WHITE PAPER

RFID in China

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ABSTRACT

This paper gives a brief introduction to the application and development of RFID technology in China. It attempts to cover more areas rather than a deep analysis in any one area. The contents will be updated and enriched regularly by the Auto-ID Center China with the expanding application of RFID technology in China. The paperincludes five parts. The first part gives an introduction on the application area of RFID technology and some examples will also be introduced. The second part illustrates the supply chain of RFID products, which include tags and readers. The third part introduces the RFID standards being drafted and proposed. In the forth part, a special interest group for the adoption of Auto-ID technology is introduced. In the final part, a survey result of RFID technology to potential clients is summarized.

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RFID in China

Biographies

Hao Min
Research Director

Feng Zhou
Technical Director

Shang-ling Jui
Managing Director

Hao Min is currently research director of Autoid Center China. He is also professor and director of ASIC & Systems State Key Laboratory, Fudan University. Hao got his Ph.D degree from the department of material science, Fudan University in 1991 and then served as an associate professor in the ASIC & Systems State Key Laboratory of Fudan University. From 1995 to 1998, he worked as visiting associate professor in the department of electrical engineering, Stanford University, USA focusing on low power mixed signal VLSI design especially on the design and characterizing of CMOS image sensors. At the same time, he worked as a consultant for several semiconductor companies. From 1998, he served as professor and director of ASIC & Systems State Key Laboratory, Fudan University and worked on the smart card and RFID chip technology. Dr. Min's research areas include VLSI architecture, mixed signal IC design, digital signal processing, image processing, etc. He has published more than 40 papers in journals and conferences.

Feng Zhou, received the B.E. and M.E. degrees in Circuits and Systems from Hangzhou Institute of Electronic Engineering, China, in 1988 and 1991 respectively. In 1991, he joined No. 52 Research Institute of China Electronics Technology Group Corporation, and then, from 1992 to 1996 he worked at Hangzhou Institute of Electronic Engineering. In 1999 he received the Ph.D degree in Solid-State electronics from Fudan University, China, and thereafter worked at Fudan. He has been working on ASIC design and VLSI design automation. His interests cover analog CMOS IC design, CMOS RF microelectronics, low power design methodologies, etc. From November 2001 to August 2002, he was a visiting scholar at the Department of Computer Science & Engineering, UC, San Diego, US, where he researched on the optimization of interconnect resources on SOC. He is currently an Associate Professor at Fudan University, leading a group engaged in the research and developing of RFID chips and systems. Meanwhile he is the technical director of Auto-ID Center, China.

Shang-ling Jui is the Managing Director of SAP Development Center China. Mr. Jui has over eight years experience in SAP China, with his last position as Senior Vice President of Greater China, responsible for consulting, training, the collaborative business solution center and partner alliance. He joined SAP AG in 1992 in Walldorf as a senior basis developer and in 1993 moved to SAP Labs North America to work as solution architect for the next generation of R/3. Before coming to SAP, Mr. Jui worked for MBB AG in Munich, Germany as a system engineer for 2 years. He started his career as a software developer for HOESCH AG in Dortmund, Germany in 1988. Mr. Jui completed his Executive MBA from the University of Stanford, USA in 2000. He also holds a Master's degree in Technical Information Engineering as well as Doctor's degree in Software Engineering from the University of Siegen, Germany.

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Biographies

Tianyang Wang
Executive Director

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Senior Consultant

Tianyang Wang is currently the Executive Director of Auto-ID Center China and the Business Development Manager of SAP Development Center China. Mr. Wang's focus area is RFID related application and the potential adoption of EPC in business application system. With more than eight years experience in supply chain management and SAP application area, he is also a senior consultant for supply chain management with the extensive expertise in business process analysis and re-engineering, supply chain system implementation. He worked for SAP since 1999. Before joining SAP, he worked for P&G China as a project manager in Product Supply department. Mr. Wang received the M.S. degree in Computer Science in 1996 and B.E. degree in Industrial Automation in 1993 from Zhejiang University, China.

Xiaojun Chen is currently the core team member of Auto-ID Center China and Solution Architect of SAP Development Center China. Mr. Chen's focus area is RFID related application and the potential adoption of EPC in business application system. Meanwhile he is responsible for SAP Best Practices Solution – High-tech industry in SAP. Mr. Chen has been worked as senior consultant and project manager for much IT projects in China and has a comprehensive expertise on industries of High-tech, Retail, and Manufacturing. He worked for SAP since 1997 and worked as senior consultants, solution architect and project manager. He also worked for Covics as consultant manager in year 2000. Mr. Chen received B.S. degree in 1996 from Tongji University, China.

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1. INTRODUCTION

RFID is introduced to China about 3 years ago after the successful application of contactless smart card technology in public transportation system (bus and subway ticketing) by Philips Mifare 1 card. RFID is introduced as a shrinked and cost-down version of contactless smart card with different package. Then, UHF RFID tags were introduced to China by several US companies but because of frequency issue (915M is in the GSM band), UHF tags are only used in some special area which will not interfering GSM mobile phone such as train car identification. Currently, ISO15693 (13.56M) compliant RFID tags and readers are promoted by TI and Philips so several local companies are developing application systems based on this technology.

2. APPLICATION OF RFID TECHNOLOGY IN CHINA

RFID is not widely used in China. The cost of tags is still too high for normal items however this is potentially the largest market. Following are the major application areas of RFID and some examples.

2.1. Certification and Anti-counterfeit

Counterfeit is a big problem in China especially for high margin merchandise such as liquor, cigarette, medicine, etc. RFID in this application has enormous potential, but lack of standard and efficient verification tool in the distribution channel hampers the widespread application. Recently, several local companies are developing an anti-counterfeit system based on RFID technology and digital signature. A drafting standard for anti-counterfeit application using HF tags (both ISO 14443 and ISO 15693) was submitted to government.

This year, a company in Shanghai is developing a system for the safety check of liquid petroleum gas (LPG) tanks. A tag (by TI) is attached on the tank and the annual safety check record is written in the tag and will be readout to verify that the tank meets the safety requirement when refilling. The project will be launched October 2003 and a total of about 3 million tanks will be tagged in Shanghai and 1.5 million in Shenzheng in 2004.

2.2. Train Car Identification

A local company successfully developed a RFID system used to identify train cars (cargo) national wide. Semi-passive tags are attached to about 17,000 locomotives and passive tags (from Amtech) are attached to about half a million cars. Three frequencies 910M, 912M and 914M are used in the system. Although those frequencies are in the GSM band, the companies get special permission from the Ministry of Information Industry by restricting the application to railway only.

2.3. Logistic

Because of the price issue, application of RFID in logistic has not even started in China. Barcodes are the only automatic identification method now. Recently, several companies in manufacturing, distribution and retail became interested in RFID. Please refer to appendix of this paper.

A report shows that a local company is proposing a container tracking system national wide using RFID (2.45G, semi-passive) technology for anti-smuggling purpose.

2.4. Animal identification

In large cities of China, pets are needed to register. Low frequency RFID (125K) is used for registration certification and immune shot recording.

2.5. Ticketing

RFID (13.56M) is used for ticketing of park, subway, etc. In Guang Zhou, RFID tokens from Philips are used to subway ticketing and in Shanghai RFID will also be used for subway ticketing start from 2004.

3. INDUSTRY

The industry of RFID in China is very limited. Very few local companies have the capability to manufacture RFID devices. But there is over capacity for contactless smart card manufacturing because of the national ID project (China will issue contactless smart card ID from 2004). Because of the large potential market for RFID, many companies start to pay attention to this industry. Currently, the major players in RFID are TI, Philips and Infinion.

3.1. Chip Design

Chip design companies have grown very fast in recent years in China. Many of them focus in chip design for both contact and contactless smart cards. Several of them successfully delivered contactless smart card chips, which is widely used for the ticketing of public transportation systems. Because of the similarity of the chip design technology between contactless smart card and HF RFID, some of them announced their HF RFID chip for either ISO14443 or ISO15693. Shanghai Huahong IC Co. Ltd announced the product for subway ticketing and Shanghai Beiling announced the first ISO15693 compliant products. Currently, the major chip providers are TI, Philips and Infinion.

3.2. Manufacturing

There are several semiconductor wafer fabs, which are suitable for RFID chip manufacturing. Shanghai Huahong NEC, SMIC, Grace Semiconductor all have embedded non-volatile memory technology, which is essential for RFID chips. TSMC are constructing fabs and will be in production from 2004.

3.3. Packaging

There is almost no RFID packaging capability in China although chip packaging industry is very strong in China. They may invest the RFID packaging facilities when the market grows. Recently, Infinion announced a packaging line in Wuxi, which may have RFID packaging capability. A small company (Hua Yang Microelectronics) in Shenzhen uses flip chip and printed antenna for HF RFID tags.

3.4. Tag Conversion

There are many paper tags manufacturing company in China. Most of them are joint ventures from Taiwan, Hong Kong and Japan. Some of them are sponsors of Auto-ID Center. They produce tags for worldwide market. But they need technology update for RFID tags. Recently, a printing company in Shanghai has started to print RFID tags on the inlay provided by TI.

3.5. Reader

Contactless smart card readers are quite mature in China and are widely used in ticketing and access control. Many companies can design and manufacture low cost and high quality contactless card readers (ISO14443). Therefore it is quite easy for them to design RFID readers in HF. Some companies have the technology in 900M and 2.4G band readers (The readers for train car identification mentioned in 2.2 are all designed and manufactured by local companies) because the technology is quite similar to the RF part of the base station of mobile phone.

4. STANDARD

Standards are the most important issue in the adoption of RFID technology in China. Standards in China have three different categories: direct adoption of international standard; adoption of international standard by some modification; fully compiled by local. In the IT area, most of the standards are direct adoption of international standard for worldwide inter-operatable. For example, network standard is exactly the same as international standard. GSM mobile phone is also the directly adoption of European standard. CDMA in China is a little different from the States. CDMA phones in China use SIM cards like GSM phones. HDTV standard in China will also be a combination of European and US standards. Recently, local industry in consumer electronics is drafting the standard for home network protocols, which will be very different from that of Europe and US.

With the globalization of economy, China is becoming one of the world-manufacturing centers. As EPC™ is becoming the worldwide standard, we expect that China will adopt EPC™ as Chinese standard.

4.1. Standard Organization

All the standards in China are issued by "Standardization Administration of the People's Republic of China"£¨SAC for short (http://www.sac.gov.cn). SAC is in charge of organizing the process of standard establishment. There are hundreds of technology committees (TC) in SAC dealing with different technology area. A new standard will go through the following steps:

– A proposal is drafted by industry or research institute indicating the importance of the proposed standard. The proposal is submitted to either the technology committee (TC) or directly to SAC.
– The proposal is evaluated and approved.
– A working group (WG) is established. The WG is in charge of drafting the standard, discussing and updating regularly. A company or institute is choosing as the secretary to maintain daily operation. Finally a standard draft is submitted to SAC for evaluation.
– SAC organize an expert group to evaluate the proposal and Q&A is need.
– SAC published the standard after it is evaluated.

TC CODE	SPECIALTY	SECRETARY	COMPANY OF SECRETARY
28	Information Technology	Lin Ning	– China Electronic Technology – Standardization Research Institute
TC28/ SC34	Automatic Identification		– Article Numbering Center of China (Member of EAN.UCC)
218	Anti- counterfeiting	Wang Hengyi	– China association for standardization
49	Packaging terms, dimensions, testing methods concerning with package for transport, and etc.	Li Miao	– China National Packaging Corp._ CNPC_
	Logistics & Purchasing		– China Federation of Logistics & Purchasing
	Barcode		– Article Numbering Center of China

4.2. Frequency Issues

The band 13.553MHz~13.567MHz falls in one of the bands for micro-power (short distance) radio equipments. The detected field strength is restricted to 100 20_V/m at the distance of 3M (quasi-peak amplitude demodulation). Generally, small-sized devices, such as toys, car doors, garages, alarming systems, wireless microphones, etc., use this band. This band is usable for RFID and there are many systems running using this frequency.

The band close to 915MHz is used for non-central-controlling, multi-channel point-to-point or point-to-points systems for local wireless audio or data communication. A hotel, factory, harbor, community, etc., may set up such a system for its internal management. The emitted power of every individual device is not allowed to exceed 3W. This band is used for GSM mobile communication system now. It is not likely used for RFID.

The band 2.4 GHz ~2.4835GHz is an opened ISM band, with its EIRP (Effective Isotropic Radiated Power) limited to 500mW. This band is shared between the worlds of industry, science, medicine, as well as communication. Basically devices working in this band are treated as micro-power (short distance) equipments, and no licenses are required for the use of this band. The well-known protocols of wireless LAN and blue-tooth adopt this band.

The band 5.725GHz~5.850GHz is again an ISM band, with its emitted power limited to 500mW and EIRP to 2W. Being an ISM band, it is shared between the worlds of industry, science, medicine, as well as communication. However, the use of this band needs to be authorized. The protocols of wireless LAN and blue-tooth use this band as their expanded bands.

In summary, in P.R. China, the bands of 13.56MHz, 2.45GHz and 5.8GHz are available for RFID applications.

4.3. Related Standards

There is a whole set of standard for smart card. Most of them are directly adoption of ISO7816 and ISO14443. EAN.UCC is widely accepted in China.

4.4. RFID Standards

There is no RFID standard published in China until now. Several standard groups (TC, SC) are proposing RFID standard in different level (application, networking, communication protocol, etc.). It is expected that next year, there will be several standard proposals submitted to SAC.

5. SIG FOR ADOPTION OF AUTO-ID TECHNOLOGY IN CHINA

A special interest group (SIG) is proposed by Auto-ID Center China and SAP Development Center China.

5.1. Objectives

The objective of this group is to promote the adoption of EPC™ and RFID technology in China.

5.1.1. Demonstration Environment in China
A small demo system will be set to study how the RFID can be used in China. The demo system will check the work distance between reader and tags, relationship between performance and media between the reader and the tag, the BER of the data communication, the EMI of the RFID system and other performance.

5.1.2. Field Test
After the small demo system testing, a local manufacture and a local retailer will be selected to have a more detailed test in a real environment. By doing this work we will know the impact of RFID in the Chinese environment.

5.2. Detailed Work Plan

5.2.1. Frequency Allocation and EMC
A comprehensive study will be performed on the frequency allocation for RFID in China in HF, UHF and higher frequency. This will lead to the proposal of RFID frequency allocation of the RFID standard in China.

EMC test will also be performed and analyzed during the demo and trial run. As EMC is not well controlled in China, many appliances and communication devices may interfere the RFID system even through the RFID system meets the EMC criteria. We need to study the interference by doing experiments of RFID with cellular phones, appliances and other devices that may emit radio wave.

5.2.2. Demo System
A demo and evaluating system will be established which include a passing gate with at least two arrogates. Different kind of samples will be tagged by RFID and pass through the gate. Performance of RFID and the arrogates will be evaluated and the inference of material of samples will be studied in detail.

5.2.3. Trial run for Manufacturing
A local manufacture will be chosen to evaluate the application of RFID in the manufacturing control system. RFID will be integrated into the CIMS and ERP to demonstrate how RFID technology can improve the efficiency of manufacturing and distribution.

5.2.4. Trial run for Retailer
A local retailer or foreign retail with local store will be chosen to evaluate the application of RFID in retailer.

5.2.5. Privacy Issues
The Chinese think of privacy very differently from Western people, a special research will be taken to study the attitude of Chinese people to RFID. A partner will be chosen to lead the survey and analysis. This will closely work with the SIG for privacy of Auto-ID Center.

5.3. Organization

A board will be organized to guide the work for the SIG. The board member will come from founders and sponsors of the SIG. Several advisors from Auto-ID center will be invited.

There will be a general director, a technical director and executive director from Auto-ID Center China.

6. A SURVEY ON RFID

The pressure of globalization and approaching competition from international companies has driven companies in China to pay more and more attention to improving their supply chain. Although Auto-ID was almost unknown to Chinese enterprises, the need of a new technology that can support them with an adaptive and visible supply chain at a lower cost and faster response promises a bright future of this technology in China, today the fastest growing and most promising market in the world.

Around 200 selected leading companies in China had been surveyed in August 2003 by SAP Development Center China concerning the adoption of RFID technology in their business environment. In this survey, the CIOs or IT managers of these companies were asked to fill out a questionnaire focusing on the following areas:

– Current data entry and item tracking approach
– Awareness of RFID Technology
– Business area for RFID Technology adoption
– Main challenges of RFID technology adoption
– Timelines and Plans of RFID technology adoption in their own business environment

Although, Auto-ID is just embryonic in China, valid questionnaires from 52 companies were collected and valuable feedbacks were given.

As the wrap-up question, companies in this survey were asked on their general attitude toward the adoption of EPC™ and Auto-ID or RFID technology in China to improve the agility of enterprises in terms of supply chain and business application area.

The attitudes of companies in China about this new technology and its potential application in business can be classified into 3 levels. And the result of the survey shows it is not obviously relate to the industry and customer profile.

Thirty-three percent of the companies felt excited about this new technology and may become the early market adopters. They are classified to be the first level, manufactures and retailers in this level may want to use this technology as quickly as they can and get benefit from it. There is huge potential that

those 53% companies will move to be level 1 if more education is provided, in this level both manufactures and retailers are planning to invest in auto-id in near future, but cautiously. The rest, which are classified into level 3, keep the conservative attitude; can be defined as the late adopters. The late adopters understand how Auto-ID/RFID is expected to be a cost effective way of doing business in the future, while through the survey, following key worries or main challenges remains to prevent them to adopt this new technologies in near future:

– No successful and integrated solutions clearly available in the market
– Standards remain the key challenge
– No early indications of consistent priority application areas for both retailers and manufacturers
– Inconsistencies remain among manufacturers and retailers regarding expectations and business benefits
– Security and reliability of RFID tag
– How to protect the privacy of the customer

7. SUMMARY

Auto-ID technology begins to get attention in China. A survey shows that both manufacturers and retailers are willing to accept this new technology to get benefit from the high efficiency and low cost after the adoption of this technology. Standard, security, reliability and privacy will be the key issues for the wide acceptance of the technology. More education about technology and application is need to accelerate the process of adoption and a trial run may give the industry good implementation examples to demonstrate the value of the Auto-ID technology.

APPENDIX:
## ADOPTION OF AUTO-ID IN CHINA SURVEY (2003)

1. INTRODUCTION

The pressure of globalization and approaching competition from international companies has driven companies in China to pay more and more attention to improving their supply chain. Although Auto-ID was almost unknown to those Chinese enterprises, the need of a new technology that can support them with an adaptive and visible supply chain at a lower cost and faster response promises a bright future of this technology in China, today the fastest growing and most promising market in the world.

Around 200 selected leading companies in China had been surveyed in August 2003 by SAP Development Center China concerning the adoption of RFID technology in their business environment. In this survey, the CIOs or IT managers of these companies were asked to fill out a questionnaire focusing on the following areas:

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– Timelines and Plans of RFID technology adoption in their own business environment

Although, as we mentioned, Auto-ID is just embryonic in China, valid questionnaires from 52 companies were collected and valuable feedback were given. Base on these questionnaires, we summarized the results and illustrate the approaches and potential of RFID technology adoption in China.

Figure 1

COMPANY CATEGORIES IN THE SURVEY
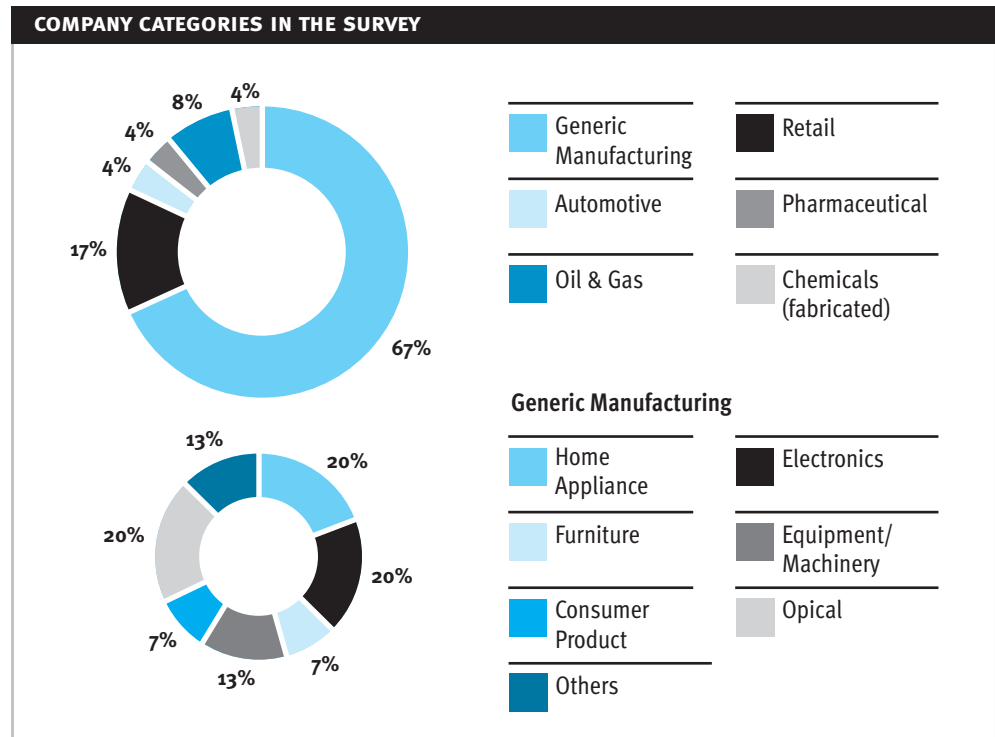
A phenomenon that arouses our interest was that about 2/3 of the companies that react actively in this survey are Generic Manufacturers from various industries. This differentiates with what we observed in US and EMEA, where the retailers take the initiatives of this new technology.

2. SURVEY RESULTS

2.1. Current Data Entry & Items Tracking Approach

Figure 2a: Current Data Entry and Items Tracking Approach

Remark: Time consuming and high error rates are the top 2 issues when using barcode technolgy. Multiple choices, thus ∑% > 100%.

AUTO-ID SURVEY QUESTION

Do you use a barcode system in your company?

53% — 47%

■ Yes
■ No

Figure 2b

AUTO-ID SURVEY QUESTION

What challenge you when using barcode system in your company?

48% 56% 26% 22%

■ Time & labor consuming
■ "Light of "sight" limit
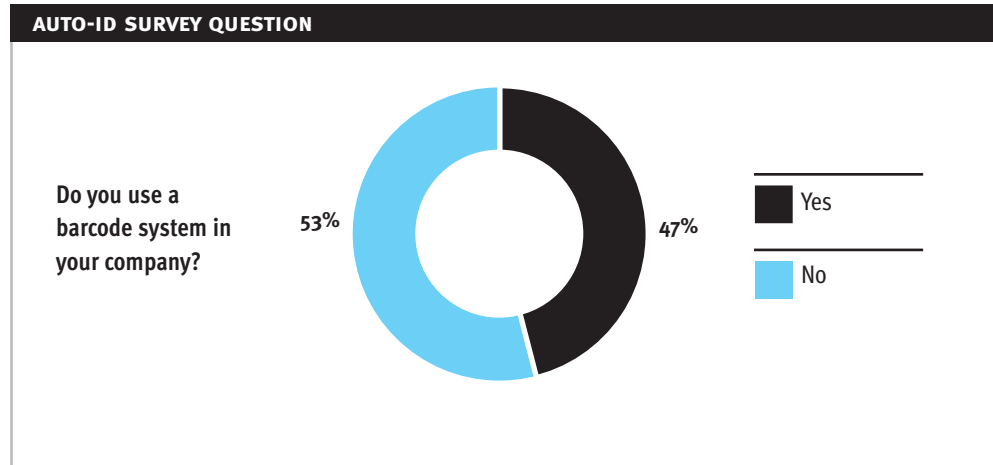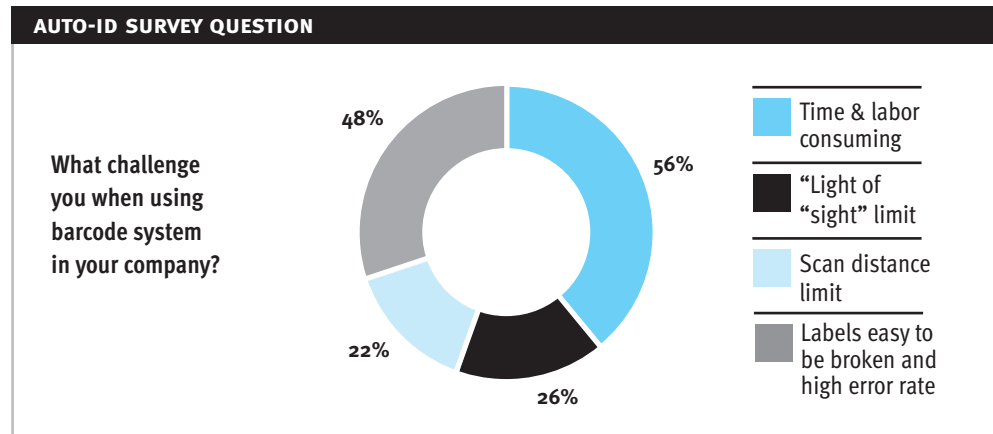■ Scan distance limit
■ Labels easy to be broken and high error rate

This part of survey aims at providing an overview of the current situation of Bar-Code System usage for data entry and items tracking.

Over half of the companies have already taken advantage of bar-code technology in their inventory management and some of the rest also sense the great benefits of using such system. They felt frustrated with the problems of "Time and Labor consuming" and "Labels easy to be broken and high error rate". "Light-of-sight limit" and "Scan distance limit" are also their concerns.

In the process of tracking items (status checking), 74% responded that they have to enter data manually while 19% answered completely blind to material status. Generally speaking, automated data entry is still not popular in china.

It's also worth mentioning that although 78% companies are using SAP Material Management Module, the problem lies in that whether they are able to capture the reliable and accurate data effectively and efficiently in the first step to maximize SAP MM and other integrated applications potentially. 56% choose the way of manually entering data and only 22% choose Barcode. Thus this may lead to incorrect inputting and discrepancy.

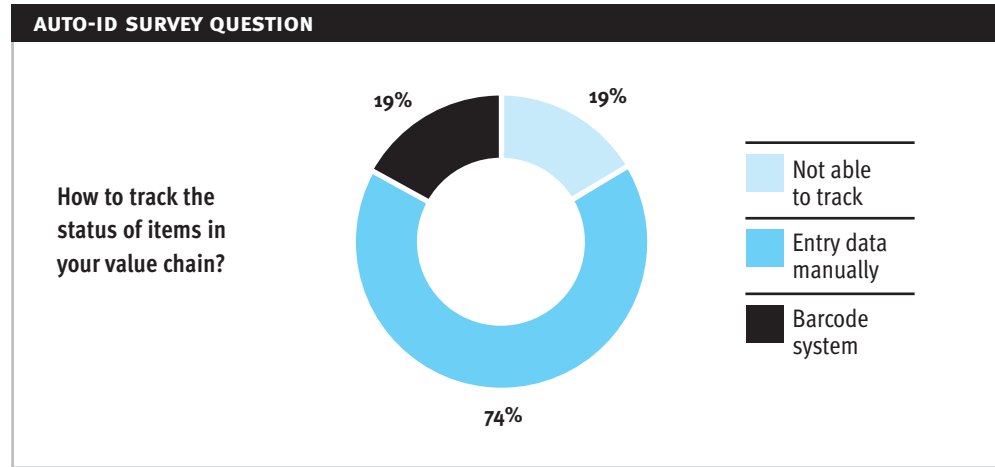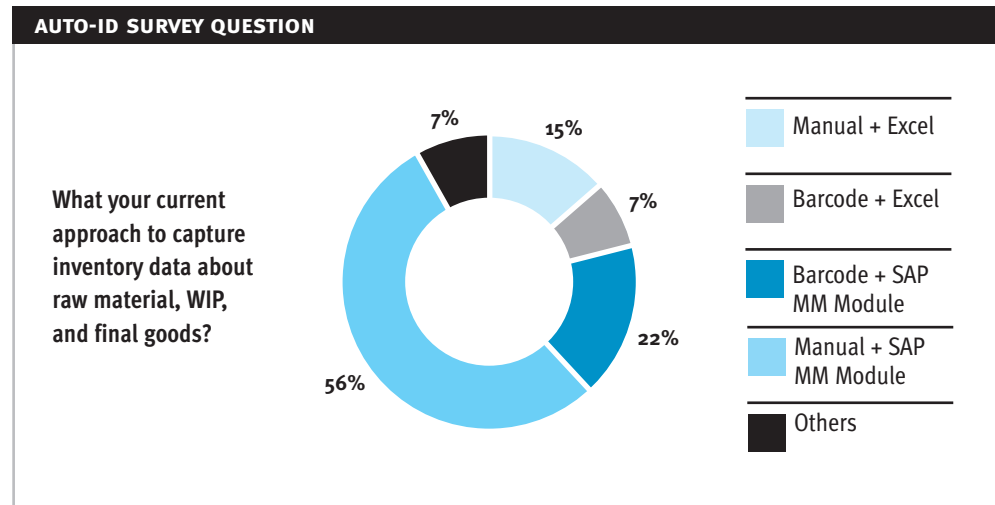**Figure 3a:** Current Data Entry and Items Tracking Approach

AUTO-ID SURVEY QUESTION

How to track the status of items in your value chain?

19% 19% 74%

Not able to track

Entry data manually

Barcode system

Figure 3b

AUTO-ID SURVEY QUESTION

What your current approach to capture inventory data about raw material, WIP, and final goods?

7% 15% 7% 22% 56%

Manual + Excel

Barcode + Excel

Barcode + SAP MM Module
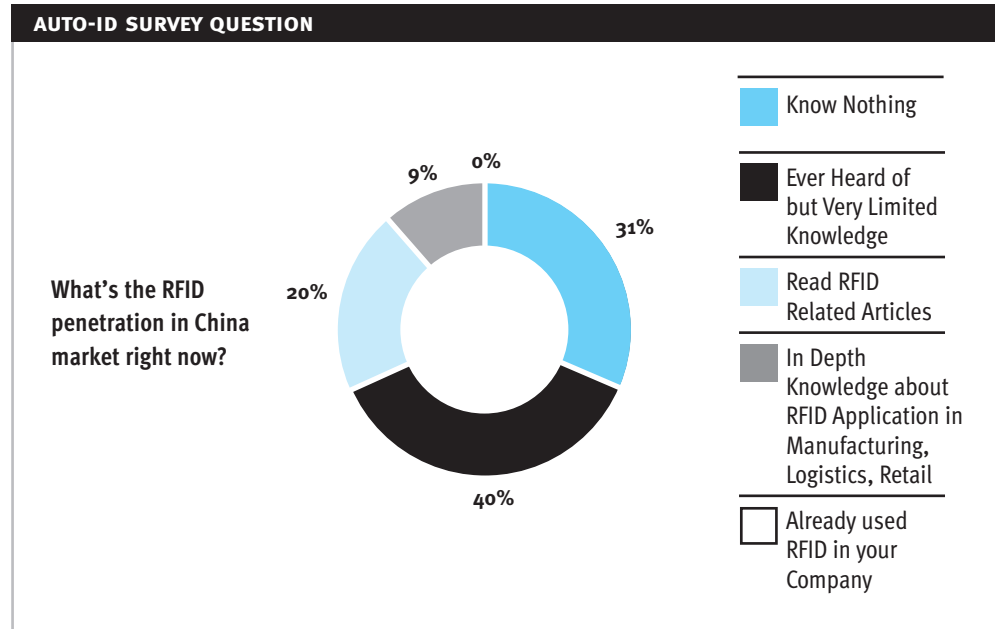
Manual + SAP MM Module

Others

2.2. Awareness of RFID Technology

This part of the survey aims at providing an overview of current awareness of RFID technology in China. Thirty-one percent of companies indicated that they have never ever heard of the technology. Forty percent had heard of this technology, but had no further understanding of its application. Generally speaking, they felt there was a lack of knowledge about RFID within their companies. This finding indicates a significant need for greater education around the RFID solution in the near term. Delightedly, the group

representing 9% of the participants had a deeper understanding of RFID application in Manufacturing, Logistics, Retail and etc. Market education and promotion about RFID technology are highly desirable in China. It could be achieved through activities such as: workshop, seminar, websites and pilots.

Figure 4: Awareness of RFID Technology

AUTO-ID SURVEY QUESTION

What's the RFID penetration in China market right now?

0%
9%
31%
20%
40%

Know Nothing

Ever Heard of but Very Limited Knowledge

Read RFID Related Articles

In Depth Knowledge about RFID Application in Manufacturing, Logistics, Retail

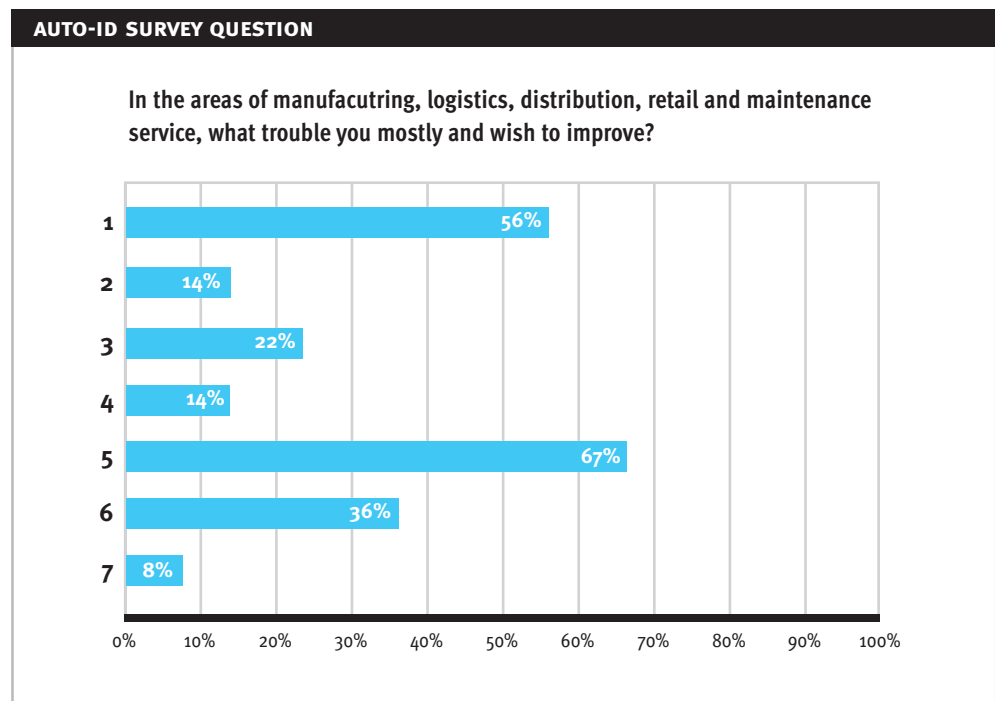Already used RFID in your Company

2.3. Problems Identified and Improvement Needed Areas

Figure 5: Problems Identified and Improvement Needed Areas

Multiple answers possible, thus $\sum\% > 100\%$.

1 High level inventory, very hard to get data along the supply chain

2 Not able to get POS data

3 High frequency of out-of-stock

4 Theft and loss

5 Control of production and monitor of WIP goods

6 Quality control and management

7 Counterfeit

AUTO-ID SURVEY QUESTION

In the areas of manufacutring, logistics, distribution, retail and maintenance service, what trouble you mostly and wish to improve?

1 — 56%
2 — 14%
3 — 22%
4 — 14%
5 — 67%
6 — 36%
7 — 8%

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

**Do you believe that RFID will help you solve the problems troubling you?**

All respondents except one believed that they would benefit from RFID application and solve the problems where a solution doesn't exists right now.

Among the areas listed above, "High Level Inventory" as well as "Control of Production" are two key worries. This also reflects the great interests of manufacturers in such area. They expect that with the new RFID application, computers will be able to 'see' physical objects, allowing them to be able to track and trace items automatically throughout the supply chain. Some of the interviewees also personally informed us that some inherent drawbacks of barcode system, like short distance and sight limit, prevent them from tracking inventory movement effectively. While they believe RFID technology can revolutionize the way they manufacture, sell and buy products.

2.4. RFID Application Areas

Figure 6: RFID Application Areas

1 Manufacturing

2 Distribution Center

3 Transportation

4 Warehouse

5 Retail

6 Field Maintenance/Service

7 Others
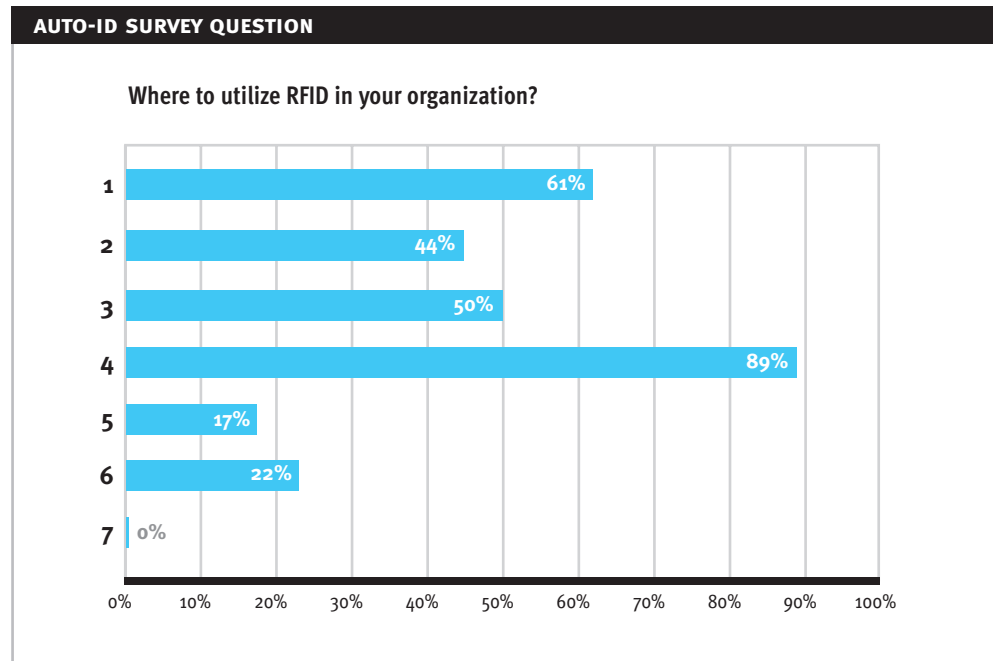
Among the choices, 89% choose Warehouse and 61% choose Manufacturing. Only a few chooses "Retail" and "Field maintenance/service".
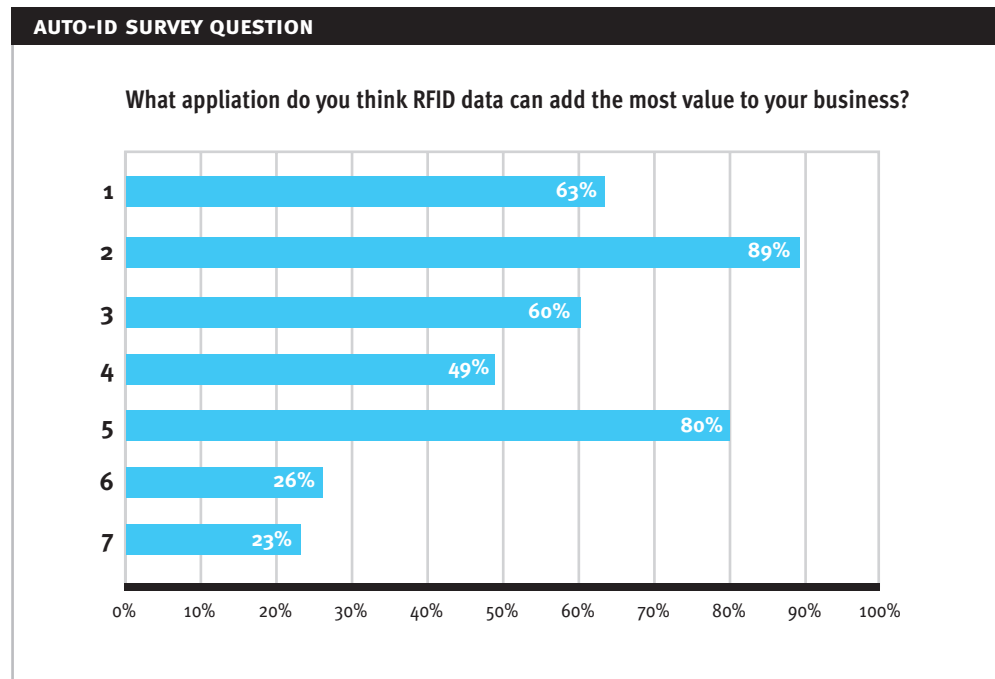
What applications do you think RFID data can add the most value to your business?

It is always hard to anticipate what a new technology will be used for. The EPC™ Network is designed to be a general-purpose system for automatically identifying objects. Like their counterparts in American and Europe, Chinese manufacturers show their curiousness in the supply chain: making and moving products more efficiently to reduce costs, time, and waste. They also show special interests in "Warehouse Management" (89%) and Material Management (80%). So we dare to foresee that with the price of RFID goes down, EPC™ Network can operate at the case and pallet level in the future. As the price of RFID continues to fall, there may be interest in applications at consumer unit level,

such as managing shelf inventory, preventing crime and identifying counterfeit products. This is where consumer privacy questions arise. The possibilities seem endless, and there are many social and economic benefits, providing privacy and other policy questions are properly addressed, and the technology meets the required price and performance targets. So Auto-ID adventure in China should also pay special attention to such area, as there may exist great discrepancies in law and society structure between oriental and west. We should also pay special attention to the performance problem to face the approaching of a "Pallet Epoch", even the "Customer Unit Epoch".
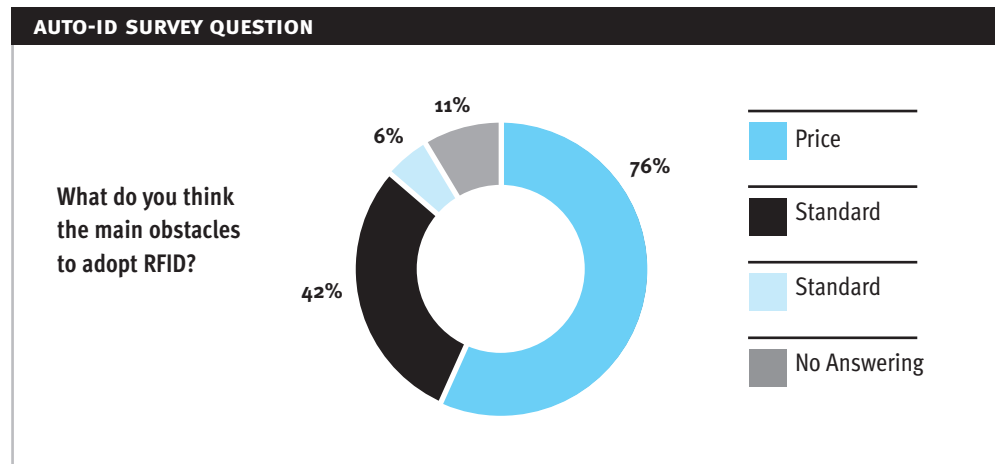
Figure 7:

1 Supply chain Event management

2 Warehouse Management

3 Sales & Distribution

4 Production planning

5 Material management

6 Asset and product life cycle management

7 Report and intelligent data analysis

AUTO-ID SURVEY QUESTION

What appliation do you think RFID data can add the most value to your business?

2.5. What Challenge the Adoption of RFID?

Figure 8:

Others:
– value-added to company and the feasibility to apply

Standard:
– Frequency
– standard interface with internal and external system

AUTO-ID SURVEY QUESTION

What do you think the main obstacles to adopt RFID?

Legend: Price (76%), Standard (42%), Standard (6%), No Answering (11%)

Price

Price is the most important factor that will effect the adoption of RFID greatly. But as the price of RFID continues to fall, more and more companies will adopt RFID. The price can be divided to two categories, the first category is price for individual tags and the second is for some derivative accessories like software, hardware and the cost of implementation of the RFID application systems.

Most of the interviewees believe that RFID tag is starting to reach the low price points and high performance levels needed to become a more mass-market technology.
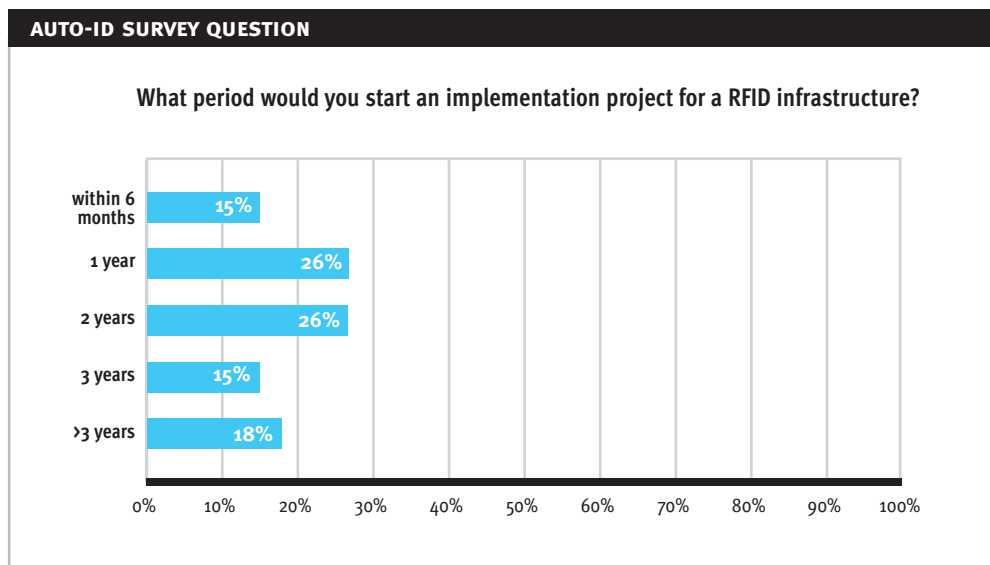
Standard

Unclear frequency and interface standards are also the obstacles for companies in adopting RFID.

Others

These companies vote for "others" think the utility of RFID will not bring them any profit and some companies feel that it's not feasible to carry out a RFID plan.

2.6. Timeline and Plans for Adoption

Figure 9: Among all 34 responds, 69% would like to implement RFID infrastructure in the next 2 years; 15% of participants wish to adopt this new technology once it is available to solve their problems in next half year.

AUTO-ID SURVEY QUESTION

What period would you start an implementation project for a RFID infrastructure?

within 6 months	15%
1 year	26%
2 years	26%
3 years	15%
>3 years	18%

In spite of the advantages and great benefits Auto-ID solution can bring about, not all the enterprises will accept this technology immediately considering cost.

We are interested in when the Chinese enterprises will able to adopt this kind of infrastructure. The charts above showed us the forecast. Among all 52 interviewees who respond, 69% would like to implement RFID infrastructure in the next 2 years; 15% of participants wish to adopt this new technology once it is available to solve their problems in next half year. But about 33% of them report that Auto-ID is not in their consideration within 3 years, calling into the question the likelihood of there companies making a significant investment in Auto-ID by 2006.

Auto-ID offers great benefits as well as great risks. Manufactures face a hard choice: they must decide whether they will be early adopters, aggressive followers, or" Wait-and-see" late adopters. Judging from

past experience, the early adopters will spend a lot of money on new technologies and see their profits decline, but get a big increase in market share. The aggressive followers will spend less as technology costs decline, experience serious profitability losses, and keep a stable market share. The late adopters will increasingly fall behind and will likely be marginalized surprisingly quickly.

Sometimes the manufacturers must consider whether they should tag their products with RFID labels because of the demand of their key customers. As we all known, Wal-Mart has announced to its suppliers that it will require that all their products have Auto-ID tags on all cases and pallets by 2006. So in the next diagram, we can see the attitude of Chinese companies toward such requirements.

Figure 10:

1 Prepare for implementation immediately in spite of high initial investment by now (customer oriented)

2 Negotiate with Clients and defer the adoption as far as possible

3 Wait until the mature market comes into being (In the risk of losing customers and market share)

4 No consideration due to the price

AUTO-ID SURVEY QUESTION

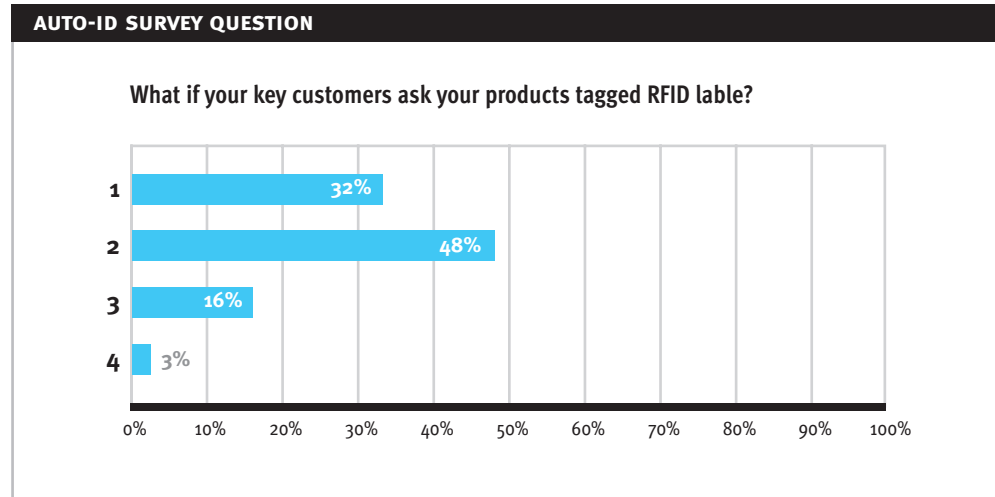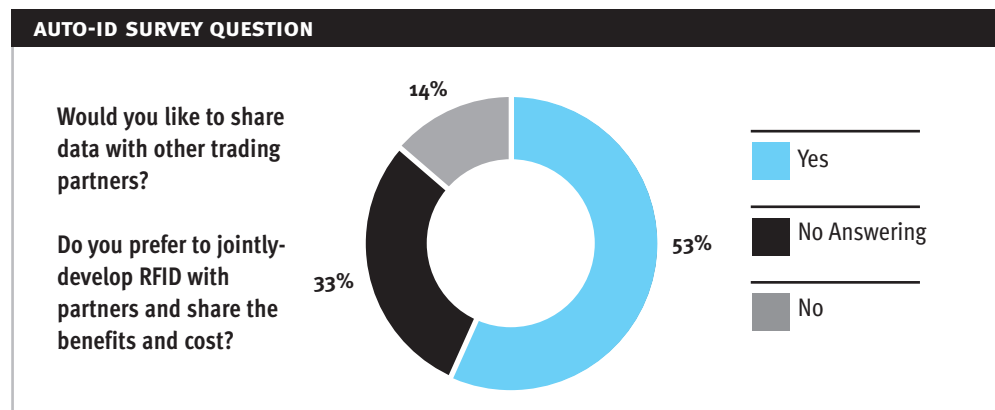**What if your key customers ask your products tagged RFID lable?**

Figure 10, we can define the reaction from China companies into 4 categories: the first column represent those who will prepare for implementation immediately in spite of high initial investment by now (Customer Oriented). But the most of the companies would rather negotiate with clients and defer the adoption as far as possible.16% of them are very prudent and they will wait until the mature market comes into being (In the risk of losing customers and market share). Only 3% of these companies will not take RFID into consideration due to the high price.

2.7. Part VI: Cooperation with Business Partners

Figure 11

AUTO-ID SURVEY QUESTION

Would you like to share data with other trading partners?

Do you prefer to jointly-develop RFID with partners and share the benefits and cost?

Yes — 53%
No Answering — 33%
No — 14%

The goal of Auto-ID is to change the world by creating an open global network that can identify anything, anywhere, automatically. It seeks to give companies the near-perfect supply chain visibility. Such system, if widely adopted, could eliminate human errors from data collection, reduce inventories, keep product in- stocks, reduce loss and waste, and improve safety and security. But another problem arises: would those companies like to share data with other trading partners and jointly-develop RFID with partners and share the benefits and cost? The survey shows us that, in spite of 14% didn't give us any answer, more than half of Chinese companies will prefer to cooperate with their partners. There are still about 33% of them not adopting it.

3. SUMMARY

As the wrap-up question, companies in this survey are asked generally on their attitude toward the adoption of EPC™ and Auto-ID or RFID technology in China to improve the agility of enterprises in terms of supply chain and business application area.

Figure 12
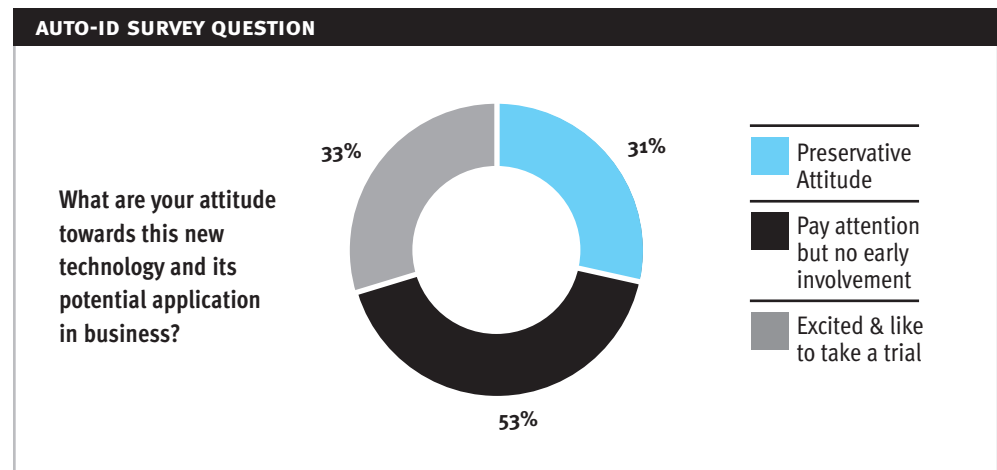
The attitudes of companies in China about this new technology and its potential application in business can be classified into 3 levels. And the result of the survey shows that it is not obviously related to the industry and customer profile.

Thirty-three percent of companies who felt excited about this new technology may become the early market adopters and are classified to be the first level. Manufactures and retailers in this level may want to use this technology as quickly as they can and get benefit from it. There is huge potential that those 53% companies will move to be level 1 if more education provided, in this level both manufactures and retailers are planning to invest in auto-id in near future, but cautiously. The rest, which are classified into level 3, keep the preservative attitude and defined as the late adopters. Those late adopters understand Auto-ID/RFID is expected to be a cost effective way of doing business in the future, while through the survey, following key worries or main challenges remains to prevent them to adopt this new technologies in near future:

– No successful and integrated solutions clearly available in the market
– Standards remain the key challenge
– No early indications of consistent priority application areas for both retailers and manufacturers
– Inconsistencies remain among manufacturers and retailers regarding expectations and business benefits
– Security and reliability of RFID tag
– How to protect the privacy of the customer