from performance measurement in immediate relief that has focuses on short-term activities (cf. Beamon and Balcik, 2008; Maon *et al.*, 2009). Having said so, literature on performance measurement in any phase of disaster relief is scant (Kovács and Tatham, 2009). The few exceptions include van Wassenhove's (2006) general assessment of at least 80% of costs of aid to be attributed to logistics, two case studies on measuring performance in immediate relief (van der Laan *et al.*, 2009, on Médecins Sans Frontières, MSF and Schulz and Heigh, 2009 on the International Federation of Red Cross and Red Crescent Societies, IFRC), and, probably most importantly, Beamon and Balcik's (2008) evaluation of the effectiveness of a relief mission. As they suggest, "the challenges identified for performance measurement in the non-profit sector include the intangibility of the services offered, immeasurability of the missions, unknowable outcomes, and the variety, interests and standards of stakeholders" (Beamon and Balcik, 2008, p.8). Yet performance measurement in relief supply chains, including reconstruction, is particularly important from the perspective of accountability to beneficiaries as well as donors.

Supply chain performance measurement traditionally focuses on the dimensions of efficiency and effectiveness (cf. Fearne and Fowler, 2006). As Kovács and Tatham (2009) discuss, breaking down these two results in debates on product and process quality, on-time deliveries, flexibility, time and cost efficiencies, and customer service levels. Beamon and Balcik (2008) suggest a tripartite measurement in terms of (a) resource performance metrics (resource utilization, quantities, output) such as inventory holding costs to man-hours, (b) output performance metrics (i.e. looking at effectiveness) such as lead times, back-orders and stock-outs, product quantities and qualities, all in accordance with the strategy of an organization, and (c) flexibility metrics such as shortest delivery lead times etc. The latter is the only key performance indicator cited in Maon *et al.* (2009), pinpointing its importance. Similarly, Fearne and Fowler (2006) emphasize the importance of delivering construction projects on time – and within budget. Furthermore, Balcik *et al.* (forthcoming) discuss equity considerations as performance metrics in the not-for-profit and public sectors that are equally applicable to relief supply chains. Equitable aid distribution targets the most vulnerable people without discrimination and according to their needs. Equity can be seen as a stand-alone measure, or incorporated in the concept of aid effectiveness.

Thus one of the most interesting dimensions related to relief supply chains is that of effectiveness, as it is far from unclear whether it is the effectiveness of an organization, a mission, or aid effectiveness en large that should be measured. What is more, while there is a call to look at all stakeholders of a "mission", it is still organizational (or programme) effectiveness that is typically under evaluation (such as in Schulz and Heigh, 2009, van der Laan *et al.*, 2009). It can be argued that to measure effectiveness in a humanitarian context, the concept needs to be approached from both the beneficiary perspective (not unlike a customer focus in "commercial" supply chain management, though including the equity aspect), from the perspective of the supporting supply chain, as well as from a stakeholder perspective. In this paper, the focus is on the beneficiary perspective on the performance and design of reconstruction supply chains.

EMPIRICAL RESEARCH

This paper is based on the analysis of secondary data as reported in the European Agency of Reconstruction (EAR) evaluation studies of two Housing Reconstruction Programmes in Kosovo and FYROM (former Yugoslavian Republic of Macedonia). Both studies were conducted for the purposes of an internal analysis of the EAR (EAR, 2002, EAR, 2003) and thus did not have the aims of this research in mind. Nonetheless, they are unique studies in that they investigate the effect of the aid programme from the perspective of beneficiaries. In other words, in contrast to other surveys (e.g. Long and Wood, 1995; Oloruntoba and Gray, 2006; Pardasani, 2006) the role of beneficiaries is not only conceptually recognized, but empirical investigations are also provided and documented in the EAR (2002) report. In addition, one of the authors was part of the original evaluation studies and was involved in primary data collection. Secondary data analysis was employed as a research strategy in this chapter due to the major practical constraints in accessing the research object. Not surprisingly, several articles in humanitarian logistics are based on secondary data analysis (e.g. Pardasani, 2006; Beresford and Pettit, 2007) as this method allows for the analyses of events in what would otherwise be inaccessible settings, due to practical weaknesses in accessing the research object. Data collection involved desk research with access to files and relevant documents, as well as structured interviews (by the Evaluators) with different stakeholders, including task and programme managers, NGOs, contractors, suppliers, Housing Reconstruction committees, etc. Case study data were collected from the members of the reconstruction supply chain as listed above, including a random sample of village committees, in in-depth interviews. The research tools developed covered a wide range of issues, such as: weaknesses and strengths during the selection process (targeting, participation, time-consumption, guidelines, etc.), comparison of the three reconstruction approaches (self-help, assisted self-help, contractors) and also coordination issues. This data was complemented with a mail survey sent to other NGOs in the area (of which 12 were returned from Kosovo and 3 from FYROM). Considering a potential bias in village reconstruction committees that made approval decisions as well as represented beneficiaries, these data were complemented (and triangulated) with focus group interviews in some areas. Furthermore, the two Housing Reconstruction Progammes (in Kosovo and FYROM) were analyzed comparatively before arriving to common findings from the studies.

FINDINGS

Reconstruction relief supply chains display the features of construction supply chains such as convergence, temporariness and observing a make-to-order principle. Yet *convergence* here starts from beneficiaries as “main clients”, and with needs assessments of these beneficiaries. As beneficiaries are usually not attributed any purchasing power (Kovács and Spens, 2008), needs assessment processes replace the function of placing orders in the relief supply chain. In fact, humanitarian organizations often act as proxies for beneficiaries when placing orders in the supply chain. Thus humanitarian organizations involved in the needs assessment process become part of the already complex (re-)construction supply chain (see Figure 1). An important aspect of convergence in the reconstruction supply chain is though the involvement of beneficiaries as active supply chain members – something that is unusual given their (otherwise) lack of purchasing power in relief supply chains.

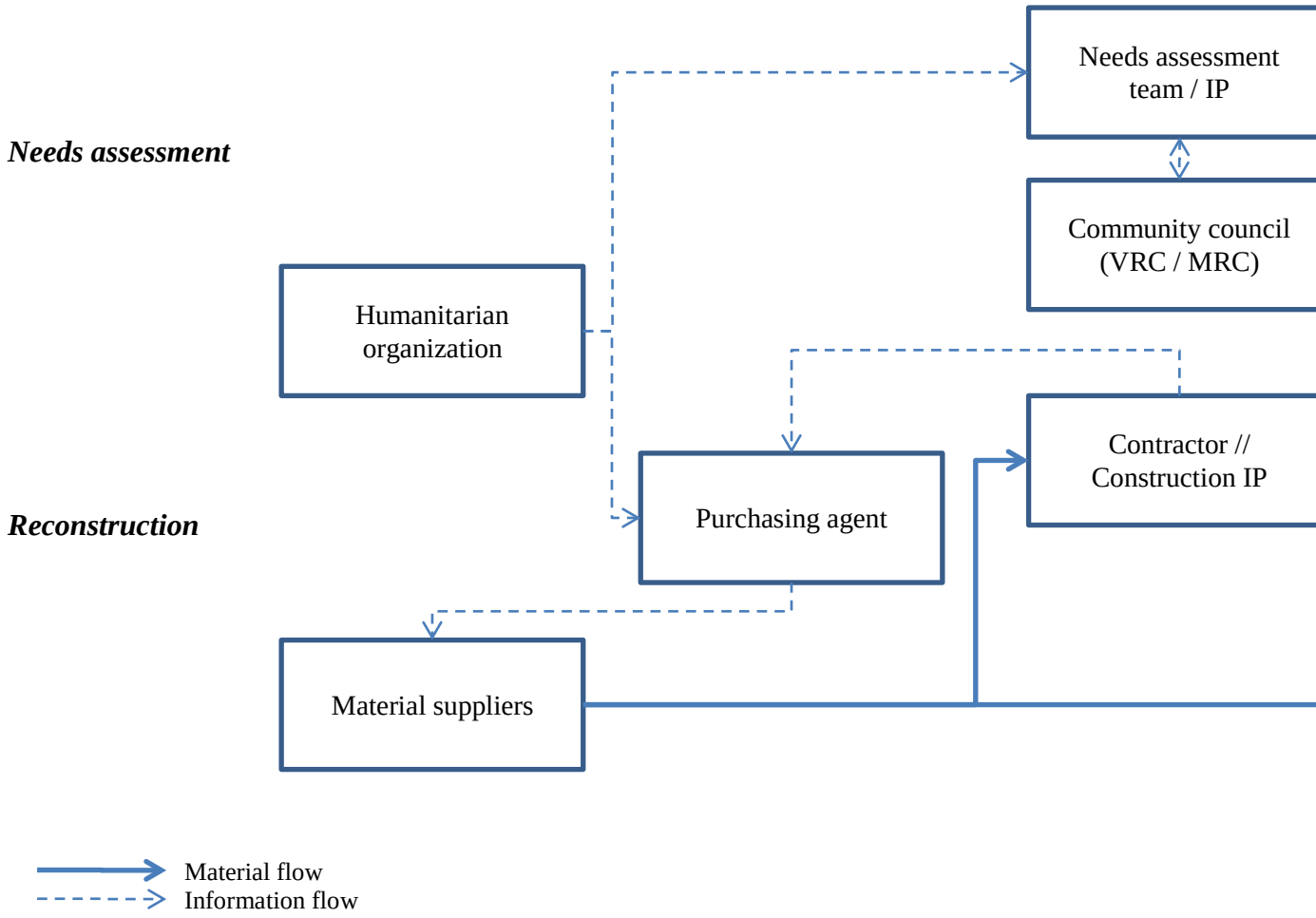

Figure 1. The reconstruction supply chain

Reconstruction supply chains are also designed for a given time, following the *temporariness* of the aid programme that serves as their background. In fact, relief supply chains in general obey principles of temporariness especially in the field or disaster area (cf. Tatham and Kovács, 2010). However, more permanent supply chain design can be employed on the global, strategic levels – bearing in mind that local sourcing is commonly preferred due to its positive impact on the local economy (Long and Wood, 1995; Jahre and Spens, 2007).

Vrijhof and Koskela's (2000) third aspect of construction supply chains is that they follow a make-to-order principle. This allows for customization, and here, for meeting the actual needs of beneficiaries. Nonetheless, design principles of prefabrication as well as modularization can still apply to reconstruction supply chains as long as they contribute positively to supply chain performance.

Involving Beneficiaries in Reconstruction Supply Chains

Beneficiaries are the end customers of the relief supply chain (Oloruntoba and Gray, 2006; Maon *et al.*, 2009) and as such, the main clients of the reconstruction supply chain Equitable aid distribution is based on the actual beneficiary needs, observing the scarcity of available resources (cf. Balcik *et al.*, forthcoming). Given a scarcity of funds for housing reconstruction, both Housing Programmes needed to establish criteria for the selection of the beneficiaries most in need of their assistance. Anderson and Woodrow's (1998) Capacities and Vulnerability Analysis (CVA) was employed to match people, vulnerabilities and their capacities with the programme. This analysis is based on a matrix that evaluates the vulnerabilities as well as capacities of beneficiaries in three dimensions: the physical/material, social/organizational, and motivational/attitudinal. As a result of this analysis, most vulnerable households were deemed the ones least able to access the necessary resources to rebuild.

Different organizations were involved in the identification of the most vulnerable households. Implementing partners (IPs) of NGOs brought in international as well as local social assessment experts to carry out the capacities and vulnerability analysis. Yet the identification of beneficiaries started at village level. Local partners in the form of community-based organizations that link implementing NGOs to beneficiaries are typical for relief supply chains (Oloruntoba and Gray, 2006). In this case, village reconstruction committees (VRCs, see Figure 1) were formed through a bottom-up approach, their members elected from and by the community. This approach ensured beneficiary participation as well as empowerment, as well as ensures the precise articulation of needs (see also Pardasani, 2006, for such an approach used in post-tsunami reconstruction). The aim of the VRCs was to ensure the transparency of the beneficiary selection process, rendered accountability to both selected and non-selected beneficiaries and informed the community about the Housing Programme. Still, the assessment of the selection criterion of the income situation of beneficiaries proved more difficult. Thus the capacity and vulnerability analysis had to be adapted in that wealth ranking was replaced with social assessors of the IPs received information from VRCs but essentially, triangulated this with indicators such as visible disposable assets and general living conditions to judge the income/asset situation of beneficiaries.

The Use of Local Resources

Such a community-based approach to reconstruction also ensured access to local suppliers and capacities. As Long and Wood (1995) point out, humanitarian logistics should always priorities information from local personnel as well as use local expertise and labor as much as possible, so that local leaders would take personal interest in the success of operations. Local sourcing, where possible, has a positive impact on the economic situation in the region, as well as ensures the cultural and regional applicability of solutions as well as the potential to maintain local lifestyles (cf. Long and Wood, 1995). Not surprisingly, thus, there is a trend towards local sourcing in relief supply chains (Jahre and Spens, 2007). Important regional conditions for reconstruction programmes include meteorological conditions of a region as well as assessments of potential natural hazards (Pande and Pande, 2007) and emphasizing the need of local knowledge in reconstruction (Pardasani, 2006). The implementing partners (IPs) of both Housing Reconstruction Programmes thus adopted construction labor techniques that were based on the community as well: self-help, assisted self-help, and contractors (see Table 1). These could be mixed, so for example a nominally self-help house could have a contractor for the roof. Assisted self-help could comprise unpaid village labor teams as well as the more typical paid mobile teams of craftspeople. Table 1 not only summarizes the different degrees of beneficiary involvement in reconstruction but also assesses their strengths and weaknesses as reported by beneficiaries in the household survey.

Labor assistance	Strengths	Weaknesses
Self-help	▪ Encourages beneficiary participation/ownership ▪ Generates local income and maximizes involvement of local labor ▪ Moderates envy of non-selected neighbors ▪ Cost-efficient	▪ The most vulnerable families cannot benefit from the self-help approach because of lack of expertise and economic means ▪ Need for more supervision by IP ▪ More time-consuming
Assisted self-help	▪ Encourages beneficiary participation/ownership ▪ Ensures a more timely delivery if used to supplement "slow" beneficiaries	▪ Higher pressure for timely delivery of material ▪ More supervision (i.e. clarifying all of the obligations the beneficiaries have to meet in order to be problem-free and to finish on time)
Contractors	▪ The only feasible approach for the most vulnerable ▪ Time-efficient ▪ Quality control	▪ Higher costs (i.e. fewer houses possible within the same overall budget)

Table 1. Beneficiary participation in reconstruction (Source: EAR, 2002)

IPs had the flexibility to decide which method was the most appropriate in the individual case. Some IPs adopted the direct financial assistance to the beneficiaries in order to utilize the skilled labor present within the assisted family (extended) or the community and, as a means of ensuring that the cash flow was absorbed by the local economy. In the beneficiary household survey, beneficiaries showed great satisfaction and reported very few problems with all construction techniques employed.

Whilst it was possible to use local labor and contractors, local sourcing of construction materials proved more difficult. In the case of Kosovo, the existing market could not cope with the rapidly increasing demand for construction materials. Therefore, most of the building materials had to be imported. For example, Kosovo did not have a functioning brick factory hence bricks were imported. Timber also needed to be imported from Bulgaria. The resulting estimate of local input, mostly of sand and gravel, sets its rate of housing materials at 25%. The supply chain design of the Kosovo Housing Reconstruction Programme changed over time. At the beginning, materials were centrally procured through an agent contracted directly by the donor, and the agents subcontracted suppliers. In the later phases of the programme, materials supply was organized through international open tenders for each municipality. Contracted material suppliers were also in charge of all logistical activities including last mile deliveries and inventory management. Implementing partners (IPs) employed, however, a controller for warehouses, while procurement specialist teams were responsible for quality control.

The main challenge in the supply of housing materials was delays in deliveries. These were caused by a lack of experience of suppliers in trading with housing materials, as well as by the sheer scale of the Housing Reconstruction Programme. Further delays were instigated by the closing of the FYROM border and the prior destabilization of transport infrastructure such as railways. The main problem, however, remained the scarcity of supply of housing materials facing such a surge in demand.

In the case of FYROM, the use of local labor was also an important decision. A link to a higher utilization of local labor without violation of the local tendering procedures could have been an important condition for subcontractors, which was not the case in all villages visited.

Local suppliers also experienced cash flow problems as no payment in advance was allowed. This led to the introduction of a voucher system in 2000 in both housing programmes. Beneficiary households

were given vouchers (value corresponding to the assessed damage category) to be exchanged for specified reconstruction materials at nominated supply locations, whether these are private trader's premises, or warehouses managed by IPs. Emphasis was placed on flexibility and maximum control of the beneficiaries. Problems due to corruption have not been seen and the use of voucher system countered partly this possibility.

FUTURE RESEARCH DIRECTIONS

Community-based supply chain design in reconstruction empowers beneficiaries as well as seemingly improves the effectiveness in meeting their needs. However, community-based approaches can go beyond mere village reconstruction committees in beneficiary identification and selection and even beyond incorporating beneficiaries as active members of the supply chain if adding a cash component to aid. Cash components have been used as early as in 1998 by the International Federation of Red Cross and Red Crescent Societies (IFRC) in response to Hurricane Mitch. They restore the purchasing power of beneficiaries and give them the opportunity to decide actively on their most urgent needs. At the same time, relief supply chains benefit from a reduced need to organize the purchasing and transportation of materials. Also, as long as materials are available on the local market, a cash component counteracts a sudden surge in imports. What is more, in the reconstruction supply chain, they can mitigate cash flow problems of upstream suppliers as well. Further research is though needed on the aspects of direct cash components versus various voucher systems (as in the Housing Reconstruction cases in Kosovo and FYROM) in disaster relief.

Construction supply chains have long embraced the topic of prefabrication (Vrijhoef and Koskela, 2000). Even though newer developments in shelter and reconstruction have initiated projects in development architecture that include aspects of modularization and prefabrication, this phenomenon needs further investigation also in research. Arguably, as in construction supply chains, prefabrication can reduce the need for the management of convergence at site as well as contribute to purchasing economies. What is more, sustainable construction embraces e.g. prefabricated concrete as a less polluting variant of concrete materials. Sustainable construction is yet to embrace both the ecological and social dimensions of construction projects. Community-based approaches to construction are rarely combined with aspects of energy efficiency, not to speak of passive housing to plus-energy housing projects.

CONCLUSION

This chapter has explored the nature and scope of the post war reconstruction efforts required in Kosovo and in the FYROM. This research was based on secondary data from two studies and their related reports that were developed for a different purpose than the research itself. Notwithstanding a potential bias of the EAR (2002) and EAR (2003) reports that were analyzed, there are a number of conclusions to be drawn. Both programmes due to budget and time restrictions targeted the most vulnerable families, therefore the selection process and procedures were of high importance. In both programmes the involvement of local communities were considered highly appropriate and successful by beneficiaries, the IPs and the Agency.

Regarding construction procedures three delivery mechanisms were applied namely: self-help, assisted self-help and cooperative forms and they were proved to be highly appropriate. In both programmes problems with reference to the speed of delivery of building materials, or supply of labor were encountered. By incorporating local labor, small construction firms and local suppliers of construction materials, all these problems were confronted. In addition, this gave a positive impulse to the local economies. Indirect and induced effects were seen in the field of social cohesion, gender equity and democratic procedures. An interesting aspect of supply chain design was raised in the introduction of a voucher system in the housing reconstruction programme. Not only did the voucher

system empower beneficiaries to take their own decisions related to housing materials but the de-coupling of financial fro material flows actually reduced delivery times in the reconstruction supply chain. The practical implication of this case is to further emphasize financial instruments (vouchers and micro-credits) as well as direct cash donations as a means to increase supply chain effectiveness. Moreover, it was proved that the introduction of a voucher system for material worked satisfactorily and safeguarded against risks of fraud.

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KEY TERMS & DEFINITIONS

Keywords: housing reconstruction, reconstruction supply chain, supply chain design, supply chain performance

The **reconstruction supply chain** is a construction supply chain in the reconstruction phase of disaster relief. It converges construction supply chain(s) with needs assessment teams, donors and beneficiaries.

Community based approaches in disaster relief emphasize socially sustainable development through a focus on the involvement of beneficiaries and their social environment in relief activities.

Supply chain design determines the structure and configuration of the supply chain in terms of its members, degree of collaboration, geographical (facility) locations, and supporting systems.