MAGICLOGIC OPTIMIZATION INC.

Cube-IQ BlackBox Load Planning Module

Load Planning Software: Cube-IQ BlackBox

MAGICLOGIC CORPORATE COMMUNICATIONS

An Overview of the Cube-IQ BlackBox Load Planning Module

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Table of Contents

Chapter 1

An Overview of the Cube-IQ BlackBox

The Cube-IQ BlackBox engine *can already be found built right into leading WMS and TMS systems from such tier 1 providers as HighJump, Swisslog and Visalign.*

We take a brief look at the BlackBox and review a list of features that make the system an integrator's dream

Introduction to the Cube-IQ BlackBox

The Cube-IQ BlackBox is Load Planning distilled to its purest form: a unit capable of producing all the quality of results you would expect from MagicLogic's state-of-the-art loading algorithms, condensed into a plug-in module compatible with any WMS / ERP system on the market. That sounds like a tall order, but the Cube-IQ BlackBox is bristling with industry-standard interfaces allowing plug-and-play with minimal work to achieve integration with existing systems.

This document will focus on how the BlackBox system fits into a larger system and discusses architecture, interfaces and some aspects of the internal function of the software.

> ***BlackBox***
>
> A system in which only the input and output characteristics are of interest - without regard to its internal mechanism or structure.

Central to the system is, of course, the loading algorithm utilized by Cube-IQ. This is a proprietary algorithm developed exclusively by MagicLogic. It is the result of many years of experience and intensive research in the field of Combinatorial Optimization.

Already recognized by many leading systems providers and integrators as "best of breed," you can find our algorithms licensed and built into software provided by

many tier 1 logistics service providers, as well as on the desktops and servers in some of the world's largest logistics operations, and here are just a few reasons why:

- Container Selection, Cartonization – sophisticated rules ensure that the most efficient container combination is selected automatically.
- Mixed Palletization – please refer to chapter 4 of this document for an in-depth discussion of this feature.
- Loading Zones – split containers into multiple zones to ensure stability, safety, product protection etc.
- Product Configurations, Grouping and Complex Loading Rules – model difficult products, groups of products and product sets.
- ULDs, Rolls, Cylinders, Tubes, L-shapes, T-shapes and Trapezoidal shapes – model and load difficult products with maximum efficiency.
- Center of Gravity – Track, control and even position the center of gravity to your tolerances.
- Prioritization and Sequencing – load priority items first, and fill to capacity with optional items to max out the cube.
- Units – the BlackBox is totally unit-independent, so it can instantly work with any unit of measurement / weight you may require.

For further details on how the Cube-IQ Load Planning algorithms can work with specific focus on business rules and customer requirements, and an in-depth study of the capabilities of the optimizer, please refer to our White Paper on the subject, which can be obtained here:

http://www.magiclogicdownloads.com/magiclogic/CubeIQ_SOA_WhitePaper.pdf

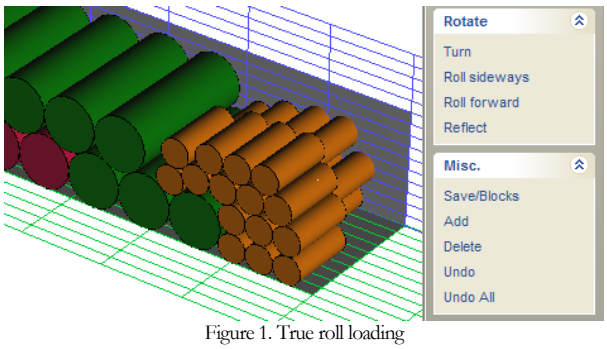


Figure 1. True roll loading

Adaptable and Friendly

The Cube-IQ BlackBox was designed from the ground up from a simple premise: our customers know what they need, and what they need is a system that works seamlessly with what they already have. These requirements can be distilled into a number of core attributes that will make or break your integration project:

Customizable. Our business is thriving on the enhancement and tuning of our products to meet our customers' exact requirements.

Flexible. The system you buy needs to be configurable to your needs. Cube-IQ BlackBox **works** with you, whether that's in a WMS/TMS environment, or intense cartonization operations, to fulfilling hundreds of orders in real-time in an e-tailing environment. In each case your unique requirements are met by Cube-IQ's flexible, intuitive rule set.

Scalable. Where do you see yourself in five years' time? Cube-IQ BlackBox **grows** with you. Our architecture is specifically designed to fit the bill from a single CPU to a network of super-servers. No additional software is required as you grow your operations. The system is self-tuning, self-balancing and fast.

Easy to implement. You and your team don't have the time to customize your existing applications to work around new applications. Cube-IQ BlackBox can be setup to work with any system out there that can generate data to a standard schema. Your system integrators will be up and running in a few days with our straightforward yet powerful API.

Easy to look after. Most operations nowadays are 24/7 and expect five nines availability[1]. Downtime must be minimized or obviated where possible. Cube-IQ BlackBox includes diagnostics and self-monitoring tools. The optimization engine is the enterprise solution you expect, installable as an NT service.

Speaks the right language. Cube-IQ utilizes the industry-standard of XML for data transfer. Of course we also support CSV, SOAP, and direct TCP connections.

Well supported. MagicLogic has been in business since 1995, and has shown consistent growth, year in, year out. We provide fast support, regular software updates and a dedicated, professional team.

Has the answer! Cube-IQ knows its business: your business. We have implemented a feature rich product which can adapt to your specific business rules and practices, right out of the box.

[1] Five nines is 99.999% availability, which translates to 5 minutes downtime per year.

Chapter

2

Integration

We take a look at how Cube-IQ Black Box Load Planning software can work alongside your existing systems.

So where and how does the BlackBox fit? In a WMS / TMS / ERP paradigm, the BlackBox is typically installed on a server on the corporate intranet, as shown in the following diagram.

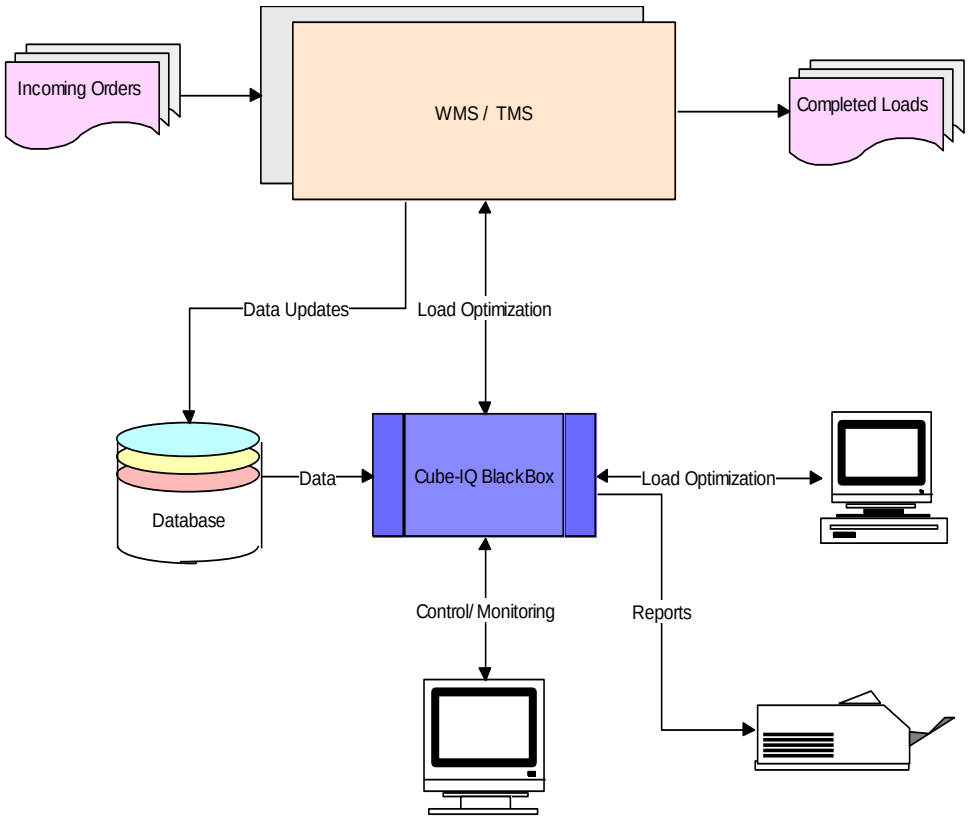


Figure 2. A typical WMS/TMS integration showing the Cube-IQ BlackBox optimizer playing its role in load planning during the order fulfillment process. Both batch optimizations and interactive sessions are supported concurrently.

Connectivity can be achieved via SOAP, TCP or simple file transmission as required. Data is maintained by existing database systems, and the BlackBox internal database can be updated automatically as required, or on a given schedule.

The BlackBox can also be coupled with one of our Graphical Interfaces to provide interactive load planning.

For extremely large-scale operations, scalability is well-supported. Single installations of the BlackBox utilize multiple CPUs, and it is also perfectly feasible to add multiple servers. BlackBox instances automatically synchronize and load balance between themselves without the requirement for any additional software or configuration.

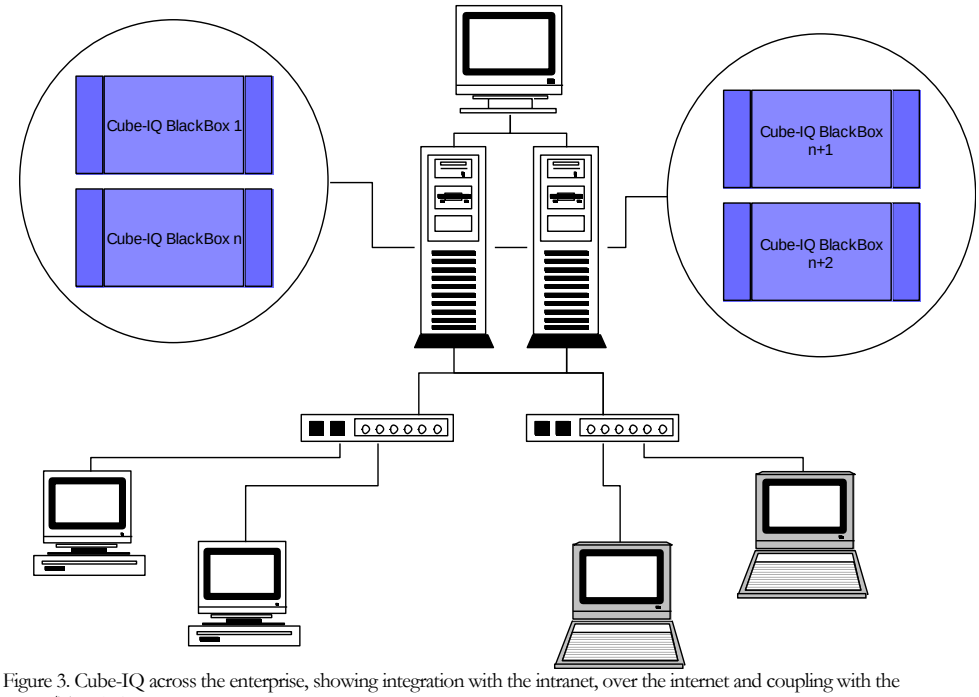


Figure 3. Cube-IQ across the enterprise, showing integration with the intranet, over the internet and coupling with the WMS/TMS infrastructure.

The above diagram helps to show you where Cube-IQ can fit in your operation. The short answer is: everywhere. From local workstations in your head office, to your divisions across the world, to your reps on the road.

All interfaces are well-documented, and include file specifications, XML schemas and DB schemas as appropriate.

You can find all this information downloadable from our website at http://www.magiclogic.com/developers

Chapter 3

Cube-IQ BlackBox Technical Information

The BlackBox is the racing engine of the SOA. *This application is responsible for analyzing and creating the load plans from the user input and data provided to it.*

The Cube-IQ BlackBox is an application which not only fits like a glove in our own architecture, but in yours as well. In order to achieve maximum deployability, the BlackBox has an extremely flexible mode of operation. These modes are discussed briefly below.

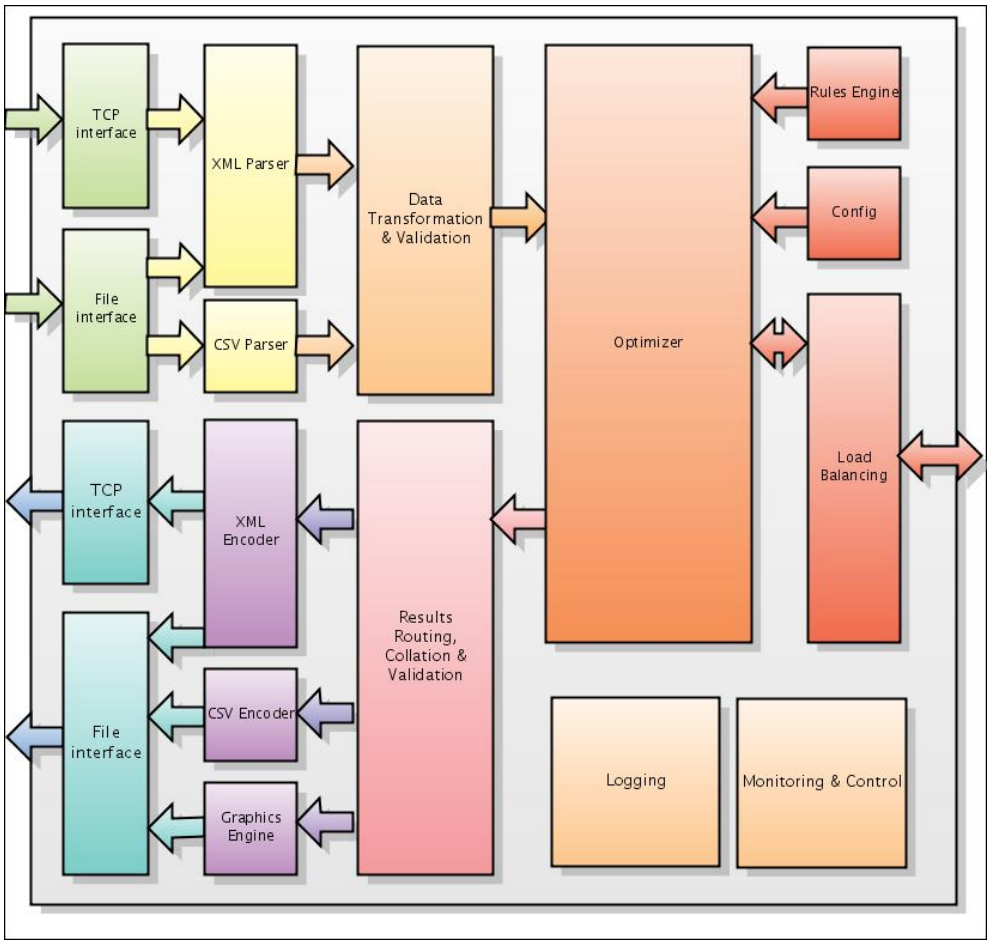


Figure 4. The internal structure of the BlackBox showing data flow.

Single-use mode - simply specify an input and an output file. The BlackBox will run, process the input file, create the solution in the output file and exit. Input and output files may be CSV or XML, and may be mixed if required.

File mode - the BlackBox constantly monitors a nominated directory. This can be local or on a remote server via a shared network drive. Any loading case files placed in this directory are automatically detected and processed by the BlackBox.

To increase throughput it is perfectly feasible to launch a number of BlackBox processes and direct them all to monitor the same directory. File locking and synchronization is automatically handled by the BlackBoxes themselves.

On completion of processing, the BlackBox writes an output file to another nominated directory. Large files or slow servers are handled by an additional semaphore file which indicates to the caller that the file has been completely written. Files may be CSV or XML, and may be mixed if required.

TCP sockets - the BlackBox acts as a TCP server, meaning that it will accept connections from external source that are able to transmit and receive via the TCP protocol. Clients have two choices as to how the optimization is performed:

1) Synchronous calls: data is transmitted and the client is blocked by the BlackBox until the load is completed, and the data is returned immediately.

2) Asynchronous calls: data is transmitted and the BlackBox frees the client connection immediately. Optimization continues on the BlackBox, and the client re-connects later to collect the results.

Both approaches can be used simultaneously. Data must be XML.

SOAP - when combined with the BlackBox Gateway (as described above) the BlackBox can also act as a SOAP server. As in the case of the TCP sockets approach, optimization can be performed synchronously or asynchronously.

SQL/Server – the BlackBox supports MS SQL/Server 2005 onwards. The system can be controlled via simple transactions and will read its data from and write results to a nominated database.

The Cube-IQ Gateways (Data Gateway, BlackBox Gateway)

These gateways are the glue which holds the systems together. They provide services to upload and download the data from the central server to the users who are running the Cube-IQ GUI, and of course load optimization services to everyone who needs them.

In order for the Cube-IQ system to perform in an SOA environment, we utilize industry standard protocols built around XML and SOAP. Secure, fast and reliable,

they bring our SOA capabilities to the intranet and internet in order to support your entire operation.

All of the above processing can be taking place simultaneously thanks to the BlackBox's advanced multi-threaded design. In addition, the system provides a client queue so that an unlimited number of incoming connections can be made and data transmitted in a timely manner. Clients are processed by the next available thread within the BlackBox, much in the way a printer server will send print jobs to the next available printer.

Threads are configurable to allow the system to be tuned for the specific environment in which it is to be used. This also means that an extremely large and complex loading problem will not block other incoming loads.

Finally, the BlackBox can also generate graphical load plans for each load, or can trigger load plan generation only if the resulting load exceeds some pre-defined level of complexity.

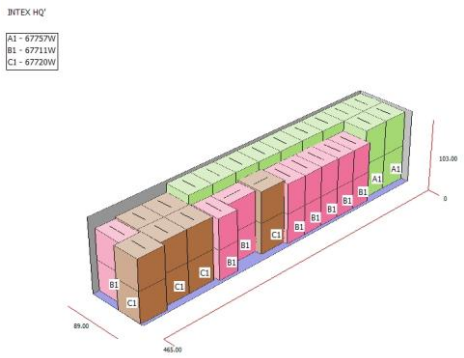


Figure 5. Sample output from the BlackBox, generated via its internal graphics engine. Output can be created in jpg, bmp or pdf format.

Output can optionally be split by product so that clear easy-to-follow step-by-step loading plans can be generated.

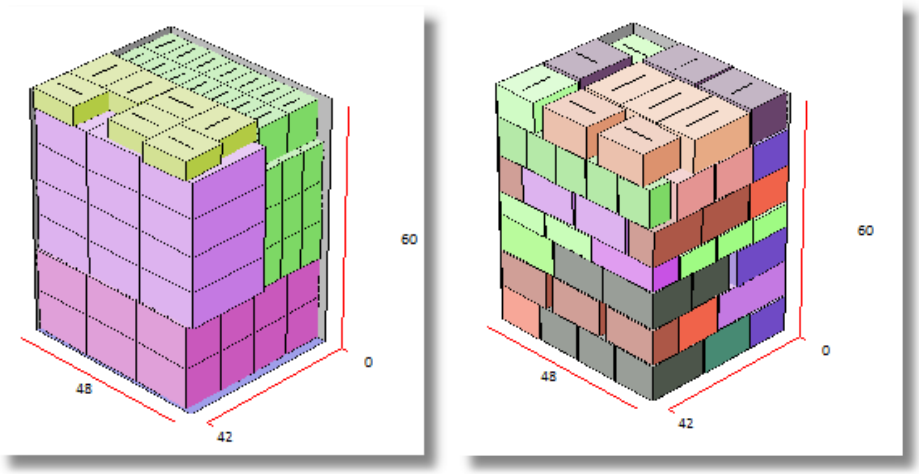
Chapter 4

Mixed Palletization

A special "mixed palletization" version of the BlackBox load engine: the MPE

Since September 2006, MagicLogic has been working on a special 'mixed palletization' version of its Load Engine. Whereas the original Cube-IQ BlackBox Load Engine (CLE) has maximum fill rate as its main objective, the Mixed Palletization Engine (MPE) has now shifted to pallet stability as main goal. Given the CLE's status as best optimization engine on the market in terms of fill rate, we are now loading to reach maximum stability at minimal loss to fill quality.

The MPE produces loads that are quite different from those of the CLE. Here is an example, CLE on the left, MPE on the right, showing the first pallet for an order of eleven pallets:

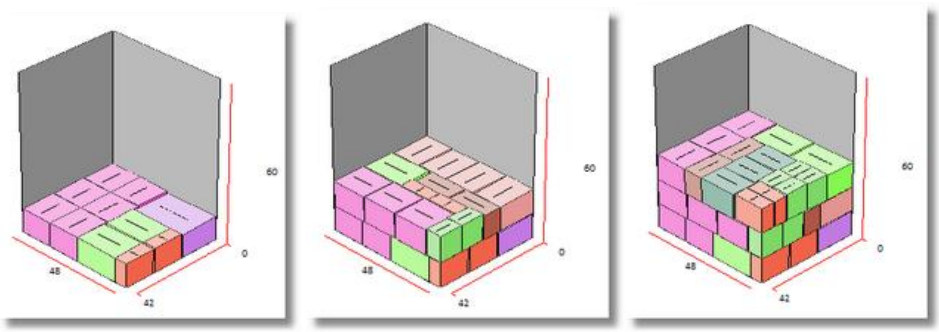


The extra requirement of 'brick laying' for stability purposes leads to loads that look less structured, but that do not show the 'chimneys' typical of fill rate optimized loads.

Tests of the latest versions of the MPE indicate only minimal fill rate loss as a result of the extra stability requirement: less than 1% on the average. Both the CLE and the MPE load 8 out of 10 pallets in several test sets at typical 85-92% fill rates, with the MPE average only 0.6% behind that of the original CLE.

For a sample 11 pallet order, run on behalf of a major food distributor, the MPE fill rates of the first ten pallets are excellent: 91.7, 92.9, 90.1, 86.6, 85.4, 86.6, 85.5, 84.5, 82.0, 83.3.

The MPE has been extended with 'layer identification' functionality, leading to loads that have a solid footprint with the top part used for boxes that are difficult to fit in layers. The layers in the bottom part of each pallet are selected for maximum variation:

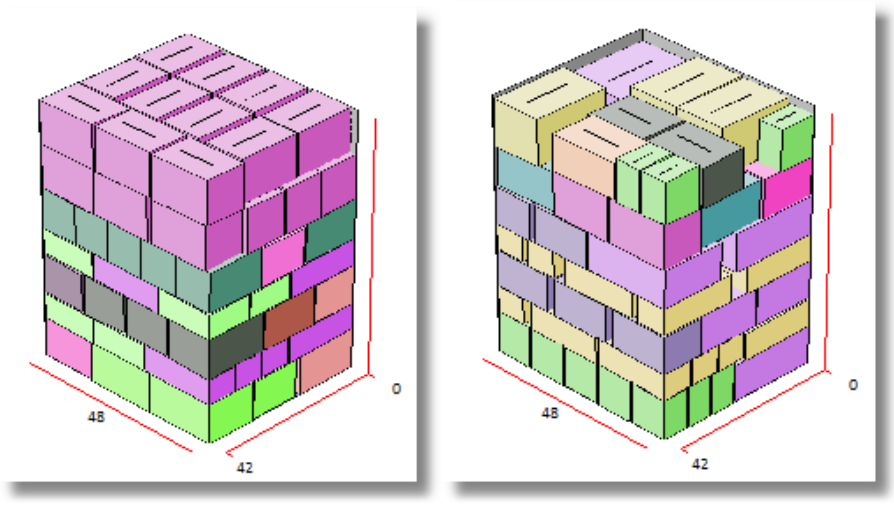


A first operational version of the MPE will soon be available. Current development work on the MPE is now down to some lower priority items, such as:

Re-sequence from 'algorithm sequence' to a sequence that is suitable for a robot. This is a post-processor to the true load optimization.

Improved 'spreading' within layers.

Development of a 'Stability Index' to make assessing a pallet's stability easier.



Chapter 5

Finding out more

Contact us now to leverage the power of Cube-IQ in your operation. We have a worldwide network of agents and offer support across every time zones in the world.

Call us for details and contact information for your nearest agent.

References

MagicLogic has now spent seven out of the last eight years as one of the Top-100 Logistics IT service providers[2].

The company was set up in 1995 to provide optimization services and software across a number of industries, including transportation and logistics, cutting, scheduling and interactive training. Our products include Cut-IQ, Plan-IQ, CarpetCutter, PickPack and TKL.

MagicLogic's flagship product, Cube-IQ, was introduced in 1996 and is now in daily use by over 650 clients in 40 countries.

MagicLogic is situated close to Vancouver, British Columbia, Canada, with satellite offices in the UK and Switzerland.

Customer recommendations, case studies and evaluation copies of our products are available by request.

For more information please contact us:

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[2] Source: Inbound Logistics magazine 2001, 2003, 2005, 2006, 2007, 2008, 2009