

Key Performance Indicators in Humanitarian Logistics

by

Anne Leslie Davidson

Submitted to the Engineering Systems Division
on May 19, 2006, in Partial Fulfillment of the
Requirements for the Degree of
Master of Engineering in Logistics

Executive Summary

When disasters strike, relief organizations respond by delivering aid to those in need. Their supply chains must be both fast and agile, responding to sudden-onset disasters which may occur in cities such as New Orleans, or on the other side of the globe in places like rural Pakistan. Since 2004, two large-scale natural disasters have captured the attention of the international media: the 2004 tsunami and the 2005 earthquake in South Asia. Disasters of this magnitude cause donors, beneficiaries, and the media to closely monitor how quickly and efficiently relief organizations are able to respond.

A disaster response operation involves trade-offs of speed, cost, and accuracy with regard to the type of goods that are delivered and their quantities. Balancing these trade-offs requires a means of measuring supply chain performance; however, the inability to centrally capture time and cost data related to the procurement and distribution of goods has prevented a systematic process of performance measurement from being implemented. Today in the logistics department of the International Federation of Red Cross and Red Crescent Societies (IFRC), software that was co-developed with the Fritz Institute makes it possible to capture the necessary data which will inform the IFRC of their supply chain's performance.

This executive summary begins by examining the underlying principles of logistic performance measurement systems from the military and commercial sectors and applying them to disaster relief operations. These principles were used to develop four indicators which measure logistic performance in terms of the trade-offs of speed, cost and accuracy: appeal coverage, donation-to-delivery time, financial efficiency, and assessment accuracy. Taken together, these indicators create a “scorecard” that will help the logistics department gauge performance both during and after a relief operation. To show how this system would be used by a relief organization, scorecards have been re-created for the 2005 South Asia earthquake operation of the IFRC. The executive summary concludes by describing one of the key issues which may arise when a performance measurement system is implemented, which is how to manage the cultural change that is needed in organizations unaccustomed to performance measurement. Although this research was performed with an international non-profit humanitarian organization in mind, the principles of measurement that are described are relevant to other organizations which participate in disaster relief operations, such as government agencies or national non-governmental organizations.

Principles of Performance Measurement from the Commercial and Military Sectors

Supply chain professionals in the commercial sector face many of the same issues of trade-offs in performance as a professional working in a disaster relief operation. In business and in disaster relief supply chains, speed is of the essence. Even more striking in parallel are military supply chains, which often face similarly short deployment periods and challenging working environments. Because of these similarities, it is important to understand the underlying principles of commercial and military performance measurement systems when

developing a system for disaster relief operations. The following three principles emerged from business research journals and from research studies of the U.S. Army as the most applicable to the humanitarian sector.

- **Align metrics to the organization’s core strategy (Lambert, 2001).** If a metric is not critical to fulfilling an organization’s core strategy, it should not be included on the scorecard. There is a tendency when designing performance measurement systems that “more is better,” but if too many metrics are selected, the scorecard can become too cluttered, preventing individuals from truly gauging performance.
- **Understand the dynamics of how performance is driven (Caplice & Sheffi, 1994).** The *faster* that goods are delivered to beneficiaries after a disaster, the less likely these goods are *accurately* meeting the needs of the beneficiaries, and the more likely the operation will be *costly*. The organization responding must decide in advance how it wants to align itself along the dimensions of speed, accuracy, and cost.
- **Review the metrics periodically as performance improves (Meyer, 2005).** The goal of implementing metrics is to improve performance over time, and as goals are achieved, targets must be re-evaluated and revised as necessary to ensure continuous improvement in the organization’s supply chain.

Framework of Four Performance Indicators

To develop our framework of four performance indicators, we first conducted interviews with the professionals at the IFRC in order to understand their supply chain and their organization’s strategic goals. We then examined the data for the 2005 South Asia earthquake operation that was captured in Humanitarian Logistics Software (HLS). This software was implemented by the IFRC in 2003, to track information relating to the

procurement and distribution of goods for all major emergency operations. Using the organization's goals of *how* they strive to deliver goods to beneficiaries and using the data available from HLS, we developed the set of four indicators: appeal coverage, donation-to-delivery time, financial efficiency, and assessment accuracy. These indicators do not represent pure index calculations, but rather they serve to help the logisticians get a sense of how well they are achieving their goals related to each "appeal," the term which refers to the list of items recorded on an operation's total budget.

1. Appeal Coverage: This indicator is comprised of two specific metrics: 1) *percent of appeal coverage* and 2) *percent of items delivered*. The first metric is the quantity of items that have been pledged by donors out of the total number of items requested for the operation. Its purpose is to indicate how well and how quickly the organization is finding pledges for the requested items. The second metric is the percentage of items that have actually been delivered on-site out of the total number of items requested for the operation. Together, these two metrics indicate how well the organization is meeting its appeal for an operation in terms of both finding donors and delivering items.

2. Donation-to-Delivery Time: This indicator is a measure of how long it takes for an item to be delivered to the destination country after a donor has pledged to donate it. Both the mean and median number of days are reported on the scorecard, which is a practice used in the U.S. Army's performance measurement system (Dumond, 2000). These two metrics help gauge both the average and the consistency of the delivery lead times.

3. Financial Efficiency: Three metrics comprise the indicator of financial efficiency. The first two metrics use two methods (one relative and one absolute) to compare the budgeted prices to the actual prices paid for items delivered in the operation. The third financial

efficiency metric incorporates the transportation cost of delivering the goods to the beneficiaries. This metric is expressed as a ratio of the total transportation costs incurred over the total costs for delivered items at a point in time. The value of this ratio should decrease over time, as less expensive transport methods are used after the initial delivery phase and as more items are delivered on-site.

4. Assessment Accuracy: How quickly donations are pledged and goods are delivered to beneficiaries relies on how accurately the field personnel assessed the needs of the population affected after a disaster. Assessment accuracy therefore indicates how much the operation's final budget changed over time from the original budget. This metric contextualizes the values of the other metrics on the scorecard. For example, if it appears on the scorecard that the delivery lead time of a specific type of item was longer than average in an operation, the assessment accuracy metric will indicate if the long lead time of that item was caused by an initially low estimation of the quantity needed.

Using the Framework in an IFRC Operation

The metrics described above have been combined to form a scorecard as shown in Figure 1. To implement this system and determine if the organization is meeting its goals for the operation, the logistics department would analyze these scorecards at different points in time after the operation's original appeal date. Figure 1 shows what the "Week 1 Scorecard" would have looked like for the 2005 South Asia earthquake operation, had this system been used by the IFRC during that operation. Only the metrics for Appeal Coverage and Donation-to-Delivery Time are included in the Week 1 Scorecard. The financial efficiency metrics are not added until the Month 1 Scorecard, because the IFRC focuses primarily on procurement and delivery during the operation's initial phase immediately after a disaster. Assessment

Accuracy is not included on the Week 1 Scorecard, because the Week 1 budget is what will serve on the future scorecards as the “baseline” budget for the operation.

Figure 1 – South Asia Earthquake Week 1 Scorecard

South Asia Earthquake				
Appeal Date: October 9, 2005				
Status Update: Week 1	Operation Total	Priority 1	Priority 2	Total Op
Date: October 16, 2005	(Weighted)	Housing	Kits & Sets	Target
Percent of Appeal Coverage (in quantity of items)				
After 1 week	63%	61%	77%	
Percent of Items Delivered (in quantity of items)				
After 1 week	6%	1%	4%	
Donation-to-Delivery Time				
Mean (# days)	3	3	3	
Median (# days)	2	3	2	

Similar scorecards would be created after Week 2, Month 1, Month 2, etc., which consecutively track the operation’s progress over time. Figure 2 shows the Month 1 Scorecard, which includes all four indicators. At this point in time, the logistics department would start analyzing the financial efficiency of the operation, since the initial delivery phase has passed.

Figure 2 – South Asia Earthquake Month 1 Scorecard¹

South Asia Earthquake Appeal Date: October 9, 2005				
<i>Status Update: Month 1 Date: November 8, 2005</i>	Operation Total (Weighted)	Priority 1 Housing	Priority 2 Kits & Sets	Total Op Target
Percent of Appeal Coverage (in quantity of items)				
After 1 week	63%	61%	77%	
After 2 weeks	47%	45%	18%	
After 1 month	74%	73%	51%	
Percent of Items Delivered (in quantity of items)				
After 1 week	6%	1%	4%	
After 2 weeks	9%	5%	2%	
After 1 month	33%	27%	8%	
Donation-to-Delivery Time				
Mean (# days)	11	12	12	
Median (# days)	11	11	12	
Financial Efficiency				
(Donor Cost - Budget Cost) / Budget Cost	-7%	-12%	44%	
Actual CHF Spent - Budget CHF	(3,570,139)	(5,531,198)	1,992,575	
Assessment Accuracy: Revised Budget / Original Budget				
After 2 weeks	131%	118%	365%	
After 1 month	139%	123%	377%	

When the operation has been completed, the information can be compiled in a Final Scorecard, shown in Figure 3, which presents a cumulative snapshot of the logistic performance throughout the entire operation.

¹ Note that the second financial efficiency metric in Figure 2 is expressed in Swiss Francs (CHF), which is the currency used by the IFRC. For other organizations using other currencies, any currency may be used in this system.

Figure 3 – South Asia Earthquake Final Scorecard

South Asia Earthquake Appeal Date: October 9, 2005				
Status Update: Final Date: March 18, 2006	Operation Total (Weighted)	Priority 1 Housing	Priority 2 Kits & Sets	Total Op Target
Percent of Appeal Coverage (in quantity of items)				
After 1 week	63%	61%	77%	
After 2 weeks	47%	45%	18%	
After 1 month	74%	73%	51%	
After 2 months	91%	92%	71%	
After 3 months	93%	99%	100%	
Percent of Items Delivered (in quantity of items)				
After 1 week	6%	1%	4%	
After 2 weeks	9%	5%	2%	
After 1 month	33%	27%	8%	
After 2 months	48%	46%	19%	
After 3 months	67%	72%	47%	
Donation-to-Delivery Time				
Mean (# days)	33	35	29	
Median (# days)	28	31	24	
Financial Efficiency				
(Donor Cost - Budget Cost) / Budget Cost	-5%	-11%	30%	
Actual CHF Spent - Budget CHF	(3,510,849)	(5,209,538)	1,810,531	
Transportation Cost / Total Product Cost	10%	N/A	N/A	
Assessment Accuracy: Revised Budget / Original Budget				
After 2 weeks	131%	118%	365%	
After 1 month	139%	123%	377%	
After 2 months	148%	127%	493%	
After 3 months	158%	127%	493%	

Implementing the Framework

The “Total Op Target” column has been left blank in Figures 1-3; an organization actually using this system must first define these values in order to compare targets to actual results. Defining quantitative goals is a critical success factor to the implementation of a performance measurement system.

A key feature to highlight from the scorecard is the systematic use of designating “priority items” in each operation. If an organization determines at the beginning of an operation what the most important items are to deliver to beneficiaries, this will facilitate communication between donors who need to know what to donate, field personnel who need

to know what they are receiving, and the logistics department which links these two parties together. The prioritized items are prominently displayed on the scorecard so that the organization can easily see how quickly and efficiently these goods are being delivered to the field.

In order to apply this framework for use in other non-profit humanitarian organizations, the IFRC's framework should be modified, since it was designed in keeping with their specific business processes and strategic goals. For example, the IFRC accepts both cash and in-kind donations (donations of goods), while many other relief organizations only accept cash donations. When only cash is accepted, there is an additional step in the supply chain: first, the organization raises the funds that are needed from donors. Next, they procure the goods from suppliers, and finally, they deliver the goods to beneficiaries. To account for this additional step of fundraising, a metric should be added which captures how quickly the organization raises funds from donors out of the total amount of money that has been requested for the operation.

Next Steps – The Cultural Change Required to Implement Metrics

The system of scorecards and metrics designed as part of this research is an initial attempt to place a framework around the long-standing question of how to measure supply chain performance of relief operations. While there is clearly room for further research on this topic, this system is a first step towards relief organizations being able to gauge “how well” their supply chains are performing and how quickly beneficiaries are reached with aid. Some improvements to the system itself may not be discovered until an organization implements a measurement system; their logisticians may determine more efficient ways to present the information they need in order to take corrective action during an operation. Implementing a

measurement system will also create additional challenges for a relief organization, because the humanitarian sector is not accustomed to measuring logistical performance. Hence, the implementation of a performance measurement system will require a change in culture. Managing this culture change is critical, because success will require support from people in various departments within an organization, particularly the organization's top management.

Although there will always be elements of chaos in the immediate days after a sudden-onset disaster, there is reason to look to the future with optimism. The development of information technology systems that can provide visibility to the disaster relief supply chain is a huge step forward for the humanitarian sector as a whole. As more organizations begin to adopt and implement these systems and this visibility is established, the use of key performance indicators will then become essential to further enhance the efficiency and effectiveness of these supply chains. By clearly defining operational targets and measuring actual performance to these targets, organizations will be better able to retain the lessons they learn from each operation and provide a higher level of service to their beneficiaries in the future.

Bibliography

- Caplice, C., & Sheffi, Y. (1994). A Review and Evaluation of Logistics Metrics. *The International Journal of Logistics Management*, 5 (2), 11-28.
- Dumond, J. (2000). Define-Measure-Improve: The Change Methodology that has Propelled the Army's Successful Velocity Management Initiative. Retrieved December 5, 2005, from <http://www.rand.org/publications/RB/RB3020/index.html>.
- Lambert, D. (2001). Supply Chain Metrics. *The International Journal of Logistics Management*, 12 (1), 1-20.
- Meyer, M. (2005). Can Performance Studies Create Actionable Knowledge if We Can't Measure the Performance of the Firm? *Journal of Management Inquiry*. 14 (3), 287-291.