Supply Chain Excellence Awards: Saving Money and Resources by Emphasizing Packaging Efficiency

Business Environment

National Instruments (NI) produces hardware and software for test, control, and embedded design applications. NI products range from basic low-cost data acquisition devices to multiplatform, custom hardware/software systems that can cost thousands of dollars. Designing and testing increasingly complex products to meet tight time-to-market demands requires a highly efficient, tightly integrated platform. The NI graphical system design platform for test, control, and embedded design spans the entire product design cycle, dramatically increasing efficiency and improving the bottom line.

NI complements its industry-leading software and hardware with an extensive collection of services and support solutions from the planning and development phases through deployment and ongoing maintenance.

Headquartered in Austin, Texas, NI has more than 40 branch offices all over the world, including the Americas, Europe, Asia Pacific, Europe, Africa and the Middle East. We have sales offices in the U.S. and sales offices and distributors in key international markets. Sales outside of the U.S. accounted for approximately 62 percent of our revenue in 2010. We expect that a significant portion of our total revenues will continue to be derived from international sales.

NI customers are mainly engineers and researchers, but we have a broad customer base including more than 30,000 customers, and no customer accounted for more than 4 percent of our sales in 2010. The types of companies we sell to range from business-to-business organizations to universities and research companies to consumer-facing companies such as Microsoft. Our customers expect high-quality products that work out of the box, as well as significant customer support for everything from minor issues to help setting up large, multiplatform systems.

Because NI has such a diverse portfolio, competition varies greatly from market to market. However, the markets in which we operate are characterized by intense competition from numerous competitors, some of which are divisions of large corporations having far greater resources than we have. The NI supply chain is of fairly average size.

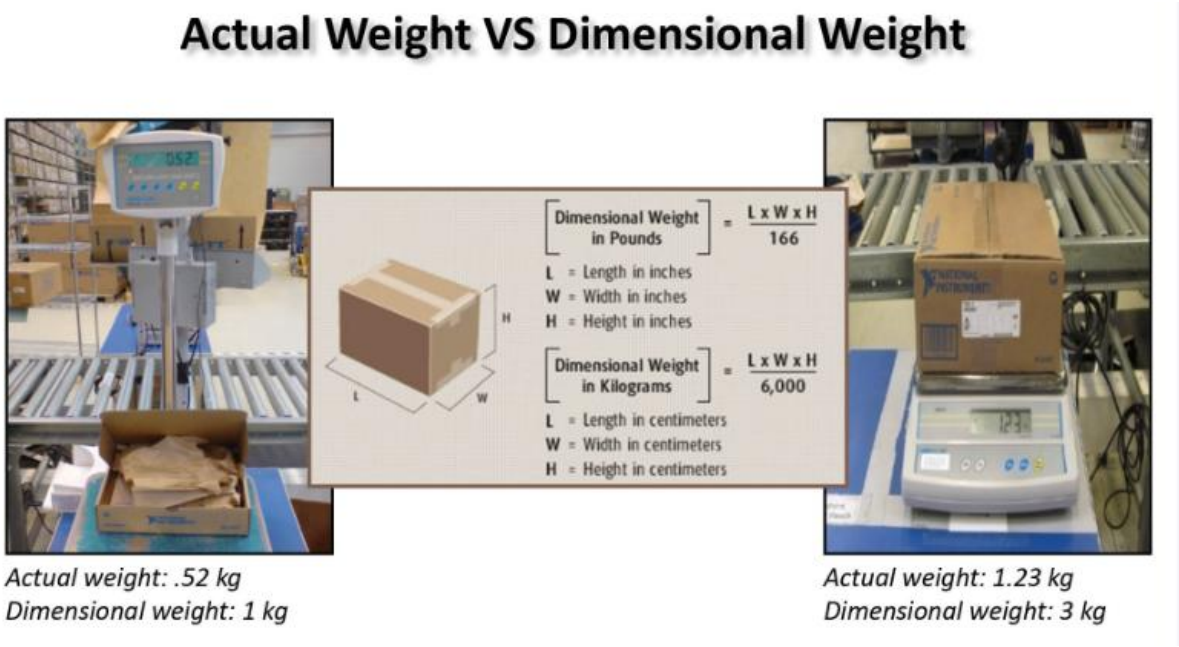
Problem Statement

In 2007, we centralized 95 percent of our global distribution network in our manufacturing facility in Hungary; thus, approximately 70 percent of our shipments became international parcels. One of the major concerns with international parcels is the cost, and although we had some very good negotiated rates in place, we realized we had to be more cognitive than ever before about our packaging efficiency.

Shipping cost has become one of the largest expenses NI incurs, and dimensional weight accounts for a large portion of shipping costs for both inbound raw materials and outbound finished goods. At this time, **we were spending more than $1 million/year** on dimensional weight charges. As you know, shipping costs are calculated by weight, size, speed and distance. Over the last 5 years, to encourage

space optimization and subsidize for large light shipments, parcel carriers have implemented and tweaked dimensional weight factors and formulas more than ever. These changes have resulted in massive revenue increases for carriers which, if unmanaged by shippers, result in major cost increases.

This corrective behavior strategy results in a win/win situation for parcel carriers by helping them to increase their revenue and/or free up space by encouraging shippers to reduce the size of their shipments. For example, a recent article from Logistics Management magazine showed an example where the 2011 tweaking of dimensional weight factors resulted in an 18.7 percent rate increase instead of the advertised 5.6 percent rate increase. Parcel carriers rarely bring attention to changes in accessorial fees and usually focus on the shipping charges alone.



Our global logistics manager, Dean Arnold, along with the NI packaging engineering team, performed an extensive analysis of the packaging NI was using, particularly focusing on package size and shipping costs. He saw an opportunity to improve efficiencies in these areas by reducing the dimensional weight of many NI packages. Many packages we shipped were simply far too large for their contents. Below is an example.

This cost NI unnecessary money and wasted precious space in storage facilities. Additionally, because of some filler material used in empty package space, reducing dimensional weight could have a positive environmental impact. Dean spearheaded a multiyear effort (from late 2007-2010) to resolve these problems, saving the company money and reducing our environmental impact.

Challenges

International parcel rates are among the highest delivery costs in the industry today, only eclipsed by same-day delivery charges. Factors that influence international delivery pricing include package density, weight, destination country, destination addresses, and customs clearance costs. In general, the NI shipping profile matches well with what parcel carriers look for in parcel characteristics. Our packages weigh around 7 - 10 lb each and are high in value with a low claims ratio, typically shipping directly to high-tech areas with a high delivery density and typically ship via international air.

Additionally, NI releases hundreds of new products annually. As a result, the NI product mix consists of high-mix, low-run parts. From a packaging design perspective, this presents a challenge.

When you sell thousands of different parts, you cannot create a custom box and solution for each part, especially when you may sell only a few of these parts each year. As a result, parts are not always custom-fitted to their packages, but are always well-protected. This combination can quickly lead to packaging density inefficiencies.

In addition, with the many redesigns of individual part numbers, the bill of materials (BOMs) often change, getting smaller in size through technological innovation. With a constant rush to get the new and redesigned product to market, packaging efficiency was frequently an afterthought for engineers.

The logistics group met with the packaging engineering group and tried to tackle the problem of making packaging important to our design engineers. NI products are not sold in storefronts; our customers purchase our parts because of our technology, not because of packaging aesthetics. The engineers' packaging goals were to maintain a quick time-to-market and high packaging protection quality over packaging efficiency.

Applied Solution and Results Achieved

We took a common-sense approach to tackling this issue. In 2008 an all-volunteer internal organization called the Green Team formed, with the goal of helping reduce the ecological footprint of NI and its employees. The logistics and packaging engineering group saw the green movement as a great avenue to push not only the importance of packaging efficiency, but also the importance of shipped product document reduction. The Green Team eagerly took on these causes and helped raise awareness for increased packaging efficiencies.

Several stakeholders became involved at this point. In addition to the packaging and logistics team, stakeholders included Green Team members, the Vice-President of Software Development, the hardware R&D directors, the Vice-President of Manufacturing, the supply chain director, technical writers, and the software and literature procurement team. They raised awareness of the issue using videos, the company intranet site, and through the annual citizenship report.

We focused on documentation reduction and packaging efficiency, and began by conducting both internal and external research. We believed the best place to start to address the known issues was to physically audit our top 200 highest sellers and our top 100 dimensional weight "offenders" which, in some cases, overlapped. To identify packaging inefficiencies, we used use IATA's international dimensional weight factor of 166 (inches) to identify our low-density packages.

We formed an audit team composed of members from NI logistics, packaging engineering, kitting, and industrial engineering groups. The audit findings confirmed our suspicions. Some of the changes could be made relatively quickly, while others required packaging redesign and testing as well as approval and help from a number of other groups such as the technical writers group. With this knowledge we were able to start making changes, but with more than 6,000 existing parts, and hundreds of new parts being released a year, we knew there was a long road ahead.

In late 2008, the global recession hit and NI began to look for more areas in which to cut costs. Dimensional weight and material savings from the packaging efficiency efforts naturally dovetailed with these efforts. Because of the education efforts from earlier in the year, dimensional weight was no longer a foreign term to engineers and they now understood the importance of packaging efficiencies. Many of our engineers championed packaging changes more than ever, proactively pushing packaging efficiencies and document reduction. From late 2008 through 2010, they undertook many projects to increase packaging efficiency, including the following:

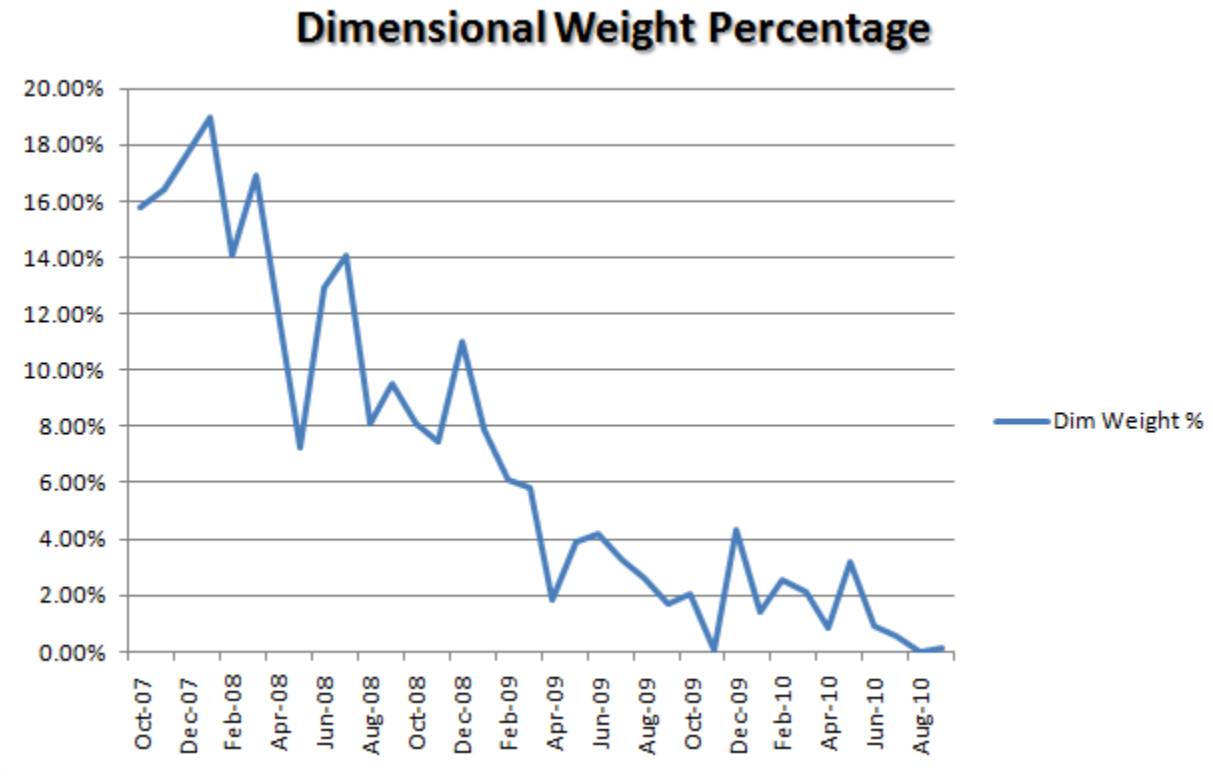
- Switching to suspension packaging for several eligible products. Suspension packaging uses air instead of foam to cushion products, which reduces the amount of material used in the package. This new packaging **contains at least 30 percent recycled content** and is recyclable in corrugated hydrapulping operations. Also, it is reusable for return shipments, which minimizes waste at both ends of the distribution cycle. This change **reduced the amount of foam used by 5 percent (87 m^3) per year** and resulted in a **47 percent reduction of box size for these products.**
- Redesigning the packaging for a fragile NI hardware product, **reducing the physical size of that product's packaging by 59 percent.**
- Developing a new method for shipping NI software by replacing the industry-standard software carton with an envelope mailer. In addition, we worked to reduce the amount of printed materials shipped with software in 2009 and condensed multiple CDs into one DVD. Through these efforts, we **reduced the physical size of software packaging by 71 percent.**
- Advancing the efforts to more quickly move to a Web-based format for manuals
- Creating custom packaging for a particularly high dimensional weight product instead of one-size-fits-all packaging, which had the following effects:
    - **Increased average shelf capacity by 88 percent**
    - **Saved $27,533** on materials per year
    - **Freed up 264 storage shelves,** making room for **196,504 boxes**
- Redesigning packaging for a popular product, which had the following effects:
    - **23 percent decrease** in corrugation used
    - **59 percent decrease** in polyurethane foam used
    - **43 percent reduction** in cubic volume
    - **$423,000** in expected annual savings

Having addressed the major dimensional weight offenders and high runners, in 2010 we decided that needed a way to further determine areas where we could increase efficiency. We formed a Kaizen team within the kitting teams at the NI global manufacturing site in Hungary. The purpose of the team was to educate kitters on dimensional weight and ask them for their help in improving packaging efficiencies. We provided a clear communication channel (an online database) where they could log their ideas, which our packaging engineers then assessed prior to making any changes.

The team was a success and accounted for **more than $260k in dimensional weight and material cost savings in 2010 alone**. In addition, it was understood this team was part of a continuous improvement effort because packaging efficiency should be an ongoing concern.

In addition to the kitting education project, we trained and audited shippers on their packaging efficiencies because they are the final group to package orders before pickup. We reviewed the data we gathered from the audits and within a few weeks began to see very positive results, such as going from a 10 percent shipping failure rate on shipping efficiency audits to zero failures within a few months.

Another good idea came from a member of our logistics group in Hungary who quickly realized the importance of using dimensional weight neutral packaging such as carrier-provided packs on our smaller shipments. Using carrier-provided packaging not only reduced material costs, but it provided a key avenue to avoid dimensional weight charges. This graph shows our packaging efficiency gains where dimensional weight is measured as a percentage of our billed weight for our largest shipping lane:



As dimensional weight accessorial charges continue to rapidly increase, we have made a concerted effort to not only reduce our dimensional weight costs through efficient packaging, but to also understand the how dimensional weight factors affect our costs. By understanding how it directly impacts our cost and how the carriers are quickly changing factors, we are able to negotiate these factors wherever possible. This chart chronicles the metric dimensional weight factors on some of our major carriers over the last 10 years.

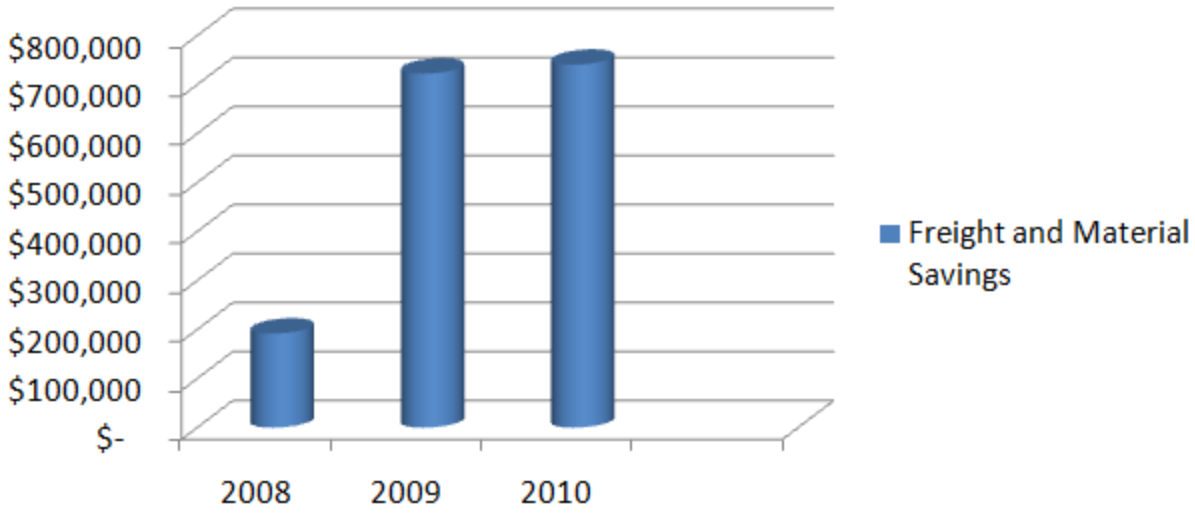
Carriers	Service Level	Changes by Year 2000 Dim Factor	2008 Dim Factor	2009 Dim Factor	2010 Dim Factor
Freight Forwarders	Int'l Airfreight	6000	6000	6000	6000
UPS Europe	Ground	6000	6000	6000	5000
	Regional Air	6000	6000	5000	5000
	Int'l Air	6000	6000	5000	5000
DHL Europe	Ground	6000	5000	5000	4000
	Regional Air	6000	5000	5000	5000
	Int'l Air	6000	5000	5000	5000
UPS US	Ground	oversize	7011	7011	5000
	Domestic Air	7011	7011	7011	5000
	Int'l Air	6000	6000	6000	5000
FedEx US	Ground	oversize	7011	7011	5000
	Domestic Air	7011	7011	7011	5000
	Int'l Air	6000	6000	6000	5000

Although we have made major progress and seen great success in our efforts to reduce dimensional weight, the biggest lesson has been realizing that this must be a continuous improvement effort. When it comes to a static environment such as product packaging, we must continue to look for ways to get smarter and better. For instance, we are currently taking a hard look at suppliers' incoming raw material packaging because this also affects our supply chain.

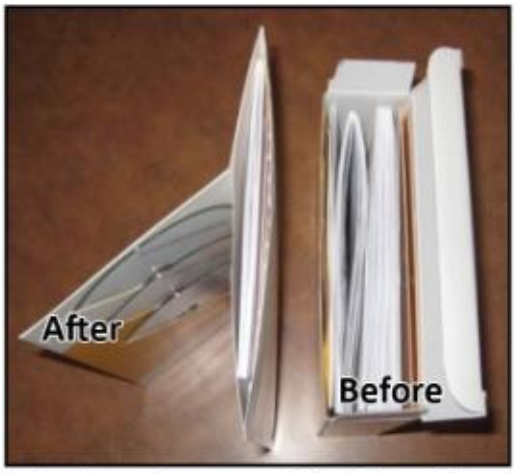
Ultimately, we achieved great success with our packaging and design enhancements. We saved money and precious resources, and raised awareness of an issue that not many people in the company knew about. Our focus on increasing packaging efficiencies remains and with the number of new products NI develops coupled with rapidly changing dimensional weight factors, we expect there to be many new opportunities to save money and resources in this area.

More Results

Freight and Material Savings Resulting from Dimensional Weight Reduction Projects



Before and After Software Packaging Redesign



- *Replaced carton with SBS mailer*
- *Reduction of literature shipped*
- *Condensed multiple CDs to one DVD*
- *71% decrease in volume of shipping kit*
- *100% recyclable packaging*

Polyurethane Foam VS Suspension Packaging