Discussion Paper

Issues to be Addressed in Discussions on a Certificate

- Verifying Effectiveness -

Mikihiko WATANABE, Yuki NANJO and Riichiro OKAWA

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Note

This paper represents the findings of a study commissioned to the Japan Research Institute, Ltd. (JRI) by the Bio-Industry Division, Manufacturing Industries Bureau, Ministry of Economy Trade and Industry (METI) of Japan and the Japan Bioindustry Association (JBA). The opinions expressed in this paper are those of the authors only and do not represent the official views of JRI, METI or JBA. It should be emphasised in particular that this paper in no way represents the views of any party to the CBD.

Version

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Summary

The objective of this paper is to propose issues that should take priority in discussions on a certificate, so that discussions on the international regime proceed in an appropriate manner on the basis of discussions on an internationally recognized certificate of origin/source/legal provenance. In the pages that follow, the authors objectively analyse certificate discussions to date, provide information that focuses on questions of effectiveness and, as conclusions, identify priority issues. The paper also contains information regarding related matters deemed to be useful.

We consider issues in the certificate based on the report and findings of the Group of Technical Experts (GTE) (January 2007). We acknowledge that this report should be well noted. That being said, given the extraordinarily large number of items commissioned to GTE by the Conference of the Parties (COP), the timing of the commission, and the schedule of the meetings themselves, some issues still inevitably require further discussion. Thus while respecting and valuing the content of the report, we also believe that we can contribute to discussions of the certificate and an international regime by identifying matters requiring further study and examining them from an objective, technical standpoint.

Outcome A Possible rationale, objectives and the need for an internationally recognized certificate of origin/source/legal provenance

The issue here is to more concretely define the objective. Another issue is whether it is possible to expect benefits when a change is made from a situation in which there is no certificate system to a situation in which a certificate system is established; a discussion from the perspective of fundamental needs is therefore required. With respect to the forecastability of benefits, the key question will be "who benefits?" There is therefore a need to examine the scope of beneficiaries.

Outcome B Distinctions between the options of certificate of origin/source/legal provenance and the implications for Articles 15 and 8(j) of the Convention

Whether the purpose of the certificate is compliance or includes something else (e.g. facilitation of access) is an important question that deserves repeated emphasis.

Outcome C Potential characteristics and features of different options of such an internationally recognized certificate

An important issue is the scope of the resources handled and the linkage to intangible traditional knowledge and protection of biodiversity. With respect to "content and format" and "procedure," there are two important questions to be answered from the perspective of effectiveness. The first is how to create a management system that is suited

to the flow of information and goods. It will be possible to create an effective tracing/tracking system if one can rationally limit objectives and scope. On the other hand, it will be difficult to build a management system for all genetic resources. The second is whether content includes user details. Ordinary corporations, as parties accessing with good intent, will seek to obtain prior informed consent (PIC) at the time of resource access, but will be hesitant to disclose information on access to resources prior to laying open patents. New ideas are needed to solve this fundamental dilemma.

Outcome D Implementation challenges, including the practicality, feasibility, costs and benefits

Verifying effectiveness will require better definitions of the concepts of "practicality" and "feasibility," their component elements and the relationship between them. In addition, studies will also be required of "acceptability" and "efficiency" in policy decision-making. In this paper, it is assumed that "practicality" is a technical element while "feasibility" is an economic element. Assessments of practicality will vary widely depending upon the objectives, scope and management system used for the certificate. Presumably, the wider the scope the lower the practicality. For feasibility, one can begin by focusing on costs, and it is a welcome development that the concept of "transaction costs" has been recognized. Transaction costs include commonly recognized components such as "negotiation costs" for negotiations and procedures, but also the necessary "measurement costs" to assess the value of the resource and "enforcement costs" to cover risks when legal enforcement is inadequate. "Opportunity costs" are another important component in cost. For instance, loss or suspension of the opportunity to access a resource eliminates the benefits that would have been obtained from that resource during the period in which it cannot be accessed. This is an opportunity cost. Care must be taken not to lose or suspend access opportunities.

The following lessons can be drawn from a case study of forest certification. There do exist forest certification systems that are international in terms of their nature. However, at a practical level, there are many cases in which these international certifications are altered to match the content of national or regional certification systems. Forest certifications are also voluntary in nature. They each have their own clear objectives as well as corresponding standards and tracing/tracking systems. The extent of diffusion for forest certification is between four and seven percent. While the effectiveness of forest certification and the efforts of those involved merit respect, an assessment of this ratio in light of ABS certification leads to the conclusion that a certification system targeting a wider range of resources would likely have difficulty being effective, given that forest certification adoption is still less than 10% despite relatively high visibility, the fact that timber is amenable to various tracking systems, and the fact that over 10 years have passed since the idea for certification was introduced. The cost of acquiring certification tends to be higher in resource-rich countries. To put it another way, measurement costs in

resource-rich countries are high. The fact that measurement costs are high also means that transaction costs are high because they include these costs. The upper limit on the premium for certified timber on the international market (the higher price that buyers are willing to pay for certified timber) is around one to five percent.

Having outlined lessons from forest certification in light of the discussion thus far and the practicality and feasibility of certificates and/or certification in general, we propose that the following matters be prioritised in future discussions related to a certificate system.

1) In continuing discussions on a certificate, determining objectives and scope should be the highest priority. Without clarity in these areas, the discussion on certificate components cannot proceed.
2) In determining scope, the issue of effectiveness must be given adequate attention. In particular, the effectiveness of tracing/tracking systems for biological resources that cannot be packaged needs to be sufficiently considered.
3) Once objectives and scope are clearly determined, options that have the potential to achieve the objectives should be identified and organised in more concrete detail. The benefits obtained through fulfillment of the objectives and the costs incurred to fulfill the objectives should be compared via a cost-benefit analysis for each option. Unacceptable options identified by the cost-benefit analysis should be excluded from consideration and the most cost effective of the acceptable options should be selected.
4) These constitute objective, fair and essential means for making objective decisions. Discussion on certificate considerations should continue so as to increase the benefit to all countries party to the convention.

1. The Objective of this Paper

The objective of this paper is to propose issues that should take priority in discussions on a certificate, so that discussions on the international regime proceed in an appropriate manner on the basis of discussions on an internationally recognized certificate of origin/source/legal provenance.

In the pages that follow, the authors objectively analyse the certificate discussions to date, provide information that focuses on questions of effectiveness and, as conclusions, identify priority issues. The paper also contains information regarding related matters deemed to be useful.

2. Review of the Discussions in the Group of Technical Experts

In this section, we consider issues in the certificate based on the report and findings of the Group of Technical Experts (January 2007).

We emphasise that the conclusions reached by the Group of Technical Experts should be well noted. The Group conducted its discussions "without prejudice" and produced the report as the outcome of its deliberations. It should be respected as an outcome of the formal negotiation process on the Convention on Biological Diversity (CBD). That being said, given the extraordinarily large number of items commissioned to the Group of Technical Experts by the COP, the timing of the commission and the schedule of the meetings themselves, it is only natural that there are some outstanding issues.

Thus while respecting and valuing the content of the report, we also believe that we can contribute to discussions of the certificate and an international regime by identifying matters requiring further study and examining them from an objective, technical standpoint. Our discussion below follows the "outcomes" of the report.

Outcome A Possible rationale, objectives and the need for an internationally recognized certificate of origin/source/legal provenance

Summary of content

Outcome A is described in paras. 2-6. There is no explicit statement of whether it constitutes "rationale," "objective" or "need," but it clearly states the need for the fundamental certificate. It says that national law is unable to guarantee the sharing of resource benefits across borders. 12 objectives that are thought to cover the concerns of the Parties were identified. Related wording can also be found in para. 46 of Outcome D.

Issues

The mandate of the Group of Technical Experts includes studying the options of the certificate, and it necessarily follows that the meeting produced a report that takes the existence of a certificate system as a given and discusses the options. We value it as such.

On the other hand, there is a remaining issue of comparing circumstances with and without the certificate, and discussion of this issue will contribute to the overall

discussion of an international regime. The fundamental question here is whether we are able to expect benefits when the transition is made from a situation in which there is no certificate system to a situation in which a certificate system has been established. Discussions need to move forward from this basic perspective, and it would be desirable to have concrete calculations of expected benefits. Calculations are particularly required from the perspectives of "rationale" and "need."

There is one issue of particular import in expecting benefits: Who benefits? Discussions of resource access frequently consider corporations to be the users of resources, but it is consumers who are the ultimate users. This distinction needs to be made when calculating expected benefits because the concept of "surplus" is closely intertwined with "benefit." The introduction of an appropriate system will presumably encourage access, reduce resource prices and generate a consumer surplus. In such a situation, even if the increase in financial benefits to companies as resource suppliers and resource users are not all that large, the system still has social benefits if through the spread of resources it generates a consumer or social surplus. That is why it is necessary to consider our answer to the question "who benefits?"

Another issue is to more concretely define the objectives. The following factors (for example the scope of resources handled, the design of the system, the expected benefits etc.) will all be influenced by the objectives.

Outcome B Distinctions between the options of certificate of origin/source/legal provenance and the implications for Articles 15 and 8(j) of the Convention

Summary of content

Outcome B is described in paras. 7-8. The concept of a "certificate of compliance" is increasingly at the centre.

Issues

Whether the purpose of the certificate is compliance or includes something else (e.g. facilitation of access) is an important question that deserves repeated emphasis.

Outcome C Potential characteristics and features of different options of such an internationally recognized certificate

Summary of content

Outcome C is described in paras. 9-39. This is the outcome covered in the greatest detail. Paras. 9-14 contain general content, following which the report takes up, in order: nature, scope, content and format, procedure and consequence of infringement. There are proposals for specific certificate procedures in the "content and format" and "procedure" sections.

The following points are of particular note.

1) Para. 10 (the range of genetic resources), a para. 17 (exemption) and para. 20 (demarcation): The opinion expressed in these and other paragraphs that the scope of the certificate should be limited or taken into account is valuable for the increase that it will provide in the specificity and effectiveness of the certificate.

2) Para. 19: This and other paragraphs deserve praise for noting the difficulty of handling the certificate for intangible traditional knowledge. Having repeatedly emphasized the need to take into account the traditional knowledge of indigenous peoples or local societies, we would like to point out the large impact that the handling of intangible traditional knowledge will have on the effectiveness of the certificate because of the sharp increase in transaction costs that will result.

3) Para. 12: This paragraph contains an extremely important perspective on linking benefit-sharing, conservation and sustainable use of resources. This is because if the sharing of benefit, from genetic resources is encouraged, then the most realistic process is for a certain percentage of the use value and option value of resources *in situ* to be discounted by the present value of the ultimate benefit and returned to the suppliers of resources so as to prevent resource utilization that is destructive of the site containing the resources and irreversible loss of them. It is possible to construct the certificate mechanisms linked to these concepts, but only if the scope of the certificate is extremely limited.

4) Para. 9: This paragraph clearly states that derivatives could be included, which is an issue that must be discussed very carefully and cautiously going forward.

Issues

In light of the extremely broad range of discussions in Outcome C, we will identify issues according to different categories of content.

1) General

One issue to be studied is specific ways to further limit the "range." As suggestions for limitations or organization there are:

- **Commercial use/Noncommercial use**
- **Corporate user/Public agency user**
- **R&D use/Product as ordinary material**
- **Reproducible/Non-reproducible (pulverized etc.)**
- **Exclusion of resources subject to restrictions and other conventions (for example, ITPGR)**

Other approaches to categorisation and restriction are also possible.

2) Nature

The report discusses a "dichotomy" between "mandatory" and "voluntary," but there are other options. One effective concept is that of a "de facto standard." In other words, from the perspective of effectiveness, there does not necessarily need to be a dichotomy in legal nature.

A de facto standard is not mandatory. In prior examples of "access and benefit-sharing" (ABS), that which can be used in each field of use automatically spreads as the de facto standard and the need for intervention by international law is minimized. What should be clearly guarded against here is the potential for monopoly, though the issues raised by, for example, a de facto standard in personal computer operating systems, will not be engendered in this area. We would like to identify this as an important issue requiring full study.

3) Scope

The scope question needs to be thought through in conjunction with the concept of range.

4) Content and format and 5) Procedure

Given the linkage between content and format on the one hand and procedure on the other, we will deal with them together. Figure 1 attempts to organise the conclusions found in the report of the Group of Technical Experts. Discussions of content and format must proceed with particular care because they will directly impinge upon the design of a certificate system. There are two issues of import from the perspective of effectiveness.

The first is how to create a management system that is suited to the flow of information and goods. For instance, if the scope of the certificate is limited to the patent system, it is possible to create a system using the "unique identifier" commented on in the report. However, if the scope includes other uses and resources, the system will need to be adapted to the flow of goods and information. In other words, a tracing/tracking system[1] will be required. The costs will be enormous in such a situation and, as noted above, there will need to be a comparison of the objectives in introducing the certificate and the expected benefits. It will be possible to create an effective tracing/tracking system if one can rationally limit objectives and scope.

[1] The term "supply chain management" could be used without any essential change in the discussion.

Figure 1 Envisioned Procedure of the Certificate

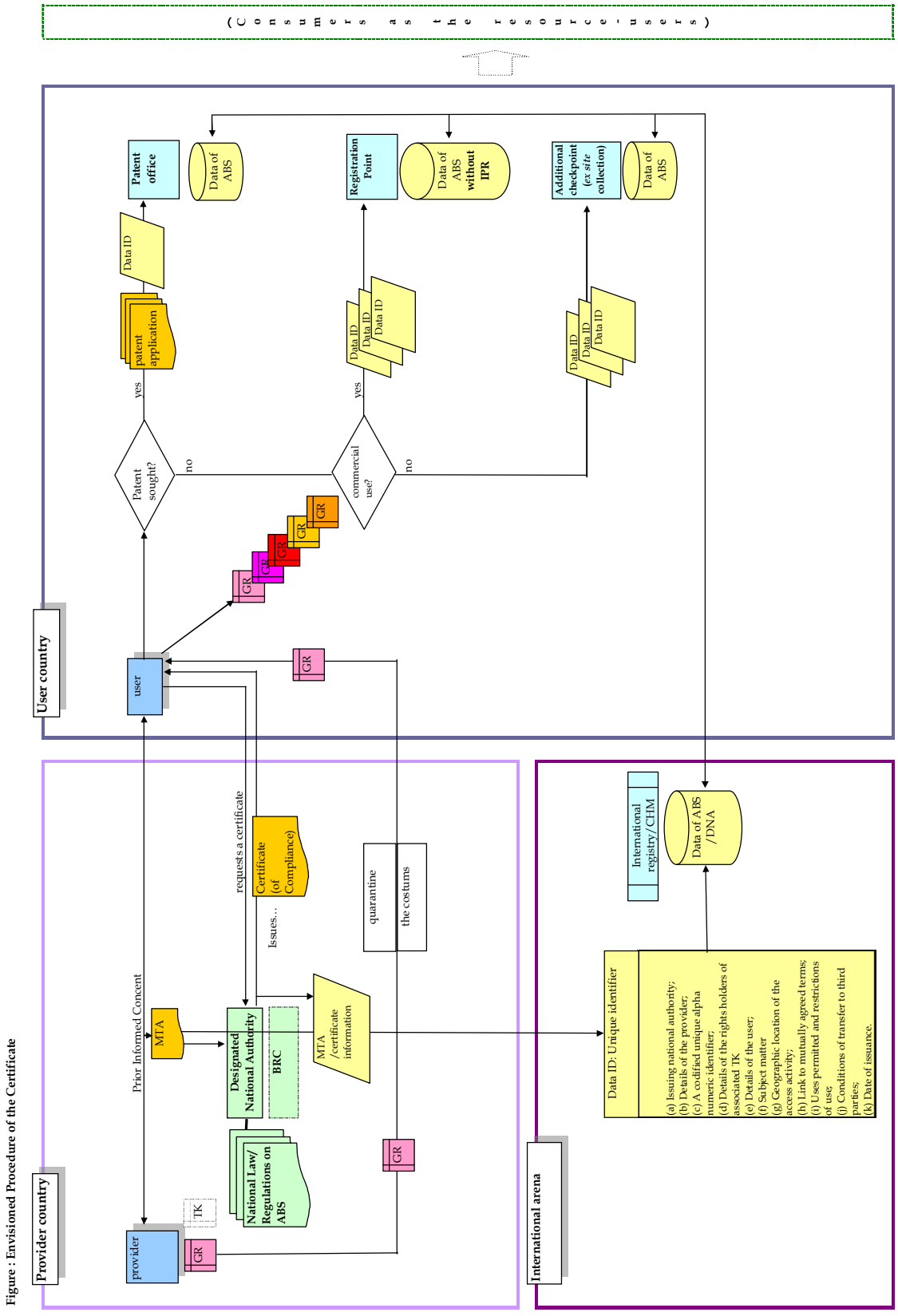

Figure : Envisioned Procedure of the Certificate

GR: genetic resources

The second important issue is whether content includes user details. This will be an impediment for the commercial use of resources and runs the risk of blocking access. Ordinary corporations, as parties accessing with good intent, will seek to obtain prior informed consent (PIC) at the time of resource access, but will be hesitant (or refuse) to disclose information on access to resources prior to laying open patents. New ideas are needed to solve this fundamental dilemma.

6) Consequence of infringement

This is not particularly problematic, but the establishment of punitive measures may cause participants to withdraw from the system,[2] so care is needed from the point of view of effectiveness.

Outcome D Implementation challenges, including the practicality, feasibility, costs and benefits

Summary of content

Outcome D is described in paras. 40-48. The term "transaction costs" is used frequently, which we interpret as a high degree of awareness of the importance of costs on the part of the technical experts.

Issues

The essential issue is to confirm the effectiveness of the fundamental certificate. Effectiveness will depend to a great extent on the objectives and scope of the certificate. Particular measures may or may not be effective for particular objectives or scopes.

Confirmation of effectiveness will, as a first step, require better definitions of the concepts of "practicality" and "feasibility", their component elements and the relationship between them. Once elements have been defined, they will require individual study. If cost concepts (described below) are correctly understood, they will need to be concepts of efficiency and, in the context of policy decision-making, acceptability, so these areas must also be addressed.

The fundamental issue in the certificate discussions is to think through the concepts of costs and benefits as they relate to the certificate and to arrive at numerical values for those that can be calculated so as to make an objective assessment. At the very least, the discussions in the Group of Technical Experts made frequent use of the term "transaction costs," which we take as indicating an appropriate increase in awareness of the importance of costs. However, the awareness of transaction costs will require some

[2] Though the political and technical background is completely different, we would note that in the negotiations of the Kyoto Protocol for the United Nations Framework Convention on Climate Change, there was a discussion of punitive measures for failure to achieve protocol targets and repeated comments about the risk of signatories withdrawing from the protocol if the punishments were too strict.

correction if costs are to be accurately calculated. There appears to be little cognizance of opportunity costs, which play an important role, so the experts in costs and other economic factors will need to take the lead in correctly recognizing and studying this point. There will also be wide variance in benefits depending upon the objectives, criteria and methods of calculation. At the risk of repetition, the discussion must return to the issue of defining objectives and scope.

3. Issues in Effectiveness

This section focuses on the issue of effectiveness within the items identified above to provide more detailed discussion. While there are no established definitions of practicality and feasibility or their relationship to each other, for our purposes we will assume that practicality is a technical element while feasibility is an economic element. We will present the degree of effectiveness for issues in accordance with information obtained to this point.

3.1 Practicality Issues

To examine in more detail the outstanding issues from the report of the Group of Technical Experts described above, we will focus on the technical aspects of effectiveness based on rationale from the case studies described below.

1) Objectives

Practicality will change according to the objectives of the certificate. The table below attempts to predict the degree of practicality for different options. Objectives must be finalized in order for these degrees of practicality to be achieved.

Table 1 The Degree of Practicality

Objective	Degree of practicality	Remarks
Compliance	Unclear (depends on system)	We anticipate practicality if the system is limited to patents.
Facilitation of access	Unclear (depends on system)	

It is difficult to determine practicality until the objectives are articulated and the resulting scope and system defined. The kind of information required at the time the certificate procedures are initiated will differ according to the objective, and therefore effectiveness will differ as well.

There is, however, one exception. We anticipate the system to be practical if it is limited to patents. That having been said, this exception is unlikely to be accepted unless two criticisms can be avoided. The first criticism is that the objective has been limited to patents even though there are many uses of genetic resources outside the patented scope.

The second is a criticism of the introduction of a patent system into the CBD arena. If the discussion is limited to patent systems, the proper arena(s) might be other organizations, such as WIPO.

2) Scope

Scope cannot be decoupled from objectives, but practicality will differ widely depending upon the scope.

Table 2 Scopes and the Degree of Practicality

Scope	Degree of practicality	Remarks
Commercial use	Depends on use	Users will comply, but will not wish to disclose information until the patent has been obtained
Noncommercial use	Somewhat high	However, management imposes heavy work burdens It is possible to "design" management systems, but the actual work burdens will be extremely heavy
User is corporation	Depends on use	Users will comply, but will not wish to disclose information until the patent has been obtained
User is public agency	Somewhat high	However, management imposes heavy work burdens It is possible to "design" management systems, but the actual work burdens will be extremely heavy
Research and development	High	We are informed that PIC has been implemented and information is managed; therefore, it is "technically" possible However, there is also the dilemma commented on above of the high degree of non-public information

Product as ordinary material	Depends on the scope	It will depend on whether equipment for physical management can be installed Closely related to cost
Reproducible	Low	It is difficult to attach "tracing mechanisms" if the resource is reproducible (See case studies)
Non-reproducible (pulverized etc.)	Somewhat high	In particular, there is a high degree of practicality if packaging methods are constant and "tracing mechanisms" can be attached
Intangible resource	Extremely low	Management is impossible unless the resource is tangible and standardised

We rated practicality "somewhat high" if the scope was noncommercial use and public agencies, and our rationale for doing so was that traffic would be lower than for commercial use. However, in an interview with the Plant Gene Bank, we were informed that people at the working level anticipated heavy work burdens for the management of additional information. It is therefore physically possible to provide management, but not without adding staff and infrastructure. In other words, the management system is practical, but actual operations perhaps not so. This will need to wait for a determination of feasibility from cost data.

A point should be raised regarding categorisation according to commercial/noncommercial use or corporate/public agency use: the definition and scope of commercial use. For example, a corporate actor seeks to make profits, but may also include basic research functions that are of a noncommercial nature. Similarly, a university may be a public institution that engages in research and development, but it is common for universities to originate enterprises from their findings or to enter into joint ventures with corporations and engage in commercial activities. There will be many cases in which use by a public agency is not necessarily noncommercial. Care will therefore need to be taken in employing form of use as a means of categorisation.

3) Management system

The practicality of the management system will vary depending upon how the objectives of the certificate are defined and what the system's scope is.

Table 3 Management Systems and the Degree of Practicality

Scope	Degree of practicality	Remarks
Management of information only	Somewhat high	Problems with the reliability of individually-input information Criticism of the appropriateness of the system itself Technically practical, but will experience constraints in terms of burdens on the operational side
Tracking of all resources	Low	It is possible to "design" a system to manage all resources However, there are intractable problems with practicality on the operational side; in particular, there is the issue of the supplying country's capacity to input resource property information
Tracking of a limited scope of resources	Unknown; will depend on scope	The physical requirements will be that the resource be packagable and non-reproducible

Below is the rationale for our assessments of the effectiveness of options based on information obtained to date.

According to information from a company with expertise in tracing and tracking systems, there will be a major burden for the input of the initial information required by the system. In practical terms, this will mean printing out codes in relevant countries and regions and using readers to read them. In the opinion of this company, questions remain about the capacity of countries supplying genetic resources in particular to maintain organisations manage information and conduct the printing/reading work.

According to the report of the Group of Technical Experts, it will be resource-using countries that first pull the trigger on the certificate, but it will be necessary first for countries supplying resources to formulate their national laws and input and manage information suitable to the certificate when they are requested to issue certificates. It can be anticipated that this will impose burdens on resource-supplying countries. This is a point that will have fundamental influence on effectiveness.

Information input is not a one-off process. Each time the form (including packaging) of a resource changes, and each time the owner of the resource changes, new information must be input. This work will have to be done by both resource-using countries and

resource-supplying countries. For example, if a plant resource's ownership changes every time the resource moves within the resource-supplying country, inputting all of that information will impose heavy burdens.

3.2 Feasibility Issues

On the economic side, it is necessary to think through issues of costs, benefits and assessment criteria. We welcome the fact that discussions to date have shown an increasing awareness of the importance of cost. On the other hand, we also note that costs are not recognized correctly and that important cost concepts have been undervalued. These points require correction. We summarise the main issues below.

1) Concept of cost

The table below illustrates the concept of cost.

Table 4 The Concept of Cost

1. Costs	1.1 Variable costs
	1.2 Fixed costs (initial investment)
	1.3 Sunk costs
2. Transaction costs	2.1 Negotiation costs
	2.2 Measurement costs
	2.3 Enforcement costs
3. Opportunity costs	(Foregone benefits)
4. Decrease in corporate value	
5. Marginal costs	（Additional costs, incremental costs）

First, the concept of "cost" itself is not particularly problematic when used in the manner generally understood. The Group of Technical Experts and the report use "cost" to describe the necessity for infrastructure enhancements in conjunction with certificate systems, and that is appropriate usage.

Transaction costs must be given adequate consideration. The term "transaction costs" appears frequently in the GTE report. This is based on the recognition that costs will be incurred by negotiations until agreement on a certificate is reached, and the concept itself is a welcome development. However, as indicated in table above, transaction costs are made up of three different concepts/components.

1) **Negotiation costs**: Negotiation costs correspond to the cost recognized by the Group of Technical Experts. They are the costs required for negotiations. The longer and more complex the negotiation process, the higher the negotiation costs.
2) **Measurement costs**: Transaction costs also include measurement costs. In the context

of genetic resources, measurement costs are the costs required to measure resource value. As is well known, measurement of resource value *in situ* does not necessarily mean that systematic means to do so have been established. Nevertheless, if the certificate is made mandatory, resource value will have to be measured in order to acquire it. Costs for this purpose are measurement costs.

3) **Enforcement costs**: Transaction costs further include enforcement costs. Enforcement costs are the costs required to guarantee the outcome of a transaction in the case the transaction is conducted in a country where legal enforcement is weak. This type of cost is generally impacted by the country's legal infrastructure and effectiveness.

As suggested here, transaction costs entail more than just negotiation costs and initial infrastructure. Transaction costs tend to increase when they are understood correctly, and this point will have an impact on discussion outcomes.

Opportunity costs are extremely important, not only to certificate discussions but also as a problem for ABS as a whole. An opportunity cost is defined as a foregone benefit. In the context of genetic resources, opportunity costs refer to the benefits that had been obtained through access to a resource that are lost when access to that resource is restricted. To put it another way, when a benefit can no longer be obtained for a given reason, the state of affairs must be understood not simply as a lost benefit but as an opportunity cost.

What is important in the context of a certificate system is that even supposing that an appropriate system is established and the discussion shifts to future implementation, this process will take time. If the current system is promoted, however, system implementation will not take much time. Even supposing that benefit allocation increases under a new, appropriate system, the opportunity costs incurred during the time until the new system takes effect may be greater than the benefits ultimately brought about by introduction of the system. In particular, future benefits are discounted to net present value (NPV), so the more time that it takes, the greater the possibility that opportunity costs will exceed benefits. This point is extremely important in the context of certificate discussions. It is very important to consider the fact of restricted access until certification implementation and the concept of opportunity costs caused by this.

Another cost that must be considered is potential declines in corporate value caused by damaging rumors. Companies can lose value simply by a third party asserting that they are using resources improperly.

Marginal costs are also a concern. Ideally, they need to be accurately assessed, but when it is impossible to obtain accurate figures, there is no need to fixate on them. An accurate

understanding of the concept is sufficient.

2) Concept of benefits

The concept of benefit is usually considered in terms of monetary and nonmonetary benefits. However, additional clarification will be required in order to understand the economic aspects of the certificate.

For example, if business opportunities increase as a result of receiving a technology transfer and incomes increase for society as a whole, that would be a benefit. This benefit is not necessarily included in the actual MTA. In addition, money is not actually received. However, the benefit does really occur. To be precise, such benefits are benefits through economic appraisal. In the context of the CBD, however, what are called monetary benefits are benefits through financial appraisal.

Another important issue related to benefits is who receives them. If transaction costs incurred by certification procedures are passed on to consumers, the social benefit decreases. This cuts to an issue that has been tacitly discussed thus far, the issue of whether to consider companies and research institutions as resource users or whether to also include consumers. Effectiveness that takes into account costs and benefits will vary substantially depending on how this issue is decided.

4. Issues in Effectiveness – A Case Study of Forest Certification

This section will take up existing forest certification as a case study. Forest certification is justified as a case study, because 1) forest certification systems currently exist, 2) the ultimate form certification takes is timber labeling and timber is a botanical resource, 3) compliance is an important component (that is to say, certification requires that the timber was not logged illegally), 4) there are empirical data in terms of effectiveness and costs and benefits, and 5) allocation of the costs and benefits of acquiring certification has been a point of contention. At the same time, in using forest certification as a case study it should be noted that 1) the original goal of forest certification is sustainable forest management, not benefit-sharing like the ABS problem under the CBD, and 2) parties acquiring forest certification are not likely to acquire patents on derivative products.

4.1 Description of Forest Certification

■Concept and Basic Characteristics

The objective of forest certification is sustainable forest management, a concept that can be traced to the Forest Principles, which was adopted at the Rio Earth Summit (United Nations Conference on Environment and Development) held in 1992. The attempt to develop indicators and standards for sustainable forest management emerged out of the Helsinki Process and Montréal Process. International nongovernmental organizations also developed certification systems to counter rapidly occurring deforestation. The basic characteristics of such systems are that they are voluntary, not legally binding, and that they entail certification, not a certificate.

The basic mechanism that forest certification hopes to bring about is outlined below.

- Certified timber is valued more highly by the market than uncertified timber (price premium).
- The existence of a price premium provides an incentive to companies to acquire certification.
- Adoption of forest certification automatically increases due to this incentive.
- Sustainably managed forests increase and the problem of deforestation improves.

This certification system is comprised of the following four components.

- Standard - the set of requirements that must be met
- Certification - the process of verifying whether the standard has been met
- Accreditation - the process of accrediting the organisations responsible for undertaking certification
- Labelling - rules for applying labels to show that products contain timber from certified forests

What is important here is that these components are based on the two concepts of forest management certification and chain of custody certification. What is important in the context of ABS certificate discussions is that an accreditation body is necessary and that there is an inevitable need for traceability for chain of custody.

■Current Forest Certification Schemes

Forest certification systems are numerous and include international schemes, regional schemes and national schemes. Major certifications are included in the table.

Table 5 Forest Certification Schemes

Name	Characteristics
ISO14001	Technical report 14061
Forest Stewardship Council (FSC)	Applicable to all countries Organised by initiative of WWF Consists of 10 principles and 56 standards Asia-Pacific countries with FSC national working groups and/or developing FSC national standards include PNG, Viet Nam, New Zealand, China, Australia and Japan
American Forest and Paper Association, Sustainable Forestry Initiative (AF&PA SFI)	Established by AF and PA External accreditation body in necessary SFM is a goal
Pan European Forest Certification (PEFC)	Established by German initiative Has relationship between Helsinki processes
UK Woodland Assurance Scheme (UKWAS)	British certification Compatible with FSC
Sustainable Green Ecosystem Council (SGEC)	Japan national scheme Biodiversity and watersheds are the important elements 7 standards Includes non-timber forest products
Malaysian Timber Certification Council (MTCC)	Malaysian national scheme
Indonesian Ecolabeling Institute (LEI)	Indonesian national scheme
Australian Forest Certification Scheme	Australian national scheme

Source : Zenrinkyo ed. (2004) and data from interviews.

4.2 Practicality

This section takes up the issue of forest certification effectiveness by first looking at the extent of diffusion and then considering barriers to diffusion and implementation.

1) Extent of Diffusion

In considering the effectiveness of forest certification schemes, we will first look at the extent of their diffusion, which is part of the consideration of effectiveness.

The extent of forest certification diffusion can be organised according to several standards.
As of 2006: 270 million ha; 7% of all forest land (UNECE/FAO, 2006)
As of 2003: 150 million ha; (excluding ISO) 4% of all forest land (Iwasako and Sato, 2006)

An important point related to diffusion is that certified acreage is unevenly distributed among regions. Diffusion ratios for each region are shown in the table. What is important here is that diffusion in Europe and North America is high, while in Asia and South America, which have vast forestland, diffusion is low.

Table 6 Certified Acreage (As of 2001)

Region	Acreage	
	1,000 ha	%
Africa	974	0.1
Asia	158	<0.0
Oceania	410	0.2
Europe	46,708	4.5
North and Central America	30,916	5.6
South America	1,551	0.2
Total	80,717	2.1

Source: FAO, quoted in Zenrinkyo 2004, p.26

2) Barriers to Diffusion and Implementation

■Management Systems

Effective management systems, such as barcodes and satellite management systems, are currently in use. However, IC tags and other wireless management systems are not profitable[3]. Also, unless timber is managed from the time it is still part of the forest, the tracing system is unable to determine whether the timber strictly meets the certification

[3] Information obtained through interviews.

standard.

■Compatibility of Certification with Market Structure

One of the reasons why the diffusion ratio for forest certification is high in Europe is that a moderate price premium is expected given consumers' level of environmental awareness (sustainable timber and timber that is acquired through means other than illegal logging) due to the fact that timber is distributed as a consumer good. To a certain extent acquiring certification is compatible with the market structure for timber.

In Japan, on the other hand, government and public environmental awareness with respect to forests is high but most timber demand is for building materials, so a consumer driven price premium does not function as an incentive. Environmental awareness is high. The Green Procurement Law enacted in 2001 actually requires that government-procured timber adhere to standards for legality and sustainability. Also, as mentioned above, Japan does have its own certification scheme. However, much forest management in Japan is small in scale and proprietors are not able to bear the cost of certification. At the same time the price premium does not function as an incentive. Accordingly, the certification system itself is currently not necessarily able to utilize market functions.

■Certification Acquisition Costs

Cost has a major impact on effectiveness. (Details stated below)

- There is a trade off between examination costs and sufficiently reliable examination content. If an adequate amount is spent on examination for initial certification acquisition, standards and mechanisms can be created that will not cause a problem later when updating certification. However, parties acquiring certification that cannot afford expensive examination costs have difficulty in terms of cost.
- With respect to certification examination costs, the cost to acquire a national certification is lower than the cost to acquire an international certification. This is because international standards are quite complicated, it takes time to create forestry standards that fulfil the requirements, and there is much work involved. Another realistic factor related to certification examination cost is that there are substantial examination costs (i.e. personnel costs) for international certification experts who conduct examinations for international certification.

■ **Implementation Difficulties Faced by Developing Nations with Diverse Forest Resources**

Developing nations with diverse forest resources bear a larger burden when acquiring certification compared to developed countries. The more diverse a country's ecosystem, which is to say, the more biological resources it has, the more time preparations take to meet the standards for acquiring certification. This is because resource assessment and monitoring take more time for a forest with a diverse ecosystem than for a monoculture forest. Also, when land ownership is unclear or forestry laws are only minimally effective, acquiring certification becomes quite difficult. In the above discussion of costs, measurement cost was shown to be a component of transaction cost. Given the fact that the costs for resource assessment and monitoring discussed here correspond to measurement costs, it is evident that measurement costs for developing nations when acquiring forestry certification are at the very least too large to be ignored.

4.3 Feasibility

This section provides an analysis of the economic feasibility of forest certification (i.e. costs and benefits) based on actual data.

4.3.1 Approach to Costs and Benefits

Simula, et al. (2004) categorizes costs and benefits related to forest certification as shown in the table below.

Table 7 Costs Necessary for Certification

Direct costs	External auditing	1	Initial costs
		2	Cost of surveillance audits
	Internal costs	1	Preparation
		2	Participation in the process
Indirect costs (compliance with the standard requirements)	Compliance with performance criteria	1	Forest management
		2	Ecological
		3	Social
	Compliance with management system criteria	1	Resource assessment and forest inventory
		2	Records
		3	Planning (Strategic and Operational)
		4	Monitoring

Source Simula at al (2004). Arranged by the authors

Table 8 Expected Benefits of Certification

Direct (Additional revenue)	Price premium	—
	Additional sales	—
Indirect	Monetary	1. Cost reduction 2. Avoidance of loss of sales revenue 3. Other
	Non-monetary	1. Environmental 2. Social 3. Organisational

Source: ibid.

4.3.2 Cost-Benefit Analysis

Simula et al. (2004) conducts case study research on five forest certification schemes. The research targets the following five sites, and the following table shows costs and the results of a cost-benefit analysis.

Table 9 Forest Certification Case Studies

	Total area	Annual timber production	
	ha	m^3	m^3/ha
Inpacel.Brazil.Plantation forest.	49,942	1,400,000	28.03
Cikel.Brazil. Natural forest.	140,658	80,000	0.57
DRT(PT Diamond Raya). Indonesia. Natural forest	90,656	57,177	1.59
KPKKT. Malaysia.Natural forest.	136,000	112,568	0.83
PITC. Malaysia. Natural forest.	9,000	10,000	1.11
Total	426,256	1,659,745	32.13

Source ibid.

Table 10 Certification Costs Over 5 Year Period

(US$1,000)

	Direct	Indirect	Total	Annual Average
Inpacel	77.0	184.9	261.9	52.4
Cikel	144.6	875.5	1,020.1	204.0
DRT	215.2	2,660.7	2,875.9	575.2
KPKKT	93.6	281.6	375.2	75.0
PITC	94.6	135.2	229.8	46.0
Average	125.0	827.6	952.6	190.5

Source: ibid.

Table 11 Cost Allocation Over Time

(%)

	First year	Years 2 to 5	Total
Inpacel	38.9	15.3	100.0
Cikel	44.4	13.9	100.0
DRT	21.2	19.7	100.0
KPKKT	81.0	4.8	100.0
PITC	84.7	3.8	100.0
Average	54.0	11.5	—

Source: ibid.

Table 12 Net Present Value (NPV) of Certification

(US$1,000)

	NPV	Sensitivity analysis	
	Discount rate 12%	Discount rate 5%	Discount rate 0%
Inpacel	199.4	232.1	261.9
Cikel	-257.3	-248.3	-236.1
DRT	194.8	338.3	477.5
KPKKT	-319.7	-349.6	-375.2
PITC	-197.6	-215.1	-229.8
Average	-76.1	-48.5	-20.3

Source: ibid.

■ The following points regarding costs in these case studies are worth noting.

- Indirect costs exceed direct costs. The former includes measurement costs, which are important in the context of biological resources. For example, in the case of DRT, inventory and monitoring costs are large, US$12,766/year and US$10,476/year, respectively. The more diverse the natural resources, the higher the costs.
- Initial costs are high even if a large-scale traceability system is not implemented. High initial costs tend to make net present value (NPV) negative.
- National schemes are likely to cost less than international schemes.

■ The following points regarding benefits in these case studies are also worth noting.

- We will first look at two contrasting case studies. Cikel has a negative net present value, while the net present value of DRT is positive. In the case of Cikel, timber prices increase by as much as 30% (price premium) upon acquiring certification. However, in order to meet the requirements of certification, harvestable forestland must be restricted, which has led to increased access costs for timber and has made net present value negative. DRT, on the other hand, yields no price premium, but certification leads to a major decrease in distribution costs. The requirement that certification criteria be met has led to a major decrease in export intermediaries, and this cost reduction has functioned effectively as an indirect benefit. Net present value is positive as a result.
- In Indonesia, illegal logging has been a problem. As demand has increased for timber that has been harvested legally, plywood companies in Indonesia have decreased in number from around 200 to about 150.[4] Such trends are ultimately in sync with cost reductions under the DRT scheme.
- Price premiums occur under schemes like Cikel in the country that supplies the timber. However, the price premium in the countries that are the end-users (consumers) of the resource is extremely small. According to Veisten (2002), based on a survey of the UK and Norway, the price premium on eco-labelled wood products is no more than five percent. The median premium in the UK on wood products is 1.6%. In Norway it is one percent. This is another way of saying that a price premium cannot be expected to bring about a major increase in benefits, if the end-user of the resource is also taken into consideration.

[4] Based on interviews with major forestry companies in Japan.

5. Conclusion – Implications for Further Certificate Discussions

To conclude this paper, the following section lays out lessons learned and priority issues for discussion in future certificate considerations, based on the information on certificates/certification that has been organised and assessed thus far.

5.1. Lessons

■ **Nature**

- There exist certification schemes that are international in nature. However, at a practical level, the schemes are often altered to match the content of national or regional certification systems. Also, these schemes are voluntary in nature.
- Some certification schemes have been found to be effective. Even the domestic certification systems of individual countries have eliminated resources obtained through illegal means while the resources remain within the country.

■ **Scope**

- Each certification scheme has its own clear objectives and corresponding standards and tracing/tracking systems.
- The scope of existing certification schemes encompasses multiple resources, so if the scope of a new certificate extends to all genetic resources, then there would be overlap with existing schemes. Future discussion needs to consider the issue of redundancy with existing voluntary certification schemes beyond the exceptions provided by other conventions.

■ **Effectiveness**

- The extent of certification diffusion is between four and seven percent. This fact is interpreted differently depending on the commentator. In terms of general impressions, however, it is difficult to conclude that this figure represents widespread adoption. At the same time, experts with knowledge of the difficulty of preventing deforestation regard this figure as laudable and have expectations for further diffusion in the future. When this figure is interpreted while emphasising its suggestiveness toward biological resources targeted by ABS certification, the fact that the diffusion ratio has not yet reached 10% for certification systems related to timber products, which enjoy relatively high visibility and are readily amenable to various tracking systems (by barcodes), even though over 10 years have passed since the idea was introduced, leads one to conclude that a new system would likely face difficulty in terms of its effectiveness.

- As stated above, the reason it is often necessary for countries or regions to alter forest certification content and standards in order to conform to the characteristics of their respective resources is that natural resource characteristics, resource supply and demand structure differ substantially depending on the country. While we have avoided touching on the meaning of unified international standards, at the very least, applying such standards without alteration cannot be expected to result in a high diffusion ratio.
- A hardware-based management system is needed for a functioning traceability/tracking system. When the system is simple and requires only minimal initial investment, operating costs are higher. In contrast, when initial investment is high, operating costs are lower. This is the trade-off/dilemma of management systems. (See the Appendix.) (This is also a problem of costs and benefits.)

■ **Costs and Benefits**

- Implementing certification systems sometimes results in the occurrence of additional benefits. Implementation of a certification system can lead to improved supply chains and lower management costs. When this function of a system is effectively utilised it can become a factor that promotes access.
- Certification acquisition costs tend to be higher in resource-rich countries. This is because when there are diverse resources it takes time to create a system for assessment and meeting the requirements of certification. To put it another way, resource-rich countries have high measurement costs. When measurement costs are high, it means that transaction costs are also high, because they include measurement costs.
- The upper limit for a premium for certified timber on the international market (the higher price that buyers will pay for certified timber) is around one to five percent. Accordingly, if the higher cost per unit of certified timber exceeds five percent, there is no longer an incentive for companies to acquire certification. If companies raise prices over five percent in order to recover certification acquisition costs, the social benefit will decrease through a decrease in consumers' surplus. At the same time, the social benefit will also decrease through a producers' surplus if companies do not pass on the costs.

■ **Other**

- Third-party examination and auditing is always necessary.
- In the case of forest certification, there is close involvement with resource exporting and importing, so the need for compatibility with WTO rules (full non-discrimination) has been put front and centre. A full non-discrimination rule is essential in connection with resource access restrictions.

5.2. Priority Issues for Discussion

■ In continuing discussions on a certificate, determining objectives and scope should be the highest priority. Without clarity in these areas, the discussion on certificate components cannot move forward.

■ In determining scope, the issue of effectiveness must be given adequate attention. In particular, the effectiveness of tracing/tracking systems for biological resources that cannot be packaged needs to be sufficiently considered. At minimum, experts involved in actual systems have pointed out physical limits in management devices for biological resources. On the other hand, if objectives and scope are limited, efficient management would be possible through implementation of a management system.

■ Once objectives and scope are clearly determined, options that have the potential to achieve the objectives should be identified and organised in more concrete detail. The benefits obtained through fulfillment of the objectives and the costs incurred to fulfill the objectives should be compared via a cost-benefit analysis for each option. Unacceptable options identified by the cost-benefit analysis should be excluded from consideration and the most cost effective of the acceptable options should be selected.

■ These constitute objective and fair means for making objective decisions. Discussion on certificate considerations should continue so as to increase the benefit to all countries party to the convention.

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Appendices

Appendix 1 Cases of Existing Logistics Management Systems for Biologically-derived Products

Case study from major retailer Ito-Yokado: 5 Disclosure to customers of source information for fresh foods

Certificate technology:	QR Code (allows access to information using the camera functions on consumers' mobile telephones)
Information available:	Source, cultivation conditions etc.
Information input by:	Retailer (Ito-Yokado etc.)

Stickers printed with QR codes are affixed to the packages of vegetables etc. In stores, consumers can use their mobile telephones to obtain information on source and cultivation conditions etc.

Case study in disclosure of food producer information: "Seica Net Catalog" (http://Seica.info/)

Certificate technology:	Information is registered on an Internet site and managed with "catalog numbers"
Information available:	Producer profiles, cultivation methods, features, shipping conditions, other audio and video information etc.
Information input by:	Producers and shippers of vegetables and fruit

Seica is owned by the Organization of Food-marketing Structure Improvement, a public corporation for the promotion of improvements in food distribution under the jurisdiction of the Minister of Agriculture, Forestry and Fisheries (of Japan) and is operated as a public database jointly by the National Food Research Institute of the National Agriculture and Food Research Organization and the Computer Center for Agriculture, Forestry and Fisheries Research of the Minister of Agriculture, Forestry and Fisheries. It began operations on August 23, 2002. Currently, it contains more than 140 items of data for approximately 1700 varieties.

Producers and shippers access the Seica website to register their production/shipping information etc. Registered producers and shippers receive an 8-digit "catalog number," and distributors and consumers can use that number to access production information via the Seica site. It is hoped that this system will improve consumer confidence in fresh fruits and vegetables, enable distributors to accurately purchase the fruits and vegetables that consumers desire and provide producers with new and expanded sales channels. Searching, browsing and registration are all free.

[5] Large Japanese retailer.

There are a number of similar examples of logistics management for vegetables, fruit and seafood in Japan. Their purposes are to ensure safety and to provide brand management for places of source.

Case study from pharmaceuticals and medical equipment (including biologically-derived pharmaceuticals): Production management obligations on manufacturers of pharmaceuticals and medical equipment (Ministry of Health, Labour and Welfare (of Japan))

Certificate technology:	2-dimensional code (not the QR code and consumers are not able to access information using their mobile phone cameras)
Information available:	Production conditions (data production, place of production, production method, lot number etc.)
Information input by:	Manufacturers of pharmaceuticals and medical equipment

2-dimensional code enables hospitals and pharmacies to contact the manufacturer in the event of problems with pharmaceuticals and medical equipment.

The amended Pharmaceuticals Law requires very rigorous management, and management levels differ according to the category of product. The strictest standards are on vaccines and other "designated biologically-derived products," followed by blood plasm and other "biologically-derived products."

Appendix 2 Cases of IC Tag Systems

1) Characteristics

- IC tag systems are management systems in the RFID (Radio Frequency Identification) category. "RFID" is comprised of a tag and an antenna, and uses electromagnetic waves or radio waves etc. for wireless communications and data exchange.
- It was developed at roughly the same period of time as barcode technology, though legal restrictions on the use of the airwaves and other technical impediments to commercialization meant that it has only recently come into commercial application.
- This technology has the following features compared to other technologies:
  - (A) Non-contact reading (unlike barcodes, "IC tags" do not require that they be lined up in a certain direction and come in contact with a reader, but can be read at random from a remote location)
  - (B) Ability to simultaneously identify multiple samples
  - (C) Excellent durability
  - (D) Able to read data
  - (E) Able to store large volumes of data
  - (F) Expensive; where a barcode or 2-dimensional code like the QR code costs 1 yen per unit, RFID can cost between 20 and several thousand yen per unit)
- Vulnerable to water and metal

2) Cases

Below are some meeting cases of IT tag systems to provide an image that will aid in evaluations of suitability and effectiveness for genetic resources.

Case 1: Infectious waste management system

- Went into full operation in October 2006 at the Kamio Central General Hospital in Saitama Prefecture (of Japan).
- Hospitals are obligated to provide proper management and disposal of needles, IV needles, waste products, blood and other "specially managed waste." They cannot be treated the same as ordinary industrial waste (approx. 20 yen/kilogram) but require more expensive treatment (200-400 yen/kilogram). Hospitals must provide management to ensure that they are appropriately treated and also need to reduce the amount of such waste they generate.
- The receptacles used to recover infectious waste products contain 4 varieties of IC tag for "plastics," "bottles and glass," "needles" and "human waste." Movement information is verified at 3 points of time: 1) upon delivery to the gathering point in the hospital, 2) upon collection by the service provider and 3) directly prior to incineration at the treatment plant.
- The system goes beyond merely tracking to measure weight and density etc., taking advantage of the strengths of IC tags to accumulate data on "which units dispose of how much infectious waste in what form." This information is fed

back to units in the hospital to reduce the admixture of non-infectious waste, prevent the disposal of residual fluids in IV bags and otherwise save on treatment costs. As a result, the hospital has been able to cut its treatment costs from about 25 million yen per year to about 20 million yen.

- Units that accurately dispose of waste tend to be well organized and have few mistakes. Management of waste is therefore expected to provide a means of monitoring and improving operations.

Case 2: Next-generation zero emissions system (in pilot operations stage)

- This project was conducted by Seikisui House, Ltd. (construction byproduct collection vehicles, collection points, recycling center) between January and March 2007. The Ministry of Land, Infrastructure and Transport (of Japan) adopted the "Residence etc. Resource Conservation and Waste Reduction Technology Development" initiative as part of its "Advanced Housing and Construction-Related Technology Development Subsidy" program in FY 2006. Marubeni Corp. (and affiliates) was responsible for providing the machinery and systems.
- Sekisui House has traditionally used its own management system that sorts waste from construction sites into 27 categories and returns it to recycling centers located within the company's factories, where it is resorted into 60 categories for recycling. Effective resource utilization is something that Sekisui House has emphasized. Having developed its own waste collection and treatment system, in July 2005 the company became one of the first in the construction industry to achieve "zero emissions" of waste from factories handling new construction.
- The company has introduced a system that is even more effective in waste management.
- As part of the management process, waste products are placed in collection bags suited to the product's specifications, at which time they are affixed with IC tags to facilitate reading.
- This system makes it possible to compare the weights and volumes of waste generated at different construction sites; contractors that generate less waste are rewarded as a means of improving on-site motivation. It is also possible to forecast the amount of waste that will be generated, preventing illegal dumping.
- Finally, work efficiency improves as well because the type of waste generated will differ according to the phase of construction, which makes it possible for the company to manage the work process.
- As a result, the company has been able to reduce the average waste per house to a maximum of approximately 1 ton, roughly half conventional levels. It has also been able to reduce the per-house construction materials requirement by approximately 2.4%.
- Sites that provide appropriate waste treatment and receive timely deliveries of materials are cleaner and appear better controlled, which has earned praise from owners as well.

3) Cost

It must be emphasised that the cost will vary widely according to the scope and content of the system. The figures below are for reference only. It will be necessary to estimate the costs for application to genetic resources after finalizing the scope and content of the system.

- The IC tag itself (chip and antenna) ordinarily costs 2-12 yen/each. The "Mu Chip" from Hitachi Ltd. (approx. 0.4 mm square) is cheaper, between fractions of a yen to several yen. Where the costs are incurred is in the technology to form the tags into easily-read shapes and provide them with the needed water and weather-resistance. The IC tags used for construction waste are not mass-produced, but are still in the handmade prototype stage and cost 500-600 yen each. The IC tags for infectious waste cost approximately 120 yen each in 2006, dropping a bit to 80 yen in 2007.
- Sekisui House ultimately plans to expand the system to 150 branch offices around Japan during FY 2009, at which time it will require approximately 750,000 IC tags and 1,000 readers. It will also need scales and reading equipment at treatment plants (6 in different locations around Japan). Factoring in software development costs, the entire project is estimated to require an investment of 1 billion yen.
- The RFID market was estimated at approximately 40 billion yen in 2006, but is expected to surge to approximately 300 billion yen in 2012. Some estimates put it at 400 billion yen in 2010.

4) Implications for the certificate

Below are the opinions voiced by experts in IC tag systems.

- It will be extremely difficult to apply IC tag-based distribution systems to all biologically-derived products.
    - The current system manages waste using uniformly-shaped bags and content weight. Each bag has an IC tag attached and weight information is used to manage the waste. It is impossible to deploy a single standard for the management of all biologically-derived products. For instance, tomatoes can be in many forms: raw tomatoes, canned tomatoes, tomato juice etc. Products derived from the same biological resources are distributed in a wide variety of forms. Even for meat, it may be possible to provide management at the level of livestock units, but not at the level of cuts.
    - In the Sekisui House case, a total investment of 1 billion yen is envisioned on the assumption of 750,000 tags, 1,000 terminals and reading equipment for 6 locations. Were a system to attempt to cover all biologically-derived products, the number of products to manage would be enormous. Assuming for illustration that resource traffic volume was 100 times the Sekisui House Project, the cost would be approximately 1 trillion yen. It is difficult to believe that the system would add enough value to justify these costs. Large servers would also be required to process extremely large data volumes.
- It would be possible to use IC tags for management of a limited scope.
    - For example, IC tag management is possible for products that are distributed in a standard form such as tomatoes in cardboard boxes.

- It is technically possible to confirm the product's history when the box is opened after shipping, which will prevent the content from being changed during the distribution process.
- Government subsidies have already been used to introduce IC tag management systems for some vegetables from the perspective of food safety. As one example, tags are attached to the packaging film on lettuce and can be shown to a reader to provide a means of assessing the source and agrochemicals used.
- Pilot programs are also being run to attach tags to the distribution crates for certain varieties of seafood (squid etc.) in which location of source has become part of the brand. Though tags increase costs, the priority is on protecting the brand's quality. (Already demonstrated on the Internet level.)
- There are already systems in operation to manage trans-boundary shipments of recombinant-DNA crops.
- As commented on in CBS/WB-ABS/5/2, a web-based biological resource management system is in trial operation using a "unique identifier" system (11 data items, including "issuing national authority," "details of the provider" and "a codified unique alphanumeric identifier"). At the current point in time, it is limited to biological resources for which R&D application has been filed, but as long as the scope is limited it appears to be possible to combine a "unique identifier" with an IC tag to manage biological resources.
- IC tag systems are being introduced into book and apparel distribution because of expected efficiency gains. This, however, is merely a matter of logistics management; there would appear to be little in the way of added value.

Shifting focus to applicability to the certificate, there are several hints that can be derived, particularly from the perspective of effectiveness. On some important points, these overlap with the opinions expressed by experts.

- A "unique identifier" is merely a standardized coding system; by itself it provides no guarantee that resources can be managed. Management requires that the unique identifier be combined with a physical tracing/tracking system.
- A system that covers "all" biologically-derived resources will be extremely difficult.
- Management is, however, possible if the scope is limited. (The "practicality" aspect of effectiveness.)
- The costs are not necessarily cheap. Systems require not only the tags themselves but the hardware to check them during movement and the software for their management. Careful study will be required to ascertain whether the effects (benefits) expected from the introduction of a certificate-oriented management system are commensurate with the costs.
- The companies and businesses that have successfully introduced and operated systems are companies and businesses that already had management systems in place before the IC tag systems were introduced. In other words, if domestic law and PIC procedures are already adequate, function should be normal even if the certificate is introduced. On the other hand, the case studies from IC tags indicate that where this is lacking, it is questionable whether functioning will be normal even if systems and infrastructure are introduced.

- Leaving aside the technical considerations, the success stories all have strong incentives for use of the system. For example, in the infectious waste management system, reducing the volume of waste emitted leads to lower waste treatment costs. This provides an incentive to introduce and maintain the system. Considering overall ABS, one important point for consideration is what the incentives are for suppliers and users to introduce the certificate systems or whether incentives can be created.

Appendix 3 Cases of QR Codes

1) Characteristics

- The "QR code" is a kind of matrix-based 2-dimensional code that was developed by Denso Wave in 1994 to provide an "easily read code."
- To facilitate widespread use, Denso Wave announced that it would not enforce its rights for the patent (No. 2938338). The "QR code" has been standardized at both the national and international levels.
- While the conventional barcode contains information only in one direction, the QR code contains information in both the horizontal and vertical directions, providing a dramatic increase in the amount of information that can be recorded (from several dozen to several hundred times what can be contained in a bar code). Within the code are 3 "opening symbols" to provide for high speed reading from any direction. By expressing data in both the horizontal and vertical directions, it is able to express the same data volume with 1/10 the size of a barcode (making it possible to print the QR code in small spaces). Even smaller sizes are possible with "micro-QR codes."
- The code contains error-correction functions that make it less vulnerable to dirt and breakage. It is possible to split up encoded data for expression.
- It is not possible to add new information after the QR code has been printed. If individual precision components have been given codes, a new code will need to be printed on the module once they are assembled. Likewise a new code will be required for the finished product once all the modules are assembled. In other words, one of the characteristics of the QR code is that all of the codes are carried on in a bundle.

2) Cases

- 2-dimensional codes are already in widespread use around the world
    - In Europe and the United States, the vast majority use the US PDF417 (Symbol Corp.) or DataMatrix (CI Matrix Corp.). Each has its own strengths and weaknesses; which is used depends on the nature of the job.
    - The Japanese QR code is used in Japan, China, Vietnam, Korea and other Asian countries because it is possible to include kanji (or other non-alphabetic characters).

3) Cost

- The cost of computer systems, readers and scanners etc. is not all that different from the IC tag system.
- The biggest difference is in the cost of the code. QR codes can be attached with simple printing technology and therefore cost up to 1 yen each. By contrast, IC tags cost between 20 and several thousand yen each. Given the enormous number of products to be covered if the system is to be applied to all biologically-derived products, the price difference for the codes will have a major impact.

4) Implications for the certificate

Below are the opinions heard from QR code experts on the application of QR codes to the certificate of genetic resources.

- Will require common, standardized information
    - Global distribution management requires that systems be common and standardized: what language is used and how information is managed in the information processing generated by member countries. This is probably a very difficult task given the number of interested countries and regions.
- There are also problems with the human and technological capacity of countries and regions (particularly provider countries)
- The system will require the ability to print and read codes in all participating countries and regions. Questions remain about the capacity of countries supplying genetic resources in particular to maintain organizations for the management of information and the printing/reading work.

Appendix 4 Current Certification/Certificate Systems

The objective of this paper is not to survey existing certification systems. Accordingly, we have not provided a comprehensive survey of all certification systems. However, organising the systems that were surveyed is useful, so they have been organised and presented in the following table.

Table 13 Current Certificate/Certification Systems

Category	Name	Objective	Effectiveness	(Cost)
Food and Beverages	・ Beef Traceability System (Ministry of Agriculture, Forestry and Fisheries)	Manage distribution via individual cow certification in order to ensure food safety *Mandatory	・All organizations involved in beef distribution manage ID codes for each individual cow using 1D barcodes. Parts from the same cow are assigned the ID code for that cow. Assigning the same code to every part of the same cow ensures traceability.	1D barcodes can be created with extremely simple printing technology, so one code only costs a fraction of a yen. With respect to costs for implementation, management and operation, readers, information processing terminals, servers and other hardware account for a majority of the cost.
	・ Information provided on the place of origin for fresh food products (Retailers, etc.)	Disclosure service for customers (Ito Yokado, etc.) *Service	・Retailers enter the place of origin, cultivation conditions and other information on QR codes, and stickers with the codes are affixed to vegetable packaging, etc. ・ Consumers are able to obtain information through their cell phones at the store. ・QR codes can be created in the form of extremely small stickers, so information can included on any shape and form of packaging, etc.	QR codes are two-dimensional codes, but they can be created with extremely simple printing technology and cost less than one yen each. With respect to costs for implementation, management and operation, readers, information processing terminals, servers and other hardware account for a majority of the cost.
	・ SEICA - Produce Network Catalog http://seica.info/ (A public database owned by the Organization of Food Marketing Structure Improvement and managed by the National Agriculture and Food Research Organization's National Food Research Institute and Computer Center for Agriculture, Forestry and Fisheries Research)	Improve structure of food product distribution *Service, sales channel expansion, etc. Helps distributors supply precisely the produce desired by consumers and helps producers develop new sales channels.	・ Produce producers and shippers register information through the site and produced is managed via an eight digit "catalog number" assigned on the basis of this information. ・ Inputted information includes a profile of the producer, cultivation methods, characteristics, shipping formats, voice and video, etc. ・Distributors and consumers are able to see production information based on the code via the SEICA site.	"Catalog numbers" are communicated via the Internet and are not directly attached to the targeted produce. Use of the site is completely free of charge. Costs are incurred on the management side for system management and administration.

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Wood (as a plant)	・ISO14001 ・FSC ・AF&PA SFI ・PEFC ・UKWAS, etc.	Sustainable forest management (SFM)	・Diffusion ratio of 4-7% 10 years since idea introduced ・Certified forests unevenly distributed ・High diffusion ratios in North America and Europe, but less than 0.2% in Africa, Asia and South America, which have enormous forestland	(Discussed above)
Ornamental horticulture	・Horticulture Industry General Certification Program (MPS) (Certification system for horticulture industry originating in the Netherlands)	General certification system for the horticulture industry that targets horticulture producers and distributors	・4,500 organizations in 35 countries have acquired certification. ・10 years since the program was started in the Netherlands, 790 participants on average have reduced agricultural chemical and energy usage by around 25%. ・Attaching the MP logo to certified products enables differentiation from other products and ensures quality and traceability.	Costs involved in receiving certification include a membership fee, annual fee, and the costs associated with attaching the logo to the product packaging, etc. Costs vary depending on the certification. Costs are incurred on the management side for system maintenance, updating, etc.

Source: Various sources.

Appendix 5　Tracking System Applicability, Diffusion and Cost

This table organises the applicability of ID codes (barcode, etc.) for ensuring the traceability of food products. What is highly suggestive here is that the operational burden of inexpensive systems is higher and that expensive systems may have a wider scope of management, but because they are expensive, initial system costs are higher. That is to say, there is a trade-off between cost and operational burden.

Table 14 Tracking System Diffusion

Means of assigning ID codes	Descriptive labeling	1D barcode（CSI-128）	2D symbol	RF-ID
Diffusion	Very high Descriptive labeling is used for all products.	Somewhat high Interoperability is high because labeling methods are standardized, and use on imported products in particular increases. (Reference: This is very widespread for domestically produced beef, for which traceability is mandatory, and interoperability with imported products is laudable.)	Intermediate In Japan, this form of ID code is growing more widespread, primarily as a means of providing information to consumers. However, overseas in particular, multiple standards are in use so compared to GSI-128 interoperability is not high.	Very low There have been technical problems with respect to reading precision, etc., and there are still few cases of it being used in practical application, but use is increasing as an internal system at produce sorting facilities, etc.
Implementation costs	Very high Can be administered without a control system, so can be implemented at a fairly low cost (starting at several tens of thousands of yen).	Somewhat high The system used to assign and read JAN codes, which are very widespread, can be used, so device costs and system development costs stay low (several hundred thousand yen).	Intermediate Codes can be read with such devices as a cell phone, but commercial readers are somewhat more expensive than readers for 1D barcodes. Specialized software is also needed to print the characters, so this type of code costs more than 1D barcodes.	Very low RF-ID readers/writers are more expensive than those used for 1D barcodes and 2D symbols. System development is also high because there are no existing packages, etc.

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Potential for automating assignment/reading		Very low ID code reading cannot be automated, so manual registration is required each time they are transmitted.	Somewhat high ID code reading can be automated. However, barcodes are read optically, so to batch process large numbers of codes the readers have to be combined with some sort of mechanized system, such as a belt conveyor.	Intermediate ID code reading can be automated. However, 2D symbols are read optically, so to batch process large numbers of codes the readers have to be combined with some sort of mechanized system, such as a belt conveyor. But, in terms of image recognition processing speed, dynamic reading precision is low compared to 1D barcodes.	Very high Batch reading is expected to be made practically viable in the future, which will substantially reduce the amount of work required to read and write the codes.
Suitable applications (in terms of work efficiency)	Shipment stage	Very low Reading cannot be automated, so registration work connected with ID codes and historical data is manual and cumbersome.	Very high Reading can be automated, so this form of code is suitable for use on automated lines, etc.	Intermediate Reading can be automated, but dynamic reading precision is low, so, as of the present, this form of code is not thought to be suitable for use on automated lines, etc.	Very high Reading can be automated, so this form of code is suitable for use on automated lines, etc.
	Distribution stage	Very low Reading cannot be automated, so registration work connected with ID codes and historical data is manual and cumbersome.	Somewhat high Reading can be automated, but the ID codes must be read individually, so registration work takes time and labor. Efficiency can be improved by installing an automated line, etc.	Intermediate Reading can be automated, but the ID codes must be read individually, so registration work takes time and labor. Even when using automated lines, etc., dynamic reading precision is low compared to 1D barcodes, so the process is difficult to expedite.	Very high Batch reading is possible, so it should be possible to register multiple ID codes efficiently.
	Consumption stage	Somewhat high Reading the ID codes can be done without equipment, but historical data cannot be accessed without a computer or similar device.	Intermediate It is necessary equip the sales floor with dedicated readers and a computer or similar device to access historical data.	Very high ID codes can be read and historical data can be accessed with a cellular phone, so consumers can search for information at the store or at home.	Intermediate It is necessary equip the sales floor with dedicated readers and a computer or similar device to access historical data.

Source: Mitsubishi Research Institute (2007), Applicability of Traceability Systems for Foods,
Food Marketing Research and Information Center