Purpose and Effectiveness of Auto-ID Device Implementation

The main purpose of introducing an AUTO-ID is to improve productivity at the production site by "controlling items and information in one source" and "uniting items with their information". There are a number of issues to be dealt with to improve productivity, including production yield, lead time, flexibility in the production management and quality assurance etc. There is also the need to deal with environmental issues and to follow relevant laws or regulations. The RFID system controls "items and information in one source" by writing information to RF tags, and barcodes/2 dimensional code systems unites "information with an item" by marking data directly onto components or products. It helps to solve a variety of different problems, leading to improvement in productivity.

Quality Improvement/Traceability
- Prevent human error in the manufacturing process
- Realize history management of the manufacturing process by writing processing history/inspection data to the RF tag.
- Perform an optimal production and trace a defective product by recording manufacturing conditions, production lot number, inspection data of an individual product.
- Create an electronic Kanban system by using Kanban reader and Kanban tags.
- Introduce an individual management for components and products by marking history directly on them.
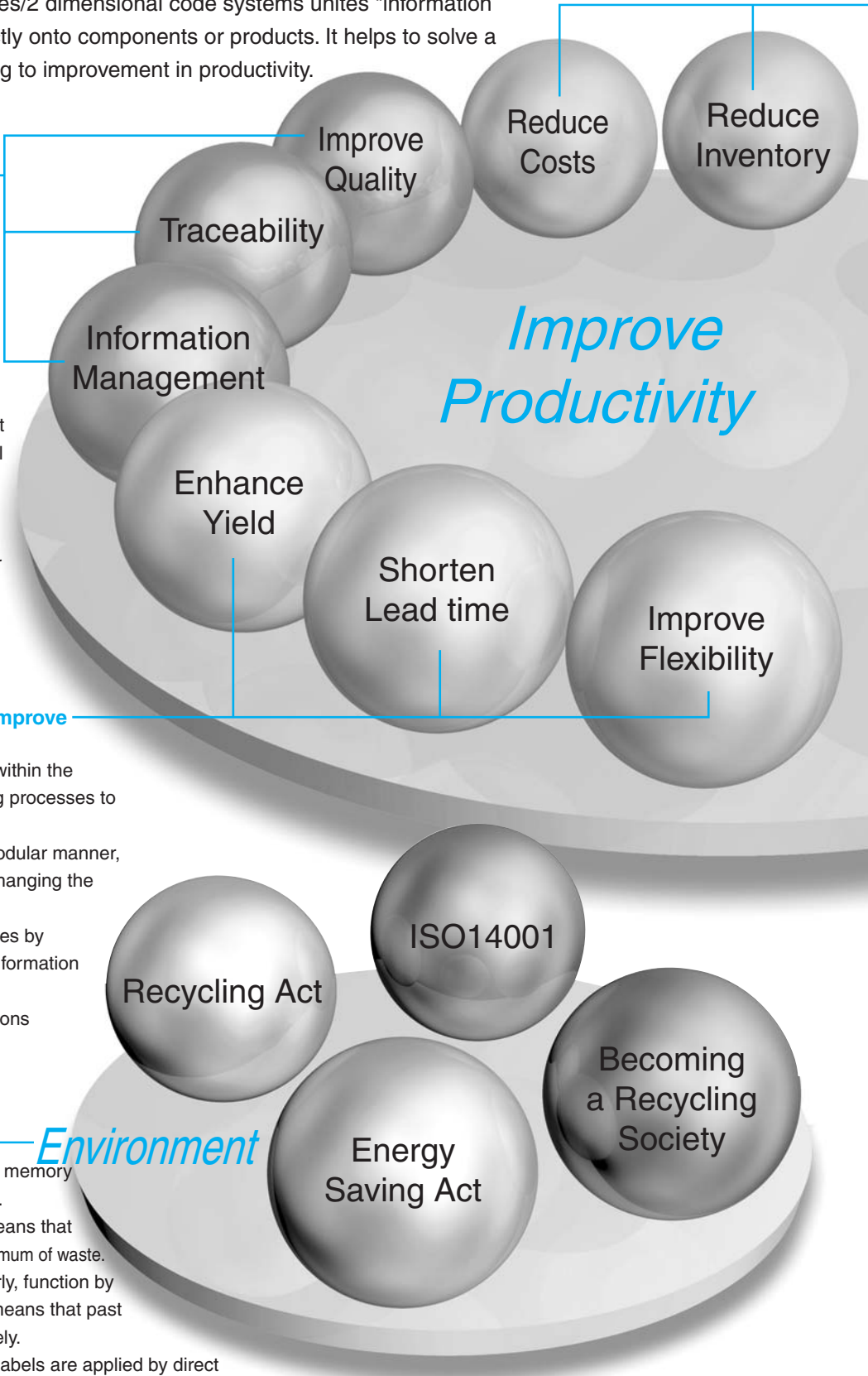
Shorten Lead Time/Enhance Yield/Improve Flexibility
- Save time by reading the product data within the RF tag and then automatically changing processes to match the information.
- By designing the production line in a modular manner, functions can be altered by adding or changing the modules.
- Improve the efficiency of repair processes by writing inspection information (simple information about failure) in the RF tag.
- Introduce a clean and paperless conditions to eliminate an yield reduction factor.

Environment
- Stop paper documentation by using the memory of RF tags for information management.
- Re-writable tags can be used, which means that the system can be implemented with a minimum of waste.
- An RFID system can be added modularly, function by function, to the current system, which means that past investments can still be utilized effectively.
- Labels and ink usage is reduced since labels are applied by direct marking, using a laser marker.

Improve Quality

Traceability

Information Management

Reduce Costs

Reduce Inventory

Improve Productivity

Enhance Yield

Shorten Lead time

Improve Flexibility

Environment

Recycling Act

ISO14001

Energy Saving Act

Becoming a Recycling Society

Cost Reduction/Inventory Reduction

● Reduce costs from loss and error due to human error (misreading information, errors in copying etc).
● Cater for the various needs of the product by placing classification data on the RF tag.
● Use of RF tags for part supply system.

Reduction of Line Numbers/Facility Management/Investment Reduction

● Lines can be used most efficiently by creating multi-product lines that can switch between processes based on quality information.
● By classifying information, there can be a realization of load reduction for the host and fast start-up for the line (simplification of tracking processing, error processing, interrupted processing etc.).
● Maintenance needs can be anticipated through the management of information such as the number of items remaining and processing history.
● The quality of facilities can be improved by storing facility information and maintenance history on RF tags.

Borderless
Part Procurement

Facility
Management

Investment
Reduction

Reduction of
Production Line

ISO9001

HACCP*

ISO/TS16949

GMP*

PL Law

Regulatory System

Regulatory System

● By writing quality information to RF tags, quality can be managed for products on an individual basis.
● Quality history can be automatically managed without the need to implement an expensive new system.
● By automating as much as possible with an RFID system, the cost of labor, materials and money required for HACCP and GMP compliance can be reduced to a minimum.
● Historical information can be managed through direct marking of products.

※HACCP: Hazard Analysis Critical Control Point
※GMP: Good Manufacturing Practice

■ RFID that is built-in Equipment/Systems

● Designing work is simplified by using functional modules that are simple and independent.
● Design can be made on a functional module basis.
● There are no wires between modules, making it easy to assmble/disassemble on site.
● Costs can be reduced through the standardization/cooperation of functional modules.
● The simplification of processing leads to a reduction in the need for debugging.
● Partial adjustments to individual modules is also possible, so assembly and adjustment can be carried out together, which leads to more efficient on-site work and a reduction in man-hours.

Points for Success!

Don't Implement Just for the Sake of Having an RFID System

- RFID is "a tool for solving problems". The purpose isn't to "implement RFID" but to "solve problems".

- It is important to clarify problems that you expect RFID to solve. If they cannot be found, it is unlikely that the implementation will be effective. That is why it is so important to understand what is happening on site.

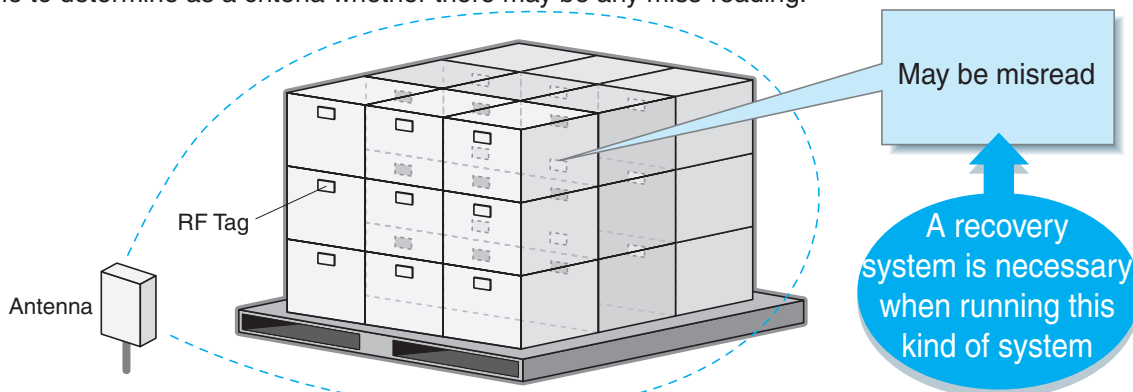Ubiquitous Society Implement RFID ➡ We have to have one too
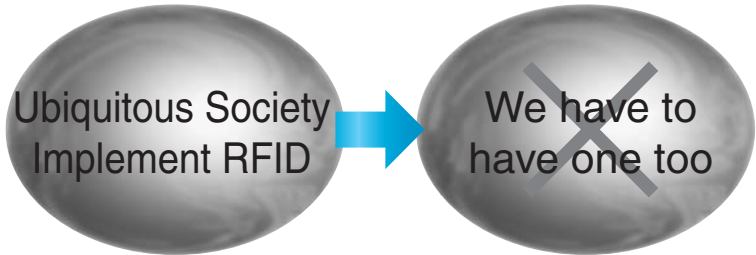
Effectively Use the RFID and Barcodes Together

- The automation process can be performed with the RFID, but it is best to use the "visible barcodes" in human involved processes.

- Barcodes and 2 dimensional codes are ascerained information. That is why they are so good for the management of individual parts and products. However, when treated as a group, the Combination of components will change each time.

Individual Management

4 001 2347

Barcode   2 dimensional code

Group Management

RFID

RF Tag   Antenna
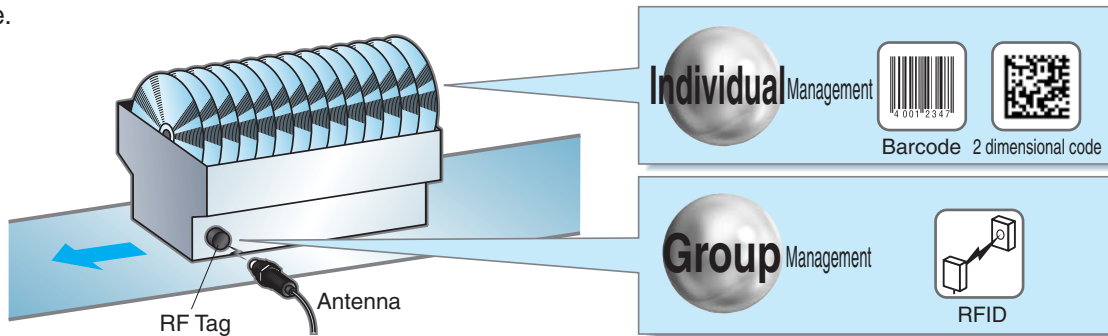
The Multi Access (Anti Collision) Function is not always perfect

- One of the attractions of the RFID, the "Multi Access Function (a function which allows access to multiple tags that are in front of the antenna)" can result in reading errors depending on the environment and the quality of the items in question.

- To make best use of the multi access function, the number of items should be checked in advance so that it is possible to determine as a criteria whether there may be any miss-reading.

May be misread

A recovery system is necessary when running this kind of system

RF Tag

Antenna

1 Evaluation of Problems

- If the loss cost on site is evaluated and understood, at least the investment cost can be estimated. Further, by investigating how to achieve a little extra from operations, it is possible to make the investment even more effective.
- First, it is important to make sure that you fully understand any problems occurring on site.

2 Investigating Management Information

- It is important to clearly define which information should be contained in the tag and which should be managed by the host. Basically, it is most effective as long as the information that is necessary in real time for on-site processing is contained in the tag.
- Since tags are subject to malfunction, a back-up data should be held in a batch on the host in case of emergency.

3 Selecting Optimum Methods and Understaning the Conditions

- It is important to understand the application and the operating conditions and select the optimal system and model for that conditions.
- It is very important to understand the operating conditions prior to installation and take into account such factors as the influence of metals, the influence of noise and reflectiveness, interference between antennas, and the influence of radio signals etc.

4 Prioritize Reliability over Cost for RF Tags

- The ability to withstand the environment will differ depending on the RF tag. For FA, by selecting an RF tag model purely on the basis of cost, the chances of failed implementation will be high.
- Less reliable RFID by which oil or heat may cause miss-reading and a line stop cannot be used for FA, so caution should be taken in selection.

5 Importance of Error Processing

- Even for RFID which has a high transmission reliability, there may still be miss-readings or malfunctions. Therefore, for most RFID devices, a response is added and transmitted to the host, giving the processing results at the time of transmission. By processing this response at the host, it is possible to analyze the problem that has been found on the site.
- RF tags are limited in the number of times that they can be re-written, and also in their battery life.By monitoring these things on the system, it is possible to create a 'facility without line stop'.

6 Recognition of Laws and Exporting Conditions etc.

- When using RFID in Japan, this is governed by the Japanese Radio Act, and it is necessary to confirm which portion of the Radio Act the device corressponds to, and whether or not it is necessary to apply for a wireless license.
- When exporting or using RFID except Japan, it is requested to follow the relevant laws in relation to radio transmission in each country. Also, since radio laws do not have conformity, it is important to confirm in advance the authority to use the device in question with the manufacturer.

Data Matrix ECC200

The relationship between symbol size (number of cells) and the amount of information is shown on the right. The following sample shows a 12 × 12 symbol size.

12 Cell

12 Cell
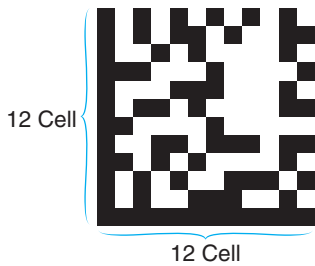
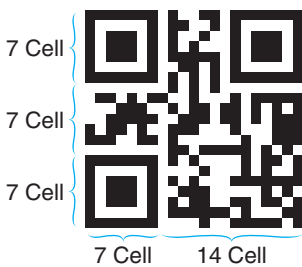| Symbol Size	Max. amount of information that can be expressed ∗1				
	Numbers	Alphanumeric Characters	Alphanumeric Symbols	JIS8 Characters	Chinese Characters (Shift JIS)
10×10	6	3	3	1	-----
12×12	10	6	5	3	1
14×14	16	10	9	6	3
16×16	24	16	14	10	5
18×18	36	25	22	16	8
20×20	44	31	28	20	10
22×22	60	43	38	28	14
24×24	72	52	46	34	17
26×26	88	64	57	42	21
32×32	124	91	81	60	30
36×36	172	127	113	84	42
40×40	228	169	150	112	56
44×44	288	214	190	142	71
48×48	348	259	230	172	86
52×52	408	304	270	202	101
64×64	560	418	372	278	139
8×18	10	6	5	3	1
8×32	20	13	12	8	4
12×26	32	22	20	14	7
12×36	44	31	28	20	10
16×36	64	46	41	30	15
16×48	98	72	64	47	23

QR Code Model 2

The relationship between symbol size (number of cells) and the amount of information is shown on the right. The following sample shows a 21 × 21 symbol size.

7 Cell

7 Cell

7 Cell

7 Cell   14 Cell

Symbol Size (Version) ∗2	Error Correction Level	Max. amount of information that can be expressed ∗1			
		Numbers	Alphanumeric Characters (Capital only)	JIS8 Characters	Chinese Characters (Shift JIS)
21×21 (Version 1)	L (7%)	41	25	17	10
	M (15%)	34	20	14	8
	Q (25%)	27	16	11	7
	H (30%)	17	10	7	4
25×25 (Version 2)	L (7%)	77	47	32	20
	M (15%)	63	38	26	16
	Q (25%)	48	29	20	12
	H (30%)	34	20	14	8
29×29 (Version 3)	L (7%)	127	77	53	32
	M (15%)	101	61	42	26
	Q (25%)	77	47	32	20
	H (30%)	58	35	24	15
33×33 (Version 4)	L (7%)	187	114	78	48
	M (15%)	149	90	62	38
	Q (25%)	111	67	46	28
	H (30%)	82	50	34	21
37×37 (Version 5)	L (7%)	255	154	106	65
	M (15%)	202	122	84	52
	Q (25%)	144	87	60	37
	H (30%)	106	64	44	27
41×41 (Version 6)	L (7%)	322	195	134	82
	M (15%)	255	154	106	65
	Q (25%)	178	108	74	45
	H (30%)	139	84	58	36
45×45 (Version 7)	L (7%)	370	224	154	95
	M (15%)	293	178	122	75
	Q (25%)	207	125	86	53
	H (30%)	154	93	64	39
49×49 (Version 8)	L (7%)	461	279	192	118
	M (15%)	365	221	152	93
	Q (25%)	259	157	108	66
	H (30%)	202	122	84	52
53×53 (Version 9)	L (7%)	552	335	230	141
	M (15%)	432	262	180	111
	Q (25%)	312	189	130	80
	H (30%)	235	143	95	60
57×57 (Version 10)	L (7%)	652	395	271	167
	M (15%)	513	311	213	131
	Q (25%)	364	221	151	93
	H (30%)	288	174	119	74

Source   2 Dimensional Code Symbol - QR Code Specifications JISX0510

∗1. Regarding Max. Amount of Information
Even the same two dimensional could have different data amount depending upon their symbol size.
In other words, if the amount of data increases, the the symbol size must also increase. Also, in terms of the information handled by the code, the maximum allowable amount of information could depend on the used characters font. The maximum number of characters for the same sized symbol changes in QR code and Data Matrix in such orders as "number only">"number and alphanumeric characters">"Chinese characters".

∗2. Regarding Version (QR Code)
The number representing the symbol size is "version" in QR Code . Version one is minimum and defined by number of cells in one side of square 21 × 21, and as the number of cells increase the version number also increases.