Beyond the bar code: Transforming business with Radio Frequency Identification

Radio Frequency Identification is a powerful enabling technology that, when coupled with process change, can transform the management of an organization's supply chain, its manufacturing processes, its assets – even its entire business.

Introduction

Most often associated with inventory tracking and supply chain management, RFID applications are growing rapidly. From manufacturing facilities to vehicles, to airport military compounds, store shelves and toll booths, this technology — which has actually been available since 1969 — is steadily (and inevitably) transforming how the world does business.

RFID enables users to access information — serial numbers, colors and sources, for example — from a remote location. The technology is based on a relatively simple concept that relies on radio waves to transfer data from a pre-programmed tag to a reader. RFID systems have three primary components:

- **Tags** — active, passive or semi-passive — that store information
- **Readers** — stationary and handheld — that read/write information from the tags
- **A host system** with its own hardware, functions and predefined tasks

The road to widespread adoption

RFID applications can take place dynamically, with no detectable human intervention—providing information that is accurate, objective, reliable and totally auditable. The data gleaned can facilitate dramatic improvements in processes, such as collaborative forecasting and demand management.

By relaying data about location, design and history to a remote automated reader, RFID technology has the potential to radically improve the effectiveness of tasks as varied as inventory control, production, check in and check out, and homeland security. Using RFID, organizations can track products, parts and services in the warehouse and on the assembly line . . . on the road, in the store and at baggage counters . . . in planes, trains, ships and ports, and in the field. The result? The ability to lower costs and heighten efficiencies . . . tighter compliance with health, safety and security mandates . . . better customer care . . . and more satisfying returns from the assets that drive operations. The key is to start now—and start smart.

Most experts agree that it is wise to view RFID in the context of a larger strategy, such as implementing a demand-driven supply chain or refining the manufacturing process. At the same time, the technology is evolving quickly—moving beyond traditional solutions to include numerous other applications.

Today, RFID solutions are enabling enterprises to react dynamically to information from remote sources in ways that can dramatically improve productivity, accuracy, service and security. For example, RFID-based systems can notify authorities if an item has been tampered with as it made its way from port to port. Likewise, companies can determine if a product has been manufactured to specifications before it leaves its point of origin. Suppliers can confirm the exact amount of inventory they will need to meet demand.

Major players are leading the way. The U.S. Department of Defense has mandated that its suppliers must provide RFID tags to track the department's case, pallet and container shipments by January 2005. Wal-Mart Stores, Inc. recently announced plans to employ RFID in 3,000 of its stores and 100 of its distribution centers by the end of 2005. Target Corporation, America's fourth largest retailer, has told its major suppliers that they must use RFID tags on pallets and cases sent to the company's select regional distribution facilities by late spring 2005. *All* of Target's suppliers must comply with this directive by Spring 2007.

Finally, METRO Group, a major grocery retailer located in Germany, is set to begin its RFID rollout later this year. The company expects to reach 250 stores and 10 central warehouses in the first year—an effort that will involve 100 of METRO Group's largest suppliers. The goal is to have the system in all of the company's stores in Germany by the end of 2007.

The automobile industry is moving forward at a rapid pace—and for good reason. The Tread Act, passed in 2000, specifies that all new vehicles in the U.S. must include RFID systems that warn drivers if their tires are significantly under-inflated. Notes Michael Lawrence, a partner in IBM Global Services' National Automotive Practice, "An automobile company must move millions and millions of parts a year through various warehouses. The logistics of managing trucks, trailers, pallets and parts is formidable."[1]

And in a move that promises to be the largest-ever deployment of RFID technology at a sporting event, the 2006 FIFA World Cup soccer games in Germany will issue tickets with smart tags to accelerate ticketing and help prevent fraud.

Whatever the industry or application, the key is to align RFID technologies with an organization's business vision. There are opportunities at every stage.

"While much of the recent focus on RFID has been on compliance initiatives in the retail industry," says Faye Holland, worldwide RFID leader, IBM Global Services, "IBM is rapidly expanding into industrial markets, where RFID is highly successful in tracking manufacturing and work-in-process, locating high-value assets and improving supply chain operations."

Automotive

In June 2003, the automotive industry represented 46 percent of the RFID market. This year, car manufacturers will spend roughly US$600 million on RFID-based solutions—about 30 times as much as retailers.[2] Having made its way into millions of vehicles, RFID is now moving into the automotive supply chain, where it will be employed to quickly identify vehicles, trace individual parts, afford multiple levels of error-proofing, trim labor costs and tighten inventory control. Ford Motor Company was an early advocate of RFID. Today, Ford plants embed reusable RFID transponders in every vehicle to track work in process and confirm that every step complies with a customer's order. Volkswagen's Wolfsburg, Germany distribution facilities use active RFID tags to immediately identify cars in large lots. Others, like BMW, have joined the path to RFID adoption.[3]

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How RFID will evolve

Aerospace and Defense

Sluggish, complex supply chains, poor asset utilization, extended lead times and steep cost structures are nothing new to companies in the aerospace and defense industries. Yet recent global incidents and new vulnerabilities are compelling organizations to better manage work-in-process manufacturing, lower the high costs but heighten the quality of after-sales maintenance and repair services, simplify processes, control inventory, and comply with ever-stronger security and track/trace mandates. With RFID, security can be refined at levels never before possible, and data integrity never left to chance. Industry leaders are showing their support. For example, Boeing and Airbus recently announced that they would work together to standardize the use of RFID for tracking major airplane parts.[4]

RFID deployments are evolving in three stages:

Compliance is spurred by dictates from large entities, such as Wal-Mart and the U.S. Department of Defense, whose suppliers and business partners (consumer electronics firms and OEMs, for example) must follow their lead and communicate RFID compliance to *their* business partners. Compliance initiatives can open opportunities to move to the next phase, optimization.

Optimization is unique to each enterprise, but is usually sparked by pressures to lower overall costs, heighten efficiencies and boost margins. This stage focuses on specific initiatives, such as enhancing customer service, increasing throughput, trimming labor expenses, improving warehouse management, enabling realtime decision support and tracking products across the value chain. Optimization becomes a reality when an enterprise extends "four-wall" implementations to include collaborations with its trading partners.

Transformation takes RFID to the next level, making it possible for an organization to use this capability to market new products and services, elevate customer relationship management and enjoy realtime visibility across the extended enterprise. The business transformation afforded by RFID can be profound—allowing higher levels of collaboration across the supply chain, plus "Six-Sigma"* accuracy in tracking inventory and maintaining records throughout the life of products and services.

* A measure of quality that strives for near perfection.

How IBM is helping

Today, IBM is playing an active role in helping businesses across industries — including themselves — realize the promise of RFID. For example:

RFID is at the heart of the US$2.5 billion revitalization of *IBM's microelectronics plant in Fishkill, NY*. Now, wafers can be tracked and routed through each fabrication station. Every wafer carrier has a passive RFID tag. RFID readers (located on automated assembly lines and in production tools) communicate the location and status of wafers to applications and databases.

Also, IBM is one of the primary technology partners of the *METRO Group Future Store Initiative*. Metro, which operates 2,300 stores in Europe and Asia, is employing RFID technology in two of its Galeria Kaufhof department stores to monitor and locate items on the floor and help ensure that shelves are appropriately stocked.

Philips Semiconductor in Asia has undertaken a joint RFID project between its Kahhsiung site and its Regional Distribution Center in Hong Kong. The initiative provides near-realtime inventory visibility to the Philips Semiconductors business units on all packaged quantities and boxes, all customer direct ships in Asia from the Kahhsiung location, all cartons from the Hong Kong distribution center to each destination and all outbound flows in Hong Kong. IBM provided an end-to-end solution that encompasses services to support Philips Semiconductor's STAR proof-of-concept approach, plus an IBM proprietary radio frequency identification framework and documentation.

Chemical and Petroleum

Chemical and petroleum companies are highly regulated and compliance-driven. Consequently, the ability to track and trace assets in the field and in transit is vital. Using RFID-enabled solutions, these organizations can dramatically improve inventory levels and tracking, enhance logistics and distribution, verify health and safety compliance, strengthen field communications and reduce labor costs — all with higher levels of security for products and personnel. For example, using RFID, companies can quickly locate containers in rail yards, shipping docks and customer storage sites. Tamper-proof tags used to seal containers and other equipment can be put into service to confirm if the material has been compromised.

The challenges ahead

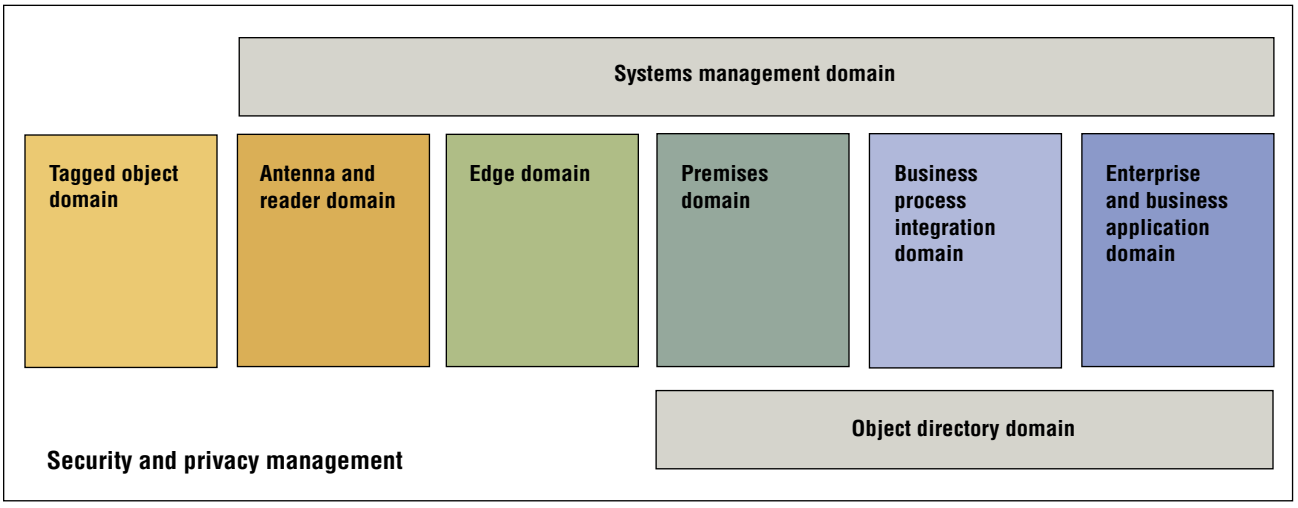
While every industry has its special challenges, RFID applications present common issues across sectors. Security is one. Until recently, RFID applied primarily to closed systems. Today, as applications grow, the invisibility of RFID systems has generated concerns that can be effectively addressed through prudent, thorough planning.

A shortage of internal skills and expertise is an issue. Another concern is systems management. Companies are recognizing the need for centralized management of their RFID systems to optimize efficiency and ensure security and privacy. The chart below depicts the key domains of the IBM RFID End-to-End Component Model.

A lack of standards is another potential roadblock. However, EPCglobal, a member-driven organization comprised of leading firms and industries, is spearheading the effort to define global RFID standards—an initiative fully supported by IBM.

On a more technical level, certain materials can present barriers when reading RFID tags. Radio waves can be absorbed, bounce off, or go right through liquids and metals, for example. Testing can overcome these issues.

And although costs are expected to drop significantly, today's RFID readers are not inexpensive, and applications must be justified from a number of vantage points. The promise of a healthy return on investment is paramount.



The End-to-End Component Model is split into specific domains to contain the architecturally significant groups of components.

Yet clearly, there is no turning back. RFID technology advances, as well as mandates by major industry players, are compelling companies to take their first steps. Dataquest predicts that full-scale rollouts will take place over the next year, and that the issues facing companies—technology and business-related alike—will dissipate.[5] Also, the efforts to set standards will help accelerate the adoption of RFID technologies and assuage any security and privacy concerns.

IBM is ready to assist organizations in reducing the costs and complexities of moving forward.

> *Unlike barcodes, RFID can read multiple tags at one time, with no line of sight required. RFID tags are less vulnerable to damage, and offer significantly higher data capability to capture detailed product information. RFID also offers the potential for read/write capability—makings tags reusable.*[6]

Forest and Paper

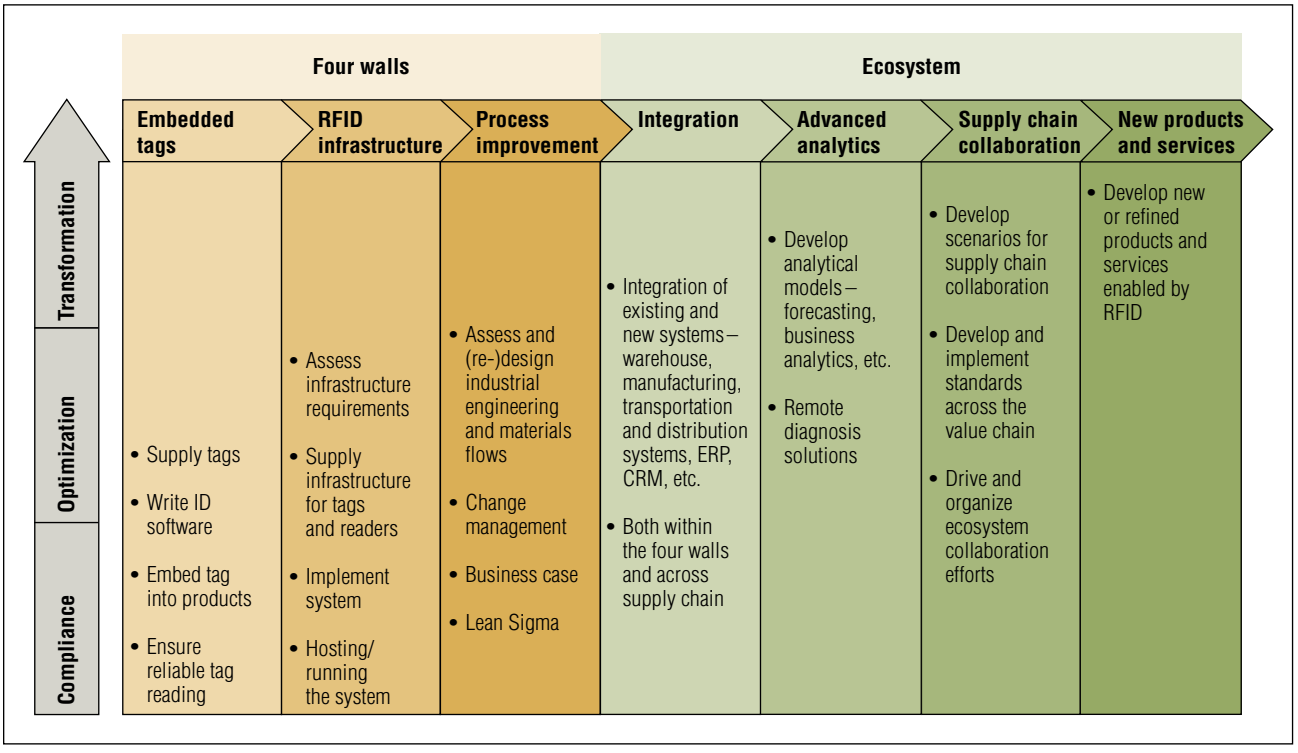
Improving supply-chain efficiency is a top priority for the paper industry. The high costs of managing transportation and inventory, limited customer visibility and a commodity-based environment make it increasingly difficult—and expensive—to accurately track products and forecast demand. With RFID, companies can achieve in-transit visibility, correctly predict supply and demand, and reduce shipping errors—all at lower costs, and with a greater degree of efficiency. For example, by attaching tags to cores of paper rolls, an organization can track those goods throughout the warehouse and signal if a roll is in the wrong location. Not only does this help maintain the right level of inventory, it also aids in assuring that loads are shipped correctly, and that the company is not subject to unnecessary losses from having the wrong product in the wrong location. Overall, RFID offers a unique opportunity for the paper packaging industry to take the lead in helping consumer goods manufacturers comply with RFID mandates.

IBM: Start here, start now

IBM was recently tapped by AMR Research as a market leader in RFID—ahead of the pack in areas like technology expertise, delivery and referenceability. In its report, AMR Research also cited IBM for its ability to link RFID projects to Demand Driven Supply Network (DDSN) initiatives.[7] IBM received another vote of confidence when it was chosen as project manager for the implementation of the U.S. Department of Defense RFID mandate.

The promise of RFID is huge. Some organizations will be driven by compliance mandates from industry leaders; others will choose an internally focused, "toe in the water" approach; still others will have larger requirements that are aimed at business transformation. The key is to start now—targeting processes that will reap the most benefits from RFID, and developing a plan that delivers returns at every stage. The following chart depicts issues to consider in all phases.

Planning for RFID



IBM RFID support addresses a wide range of topics, from very tactical (tag physics) to strategic (new processes enabled by in-product tags).

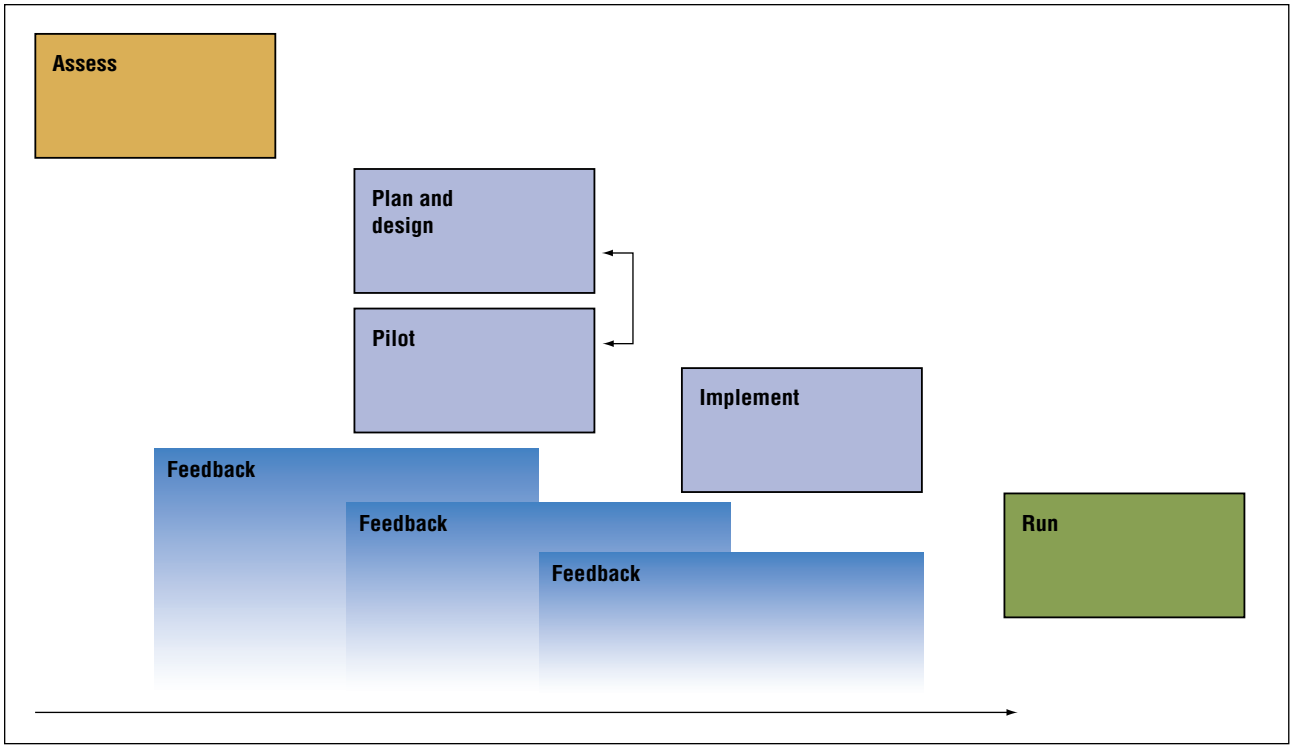
It is important to remember that RFID is not a product or solution; it is an *enabling technology*. Given that standards and capabilities will evolve over time, IBM encourages companies to adopt a prudent, incremental approach to RFID. Initiatives can be both tactical and scalable; strategies should allow for growth as the technology evolves. The chart below shows a recommended model for implementing RFID capabilities.

Early on, IBM saw the potential of RFID, and has aggressively supported RFID advancement—both internally and with IBM clients.

Electronics

For electronics companies and OEM organizations, the adoption of RFID solutions will be driven to a great degree by mandates from giants like Wal-Mart and the Department of Defense. Nevertheless, the industry is especially well-suited to RFID. For example, RFID tags in products and components can automate processes and help assure precision in areas like testing, production, authentication, calibration and service. Inventory can be managed in a way that balances supply and demand, and assures the right mix of product at the right time. Individual products can be tracked dynamically, "from cradle to grave"—easy to locate, and virtually impossible to duplicate.

An incremental approach to RFID



The execution of integrated and concurrent work streams can help accelerate RFID readiness.

The experience and expertise gained from these efforts have resulted in an all-inclusive, customizable and flexible RFID framework that incorporates all the elements needed for RFID success at every stage—from business case to process transformation to technology and infrastructure.

When helping clients develop an RFID strategy, IBM consultants bring to bear years of experience, plus proven, best-practice-based tools and methodologies. IBM's approach takes into account all the aspects of RFID—strategic, organizational, financial and technological.

The IBM solution framework

The IBM solution framework for RFID encompasses hardware, software, middleware and services (including business transformation consulting and outsourcing), plus offerings from IBM's global network of IBM Business Partners. Working with IBM, businesses in virtually every industry can determine when and how best to employ RFID—from process reengineering to business transformation—in the context of their organizational and industry requirements, and at the appropriate time.

Developing an RFID strategy

Strategic • How can RFID enable our overall strategic vision? • Should we be a leader or a "fast follower"? • Which trading partners should we pilot with and when? • How will we operate in a world of dual processes? And for how long?	**Financial** • What is the expected return on our RFID investment? • What specific RFID applications can drive value for us? • What is a realistic adoption pattern/rate of RFID, and how will that impact our business case?
Organizational • What are the change management implications? • What are the risks involved in an RFID implementation?	**Technological** • What are our technology requirements for an RFID implementation? • What is the architecture that best delivers on our strategic technology plan? • How will an RFID implementation impact our current applications?

Find out more

With more than 50 RFID patents, years of experience in applying RFID within IBM and active involvement in numerous pilot efforts, IBM is uniquely qualified to help organizations across industries everywhere navigate the RFID journey. IBM has organized its capabilities in a way that addresses and integrates the various phases of RFID requirements with proven methodologies, ROI tools, industry and IT expertise, and renowned research—all supported by superior technologies that simplify the development and implementation of a first-class, future-tuned infrastructure that makes the most of businesses' IT investments. Plus, we offer clients a range of choices for acquiring and managing their IT environment—from application hosting to outsourcing of the entire infrastructure.

To learn more about how IBM Global Services can help you chart your path to RFID, please contact your local IBM representative, or visit:

ibm.com/solutions/rfid

On demand business: The perfect fit for RFID

With IBM, organizations can chart their path to becoming an on demand business—a model that enables enterprises to respond with flexibility and speed to virtually any customer requirement, market opportunity or external threat. These capabilities apply especially well to RFID initiatives, which, like the on demand business model, enable organizations to innovate, capture new value and make better use of resources. IBM's full-scope capabilities can assist in developing a roadmap for on demand business that take into account a client's specific industry, at a starting point that makes the most sense—short- and long-term.

On demand businesses reflect four common attributes:

Responsive—*Capable of sensing changes in the environment and responding dynamically, whether to unpredictable fluctuations in supply or demand… emerging customer, business partner, supplier and employee needs…or unexpected moves by the competition—even in the face of limited resources.*

Resilient—*Prepared for changes and vulnerabilities—around the world, around the clock—be they computer viruses, physical threats, natural disasters or sudden spikes in demand.*

Focused—*Committed to concentrating on core competencies and differentiating tasks and assets; utilizing tightly integrated strategic partners to manage specific functions like manufacturing, logistics and fulfillment, HR and financial operations.*

Variable—*Employ multiple cost structures, and adapt business processes to address the situation at hand—with higher levels of productivity, cost control, capital efficiency and financial predictability.*

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[1] "Driving Change in the Auto Industry," *RFID Journal*, April 2004.

[2] ibid.

[3] ibid.

[4] Mark Roberti, "The Importance of Standardization," *RFID Journal*, May 17, 2004.

[5] Mohit Chhabra, "Mobility: RFID Going Places," Dataquest, March, 2004.

[6] IBM Business Consulting Services Analysis, 2004.

[7] Dana Stiffler and Kara Romanow, "RFID in Consumer Products: Which Service Providers Have the Goods?" AMR Research Report, May 2004.

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