

Wal-Mart's Data Warehouse

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Abstract

Wal-Mart is an exceptional company. As professor Strassmann [Stra06] says, "Wal-Mart really is an information system integrator. Not a merchandising company. They are just selling goods as a byproduct. Fundamentally when you look at the value added by Wal-Mart, it is knowledge assets and how they are able to establish a global information network."

Wal-Mart's data warehouse, the biggest in the world, enabled it to become a very successful company.

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1 About Wal-Mart

Just getting read about in Austria, Wal-Mart is omnipresent in the U.S. It is the biggest retailer in the world and in many aspects just as well the biggest company in the world. Wal-Mart has 1,700,000 employees and their 5500 stores cannot be ignored.

Wal-Mart is the second biggest private company in the world. With sales of \$312 billion, this retailer is just behind ExxonMobil. While ExxonMobil is holding this position because of record oil prices, Wal-Mart is here to stay. As the worlds biggest company ¹.

NAME	COUNTRY	INDUSTRY	SALES (\$BIL)	PROFITS (\$BIL)	ASSETS (\$BIL)	MARKET VALUE (\$BIL)
ExxonMobil	United States	Oil & gas operations	328.21	36.13	208.34	362.53
Wal-Mart Stores	United States	Retailing	312.43	11.23	138.17	188.86
Royal Dutch/Shell Group	Netherlands	Oil & gas operations	306.73	25.31	216.95	203.52
BP	United Kingdom	Oil & gas operations	249.47	22.63	206.91	225.93
General Motors	United States	Consumer durables	192.60	-10.60	475.28	11.49
Chevron	United States	Oil & gas operations	184.92	14.10	124.81	126.80
Ford Motor	United States	Consumer durables	178.10	2.25	275.96	15.21
DaimlerChrysler	Germany	Consumer durables	177.04	3.36	245.86	56.45
Toyota Motor	Japan	Consumer durables	173.09	10.93	227.05	175.54
ConocoPhillips	United States	Oil & gas operations	162.41	13.62	107.00	83.99
General Electric	United States	Conglomerates	149.70	16.35	673.30	348.45
Total	France	Oil & gas operations	144.94	14.51	125.47	154.74
ING Group	Netherlands	Diversified financials	137.11	8.52	1,369.55	81.43
Allianz Worldwide	Germany	Insurance	124.41	2.98	1,300.65	65.55
Citigroup	United States	Banking	120.32	24.64	1,494.04	230.93

Figure 1: Companies ranked by Sales [Forbes2000]

Wal-Mart not only is big, with \$11 billion in profit, it is also very successful.

1.1 Where did Wal-Mart's success come from?

Sam Walton, the founder of Wal-Mart:

”The secret of successful retailing is to give your customers what they want. And really, if you think about it from your point

¹The Forbes Global 2000 [Forbes2000] is an annual ranking of top 2000 corporations in the world by Forbes magazine. In the year 2006 Wal-Mart is ranked 13th based on a mix of four metrics: Sales, Profit, Assets and Market Value. Based on Sales Wal-Mart is ranked 2nd.

of view as a customer, you want everything: a wide assortment of good-quality merchandise; the lowest possible prices; guaranteed satisfaction with what you buy; friendly, knowledgeable service; convenient hours; free parking; a pleasant shopping experience.”



Figure 2: The Wal-Mart trademark

The key to Wal-Mart’s success are *Always Low Prices. Always.* For Wal-Mart to become successful in achieving *everyday low prices*, they have to be efficient in literally everything they do. And increasingly in what their 21,000 suppliers do.

”By now, it is accepted wisdom that Wal-Mart makes the companies it does business with more efficient and focused, leaner and faster. Wal-Mart itself is known for continuous improvement in its ability to handle, move, and track merchandise. It expects the same of its suppliers.”

1.2 The Key to *Always Low Prices. Always.*

With 5500 stores to supply with goods, Wal-Mart became the biggest delivering business in the U.S. *You cannot drive on a US highway for more than*

20miles without seeing a Wal-Mart truck [Fish06]. Optimizing such vast operations can only be done with extensive use of Information Technology (IT). IT enabled Wal-Mart's success.



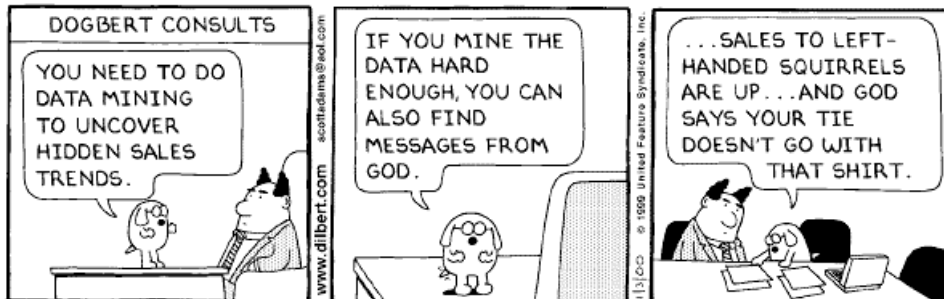
Figure 3: Wal-Mart Data Center in McDonald County is deemed so secret the county assessor was required to sign a non-disclosure statement before entering the site to determine property value. The photo was taken in 2004, when the center was nearly complete.

Wal-Mart is very secretive about their data warehouse (see Figure 3). After achieving a major milestone Teradata, Wal-Mart's data warehouse supplier, was given permission to announce a few shallow facts about Wal-Mart's data warehouse.

- Wal-Mart has indeed the world's largest, non military, database with a size of one-half a petabyte.
- It is the world's largest data warehouse.

Wal-Mart keeps track of 100 million customers buying billions of products every week. Using this data allows Wal-Mart to achieve *Always Low Prices*. It is the data warehouse that enabled Wal-Mart to become one of the 15 most profitable companies in the world.

2 Wal-Mart's data warehouse provides Business Value



Let's look at some sales questions Wal-Mart's data warehouse has to answer:

- How much orange juice did we sell last year, last month, last week in store X ?
- Comparing sales data of orange juice in various stores?
- What internal factors (position in store, advertising campaigns...) influence orange juice sales?
- What external factors (weather...) influence orange juice sales?
- Who bought orange juice last year, last month, last week?
- And most important: How much orange juice are we going to sell *next week, next month, next year*?

Other business questions include:

- What is the suppliers price of orange juice last year, this year, next year?
- How can we help suppliers to reduce their cost?
- What are the shipping/stocking costs of orange juice to/in store X ?
- How can suppliers help us reduce those cost?

Unfortunate, but understandable, Wal-Mart is very secretive about their data warehouse.

Never the less Paul Westerman [West01], one of the four people responsible for designing and building the Wal-Mart data warehouse, wrote a book on the development of Wal-Mart's data warehouse. He emphasizes to *Focus on the Business, Build a Team* and *Apply Technology*.

3 Focus on the Business

Wal-Mart can look at the sales of a given item, store by store, and determine whether something didnt sell well because it wasnt on the floor on the best day of the week or timed with an advertising campaign.

A data warehouse really is a Decision Support System (DSS). Providing the data to support business decisions is hole point of a data warehouse. A data warehouse coming from the IT department, or from the higher IT consultants is never going to work if the support form the business side is missing. Ideally the business side should demand a data warehouse. Then the right business sponsorship is possible to really drive the data warehouse. Building a data warehouse is an enormous and never ending operation. It involves every part of the company:

- Stake-holders: management, employees, customers, suppliers even shareholder
- Departments: management, human resource, marketing, sales, research and development

A successful implementation is only possible if the entire company understands the value and need of a data warehouse. If data is not, or only partly, provided because departments are unwilling to share there results with other departments. The data warehouse quickly becomes obsolete. Everyone must understand why the entire data is important for the success of the company. The data warehouse has to be in complete alignment with your companys objectives. Technical obstacles, such as extremely large data and processing volumes, can be managed but are a dismal issue if there is no business sponsorship.

4 Build a Team

An important lesson from Wal-Mart's development process is the importance of choosing the right team from the start.

The team has to include:

A responsible Leader

- Only one person should be identified as the project leader for data warehouse. This person has to be fully responsible for this project and only for this project.

The Business Side

- This side has to constantly ask: What is the business value of?
- They have to insist on answers for their business questions.
- They provide the interface to the management

Database Analysts

- Defining and implementing the interface to a vast number of data bases
- They have to work closely with database people from every department
- They extract, transform, and load (ETL) data into the data warehouse

Programmers

- Besides the database platform and interfaces they have to implement the graphical user interface (GUI)
- Finding a simple GUI is most challenging and demanding. The decision makers have very limited time and possible limited IT knowledge. Providing a simple interface to the vast amount of information in a database is the most daunting task in the development of a data warehouse.
- The programmers have to work closely with the business side and the database analysts, to find the best tools for Data Mining. The GUI should assist the user to find (a) hidden and predictive information and rules and (b) relationships and trends.

Technical writers

- Frequently neglected is extensive documentation of the data warehouse even for the project leader it is impossible to know every aspect of the data warehouse. Therefore documentation is required to provide the information when needed.

5 Apply Technology

Applying technology to solve a business problems should be the goal of the IT department. Business people are not interested in the next open source, AJAX, Web 2.0, open standard, UNIX based Intranet system. They want a solid solution to their business problem. The focus is on business value, not on the technology.

Wal-Mart is known for two technologies which are truly business value driven. Their Retail Link system and, as successor to omnipresent barcode, radio frequency identification (RFID) ².

5.1 Retail Link

Wal-Mart shares the same objectives as their suppliers, i.e. to sell more merchandise. To make suppliers as efficient as Wal-Mart itself, suppliers got full access to Wal-Mart's data warehouse. Of course only to data related to their own products and after signing a strict non-disclosure statement. With Retail Link, suppliers were able to view almost everything that Wal-Mart could see. Most importantly, they could perform the same analyses and exchange ideas for improving the business. They were, and still are given the Retail Link software for free. But Wal-Mart demands that they make the best use of it.

Retail Link allows suppliers to:

- Retrieve the sales data of my items in Wal-Mart
- Retrieve the inventory data of my items in Wal-Mart
- Retrieve Wal-Mart information on its development
- Download purchase order in Retail Link

There is an entire industry out there to help suppliers make best use of Retail Link.

5.2 RFID

Wal-Mart started using RFID technology in January 2005. By 2007 every supplier of Wal-Mart has to include RFID tags in their products.

²RFID does not depend on line-of-sight and therefore improves automatic reading of a products unified identifier (UID).



Figure 4: RFID Tag

RFID technology offers high opportunities to tracking, plan and organize products logistics. It is safe to say that RFID will revolutionize the shipping industry.

Among the benefits of RFID technology

- Preventing theft.
- Reduce check-out time.
- Automatic check-out (no cashier required).
- Adding sensor tags to perishable items such as fruit. Wal-Mart can track just how long a crate of bananas has been in transit and can ensure that its sold when the fruit is ripe.
- No more out-of-stock items.

Among the challenges of RFID technology

- Even more detailed information of every product (watch out Teradata).
- Getting suppliers and partners to comply with Wal-Mart's RFID requirements.

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