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Dissemination Paper (Drafted by Prakash Nelliyat)

'Resource Rent' from the 'Access and Benefit Sharing' Perspective

Introduction

A wide range of manufacturing sectors undertake research and development on commercial products from genetic resources. They include the pharmaceutical, biotechnology, seed, crop protection, horticulture, cosmetic and personal care, fragrance and flavor, botanicals, and food and beverage industries. Each sector is part of a unique market, undertakes research and development in distinct ways, and uses genetic resources and demands access to these resources very differently (Laird and Wynberg, 2005 in ABS).

Generally, in bio-resources based production and business, the users of the resources may make substantial benefits. Under normal conditions, the possibilities for sharing these benefits under by the user with the providers are limited. Providers of the resources (communities) are given a meagre price by the users whenever, they obtain the resources. In reality, the provider of the resources (local and indigenous communities) are unaware of the real economic potential of the bio-resources, which leads to unsustainable harvesting and mismanagement of biodiversity, and is considered as one of the reasons for its rapid degradation.

To tackle the above challenges on biodiversity, access and benefit sharing (ABS) has emerged as a universally accepted mechanism under the umbrella of the Convention of Biological Diversity (CBD). ABS proposes the way in which bio-resources are accessed, and how the benefits derived from the use of bio-resources should be shared between the users and providers. The negotiation between a provider and a user of resources can never be entirely based on the physical nature and quantity of resources to be used, but on the real potential of the resources. Both the user and the provider need to have at least a reasonable understanding about the true value of the resources.

The expert committee on the economic valuation of bio-resources under the UNEP-GEF-ABS Project, National Biodiversity Authority (NBA), provided guidelines in drafting a methodology for bio-resources valuation. Bio-resources based industries have been classified in to different heads: modern drugs / botanicals (AYUSU) / crop protection products / food processing / cosmetics etc., and accordingly a draft methodology has been developed (see table 1).

Table 1

Suggested Economic Valuation Methods for ABS

	Category of Bio-resources	Possible Methodological Approach	Payment Detail
A A1	Bio Pharmaceuticals (modern drugs) (*Population status, Rare Endangered and Threatening (RET), Abundant, Endemic*)	Scarcity Rent (SR) + Information Rent (IR) (share a proportion attributable to the product). Endemic Rent (ER)	Initial payment + payment at the time of product development + payment at marketing stage. Monetary + Non- Monetary (for endemic and RET)
B	Bio-technology (Seed / Agriculture Related), Land races, Microorganisms,	Information Rent (IR) (share a proportion attributable to the product).	Initial payment + payment at the time of product development + payment at marketing stage Monetary + Non- Monetary (for endemic and RET)
C	Crop protection products	Information Rent (IR) (share a proportion attributable to the product).	Initial payment + payment at the time of product development + payment at marketing stage Monetary + Non- Monetary (for endemic and RET)
D	Botanicals (AYUSH)	Based on the proportion of Net Present Value (NPV) of the profit x the contribution of input to the out put	Initial payment + payment at the time of product development + payment at marketing stage Monetary + Non- Monetary (for endemic and RET)
E	Nutraceuticals / Personal care and cosmetic products	Based on the proportion of NPV of the profit x the contribution of input to the out put	Initial payment + payment at the time of product development + payment at marketing stage Monetary + Non- Monetary (for endemic and RET)

Source: Nelliyat and Pisupati (2014)

In this methodology the concept of “Rent” or “Resources Rent” or “Economic Rent” were emphasised. Further, the role of different kinds of rents (Scarcity Rent, Endemic Rent and Information Rent) and their share in the net present value of the products derived from bio-resources, were also indicated.

In a broader sense, ABS is synonymous with rent recovery and is highly interlinked. Since the economic theory has discussed the concept of rent from different perspectives, the investigation of the thoughts of rent and its replicability to ABS is useful for designing a better valuation methodology. Against this background, this paper examines the concept of resource rent and its significance towards a better understanding and conceptual clarity on ABS mechanism for bio-resources management and its valuation. Besides, the paper also discusses various issues related to resources rent in bio-prospecting and benefit sharing such as: (a) why resources rent comes into the picture of ABS and valuation of bio-resources, (b) when can resources rent be introduced, (c) how much should be the rent?, and (d) how could it be recovered ?

Commercial Utilization of Genetic / Bio-resources and the Emergence of ABS

According to the Biological Diversity Act (2002), “Bio-resources / Biological resources means: plants, animals and micro-organisms or parts thereof, their genetic material and by-products (excluding value added products) with actual or potential use or value, but does not include human genetic material” (National Biodiversity Authority, 2010). Genetic / bio-resources are significant in economic development and enhance human well-being. Its contribution and role are broadly classified under the following heads:

- *Source material:* Bio-resources are the major sources or input factor for developing new drugs, new seed varieties, ornamental horticultural products, crop protection products, biotechnologies in fields and other botanical medicines, healthcare and agricultural products, and personal care and cosmetic products.

- *Livelihood Option*: Bio-resources can provide sustainable livelihoods to rural communities, particularly the socially vulnerable communities in developing countries like India, since sizable numbers of their population in these countries are living in rural areas, where agriculture and allied activities (source of varieties of bio-resources) are the major source of livelihoods. Further, village commons like wetlands, grasslands and forests are the source for different bio-resources, which are historically used by villagers for their consumption and as a source of income.

- *Base for Ecosystem:* Bio-resources can be the basis for the protection of ecosystems, and support ecological and economic goals; Bio-resources and biodiversity are inseparable and complementary to each other. Different bio-resources play a significant role in the formation of rich biodiversity providing its different ecological functions, which are essential for achieving various economic goals.

- *Basis for non-monetary benefit sharing, including technical assistance and cooperation in R&D activities*: Research and Development in biology is primarily on genetic or bio-resources. The results obtained from it may be shared among nations without any monetary benefits. Non-monetary benefit sharing includes the involvement of research activities, development of inter-generational research capacity, infrastructure development and wider strategic inter-generational capacity development needs.

The following table (table 2) provides the ballpark estimation of various categories of the products derived from genetic resources.

Table 2

Ballpark estimation of annual markets for various categories of the products derived from genetic resources

S. No	Sector	Market (US $ Billion)		Note
		Low	High	
1	Pharmaceuticals	75	150	Some products derived from genetic resources. Low estimates: natural products from 25% of global market. High estimates 50%
2	Botanical medicines	20	40	All products derived from genetic resources. Low estimates for global botanical medicines market; high estimates include botanical medicines, minerals and vitamins.
3	Agriculture products (commercial sales of agriculture seed)	300 + (30)	450 + (30)	All products derived from genetic resources. Low estimates: final value of the produce reaching consumer 10 x commercial sale of seed to the farmers. High estimates 15 x commercial sale of seed to the farmers.
4	Ornamental Horticulture products	16	19	All products derived from genetic resources. Low estimates: based on available data. High estimates: allows for unreported sale and product.
5	Crop protection products	0.6	3	Some products derived from genetic resources. High estimates include wholly synthesised analogues, as well as semi-synthesised products.
6	Biotechnology in fields other than health care and agriculture	60	120	Some products derived from genetic resources. Low and high estimates based on assessments of environmental biotechnology.
7	Personal care and cosmetics products	2.8	2.8	Some products derived from genetic resources. Reflects 'natural' components of the markets.
Rounded Total		**500**	**800**	

Source: Kate and Laird (2000)

It is very clear that biodiversity in a broader sense and bio-resources in specific, have commercial/economic as well as ecological/biodiversity significances. However, biodiversity's conservation and its sustainable use are pre-requisites and also a challenge. In most cases, the commercial and business sector is progressing at the cost of the ecological or biodiversity sector. In the long run, the ultimate the impact of the loss of biodiversity would reflect on the business sector. Hence, the system may not be economically and / or ecologically sustainable. For example: A mass extraction of medicinal plants for drug manufacturing from a particular forest area may affect its renewability and threaten various ecological services. In this context, the Access and Benefit Sharing (ABS) principle for the conservation and sustainable utilization of medicinal plants (bio-resources) attains immense significance.

ABS refers to the way in which genetic resources are accessed, and how the benefits that result from their use are shared between the people or countries using the resources (users) and the people or countries that provide them (providers). Providers of genetic resources are governments or civil society bodies, which can include private land owners and communities. Users of bio-resources are bio-prospecting industries. The ABS mechanism proposes that whoever, accesses the genetic resources for commercial intent, should share the benefits (even at least a part) resulting from their use.

The access and benefit-sharing provisions of the Convention on Biological Diversity (CBD) are designed to ensure that the physical access to genetic resources is facilitated, and that the benefits obtained from their use are shared equitably with the providers. In some cases this also includes valuable traditional knowledge associated with genetic resources, that comes from indigenous and local communities (Convention on Biological Diversity, 2011).

The benefits to be shared can be monetary, such as sharing royalties when the resources are used to create a commercial product, or non-monetary, such as the development of research skills and knowledge. It is vital that both users and providers understand and respect institutional frameworks such as those outlined by the CBD and in the Bonn Guidelines. These help governments to establish their own national frameworks, which ensure that access and benefit-sharing happens in a fair and equitable way. Access and benefit-sharing is based on prior informed consent (PIC) being granted by a provider to a user, and negotiations between both parties to develop mutually agreed terms (MAT) to ensure the fair and

equitable sharing of genetic resources and associated benefits (Convention on Biological Diversity, 2011).

The providers and users of genetic resources are the main actors in ABS mechanism. States have sovereign rights over natural resources under their jurisdiction. They are obligated to put in place conditions that facilitate access to these resources for environmentally sound uses. Providers agree to the terms, which include PIC and MAT, for granting access and sharing benefits equitably. Laws within the provider country may entitle others, such as indigenous and local communities (ILCs), to also negotiate terms of access and benefit-sharing. The participation of ILCs is necessary in instances where traditional knowledge associated with genetic resources is being accessed.

According to CBD, the users are responsible for sharing the benefits derived from genetic resources with the providers. They seek access to genetic resources for a wide range of purposes, from basic research to the development of new products. Users are a diverse group, including botanical gardens, industries such as pharmaceutical, agriculture and cosmetic industries, collectors and research institutes. However, between the providers and users of bio-resources a large number of traders and intermediaries exist and play a significant role in materializing the trade or exchange.

Valuation of Bio-resources a Pre-requisite for Operationalizing the ABS

For operationalizing the ABS mechanism, the estimation of the bio-resources induced benefits to the users/industries or bio-resources valuation is significant. According to Morte and Tamme (2007), 'currently, there is no basis in the CBD or elsewhere for unilaterally choosing and imposing a set value on either Party'. Consent to a specified payment as full or partial satisfaction of the benefit-sharing obligations must be reflected in MAT. But a lot of constrains and complexities exists, when practically viewing this negotiation process.

The valuation process in ABS is very complex, and needs to realize that "genetic resources" are something more than simply the raw-materials of biotechnology (Morte and Tamme (2007). In this context only, within the CBD, the specialized legal right to utilize genetic resources was created as a mechanism for integrating a variety of linked objectives and rights, through a legislative and contractual system.

Broadly, the genetic resources' value may depend on either or both the micro-physical genetic material and the genetic information it contains. Whether these components are utilized individually or together, the utilization of genetic material is recognized to confer a different or additional value beyond the bulk value of the particular biological resource. This statement reveals that the value of "genetic resources" for ABS must be discussed from the perspective of drawing benefits from using the micro-physical materials and the utilization of the genetic information that they contain. Valuation must target the new resource value, separating the bulk value of the biological resource from the value of its tangible and intangible genetic resources. This would include, for example, DNA sequences and biochemical formulas, whether contained in whole specimens, prepared samples, extracts, or written scientific notation or descriptions Morte and Tamme (2007).

For operationalizing the ABS mechanism as per the CBD norms (sharing benefits arising from the utilization of genetic resources) it is required to assess the genetic resources' value. In most countries, biodiversity and the associated genetic resources are considered to be public goods, managed under the oversight of the national government. Consequently, some mechanism is necessary to assure the negotiating government official that he is getting a fair value for a public resource which he is sworn to preserve and use in the best interests of the country and its citizens.

In the absence of the valuation of genetic resources, parties in ABS transactions may be compelled to accept inappropriate (too high or too low) payment as the user's benefit-sharing obligation. However, transparency about prices and financial terms will enable the development of professional appraisal standards, which can ease contractual negotiations.

Identifying the real value of the bio-resources, which are used by bio-prospectors, is an important task in the on-going UNEP-GEF: ABS Project, since the providers (local community or local governmental or non-governmental agencies) of the bio-resources obtain a meagre price when they exchange them with the users (traders or companies or other countries). The price of the resources at the collection point may represent only the cost of collection or the effort that the local communities incurred for obtaining the resources.

However, based on these resources, the companies are manufacturing many value added products. Here, this process is generating substantial resources' rent which rests completely with the companies, and is hardly shared to the providers of the bio-resources.

From the ABS perspective, the value of a particular bio-resource needs to be assessed with consideration for its bio-prospective potential which the rent has generated. In these circumstances, the rent generated for the bio-prospective should be an ideal option or criterion towards determining the real value of the bio-resources. However, the genuine question would be how one can attribute the entire rent towards bio-resources, since there are many other factors of production including entrepreneurship, that contributes towards generating the rent. In this circumstance, the segregation of rent towards various components who contribute to the production process based on the appropriate criteria is important. Through a comprehensive value chain analysis of the product, one can derive the real value of the bio-resources.

In brief, the practicability of estimating the true value of bio-resources is a complex phenomenon, since it required a comprehensive understanding of the bio-prospecting carried out by each industry, with its full-fledged support. However, a broader discussion on 'rent' will help us to provide much conceptual clarity in approaching the valuation of bio-resources.

Economic Rent or Resources Rent: from the Bio-resources' Economics Perspective

Concept and Definition:

The theory of economic rent was first advocated by the classical economist David Ricardo, in his book, "Principles of Political Economy and Taxation". He defined rent as, "that portion of the produce of earth which is paid to the land lord for the use of the original and indestructible powers of the soil". Ricardo, in his theory of rent has emphasized that rent is a reward for the services of land which is fixed by the supply. Further, rent arises due to the original qualities of the land which are indestructible, and these include natural soil, fertility, mineral deposits, climatic conditions etc. According to Ricardo, all the units of land are not of the same grade, but differ in fertility based on the location. The application of the same amount of labour, capital and other resources gives rise to differences in productivity. This difference in productivity or the surplus which arises on the superior units of land over the inferior units is an 'economic rent'.

Subsequently, Economic rent (also commonly known as 'resource rent') is widely analysed by economists and becomes a concept in management. According to Jim Sinner and Jorn Scherzer, (----) rent has been part of resource management policies in countries like New

Zealand for several decades, particularly in relation to the resources' extraction such as minerals, geothermal energy, sand and shingle, and, somewhat more recently, coastal space. Further, in situations such as bio-resources' extraction from common lands (where people have use rights when in fact the government is the legal owner) too, rent can effectively use a resources' management strategy.

While literature on rent is available from the classical economist's era led by the political economists to the modern resources economists, it does not provide a clear explanation of the concept for a non-technical audience and or non-economist. As a consequence, readers often confuse the 'rent recovery' with 'cost recovery' or 'payment for externalities', or they focus on rent collection mechanisms rather than finding agreement on what they actually want to achieve by collecting rent (Jim Sinner and Jorn Scherzer, ----).

Resource Rent for Bio-resources:

The resource rent concept can be very significant in the area of renewable natural resources (like bio-resources or genetic materials) based manufacturing sectors. In this regard, officials from the concerned government institutions - such as the National Biodiversity Authority (NBA), State Biodiversity Boards (SBBs), users of resources (bio-resources based research and development sectors and bio-prospecting companies), and providers of bio-resources (local and indigenous communities and / or Biodiversity Management Committees - BMCs), require a clear understanding of the concept of resource rent.

Generally, rent from the resources is the difference between this value and the costs of obtaining and exploiting the resource. In the bio-prospecting industries case, the definitions proposed by DFID (2003), Luchsinger & Muller (2003), Sharp (2003), and Stoneham *et al.* (2005) are much more relevant. According to these authors, "rent is a surplus value, i.e. the difference between the price at which an output from a resource can be sold and its respective extraction and production costs, including normal return". In brief, rent is the surplus value that remains with industries after all the costs are met, including a normal profit. Hence, in bio-prospecting, rent is the amount remaining after all costs of businesses, which include the raw-material costs, labour costs, building and machinery cost and the cost of entrepreneurs' skills, and the legitimate profit. In brief, this rent is the focus and debate in ABS.

From the ABS perspective, the first task is one should identify whether a potential bio-prospecting industry is making rent or not; and if so how much? In ABS, this surplus value in bio-prospecting is of concern and the argument is 'why can't this surplus value (abnormal benefits) or at least a reasonable share of it be shared with the original owners of the bio-resources, that is, the government or the local and indigenous communities who provide the resources. As per the ABS norms, if one shares the rent with the community, it acts as an incentive to conservation and the sustainable use of the resources.

In bio-resources case, rent can go to either of the parties, depending on different circumstances: (1) all to the owner of the resources (community), if the price is set considering the economic value of the resources, (2) all to the producers (user / industries) if the price is at the cost of extraction, and (3) shared if price is set in between the provider and user through negotiation (Markandeya, 2008).

In any resources based exchange the maximum 'willingness to pay' for accessing the resource and the rent emerging from it, is mutually linked. In the bio-resources case, we are assuming that the providers (community) are not aware about the value of the resources, but the users (industry) are fully aware it. In an auction setting, a (buyer) would keep bidding for access to the resource up to the point where he or she is able to obtain no more than a normal return from that resource. This *maximum bid* may include a certain percentage of rent. Hence, in bidding the provider is able to obtain the maximum willingness to pay of the user. A share of the rent can be distributed.

Type of Rent

Depending on how rent is created and the situations that exist, rent can be categorised into different kinds.

Differential Rent: Differential Rent also called quality or Ricardian rent, arises because of differences in the quality of similar goods or inputs. In the case of bio-resources its quality may vary, based on the geo-climatic conditions and certain uniqueness of the sites. For example, even if a particular medicinal plant (*Antographic paniculat*) is available all over India, a drug manufacturing company may procure it from a specific zone, say the Himachal region, due to its superior quality, which may help the company in manufacturing products in a cost effective and efficient manner. In this case, procuring the resources (which is superior)

from the Himachal region will help the company in obtaining a special rent, which is the differential rent.

Scarcity Rent: Scarcity rent arises from a restricted supply of (excess demand than its availability) the good or resource. Certain bio-resources (such as large cardamom) may be scarce in supply or availability, compared to its demand. Generally, these bio-resources are entitled for a special rent due to their limited availability. In other words, scarcity rent is the value derived for a resource from its limited stock. For example, if the stock or availability of a particular bio-resource (*arogyapacha*) is limited, *the price will be well above the costs of production or extraction,* and difference is the scarcity rent. Imposing a high price for scarce resources will help to transfer the scarcity rent from the users to the provider. Further it acts as an economic dis-incentive to the company towards the extraction / damand of the resources.

Entrepreneurial Rent: Entrepreneurial rent, also called quasi-rent, occurs due to entrepreneurial skills or managerial investments. A company's investment in advertisement, training of employees, better technology, and research and development can result in a higher price of the product, through better branding or lower costs.

Monopoly Rent: The amount by which the profits of a producer are above 'normal' due to monopoly power is known as monopoly rent. In the case of bio-resources, particularly those that are from common properties and not available in private lands, the state has an exclusive monopoly on its ownership and is eligible to fix a higher price than its normal price or cost of collection. Here, the state should come forward and collect this rent, since it is its monopoly right.

Information Rent: In certain cases, the information available with the public or any other external agencies may help the entrepreneurs in making a profit. Information rent is significant in bio-prospecting and information is a valuable economic resource. Any bio-prospecting research starts with prior information which makes the discovery easy and achieves huge time and cost saving. Therefore, the value / profit acquired through relevant prior information (high probability leads) commands information rent. Generally, the traditional knowledge (TK) about bio-resources (such as availability, season and location; collection, storage, packing and transportation procedures; sustainable extraction; different / promising users; harvesting practices etc.,) exists with the local communities and is the key for bio-prospecting.

A common theme in all the above concepts is that a resource may receive a payment above the costs of exploiting it or producing some services by using it. This 'surplus' amount also indicates the difference between what is paid for something to the provider and what is its 'worth' to the user. For instance, for a consumer the 'surplus' is the value in consumption less payment, and for a producer the surplus is very close to the rent.

Emergence of Rent

Generally, the cost of production of a bio-resource based commodity includes 'normal profits'. However, rent can be a 'super-profit' or an 'abnormal profit'. Unless the resource rent is actually collected, this surplus value will be kept by the users of bio-resources (industries) over and above their normal profit. In bio-prospecting the rent may emerge through different situations, as highlighted below.

In Scenario 1: Imagine that the cost of producing one bottle (500 g) of an Ayurveda medicine, say *Jeevani,* amounts to Rs. 300, for which *arogyapacha* is an unavoidable bio-resource. The cost of *Jeevani* includes the cost of different raw-materials, labour, technology, research and development, administrative and marketing cost, and normal profit. Suppose the medicine is sold for Rs. 500 in the market, the resource rent amounts to Rs. 200 (Rs. 500 - Rs. 300). In this case the company would be willing to pay up to Rs. 200 for access to the raw-materials (*arogyapacha).*

In Scenario 2: the market price for *Jeevani* has increased to Rs. 600, while the costs remain the same at Rs. 300. Here, the resource rent increases to Rs. 300 (Rs. 600 – Rs. 300).

In Scenario 3: the market price for *Jeevani* is unchanged (Rs. 500). However, the company has managed to reduce the cost from Rs. 300 to Rs. 200. This could be due to the management's entrepreneurial skills and more efficient use of labour and capital. In this situation also, the resource rent increases from Rs. 200 to Rs. 300.

In Scenario 4: the market price for *Jeevani* is unchanged (Rs. 500). However, the company has managed to reduce the cost from Rs. 300 to Rs. 200. This could be due to a lower price for the resources and labour. In this situation, the resource rent increases from Rs. 200 to Rs. 300.

In the above case, *Arogyapacha* - a bio-resource provided by a tribal community - is an unavoidable and a major input factor (bio-resources) in the production of *Jeevani*. When the price and or cost of production of the *Jeevani* (which emerges from *Arogyapacha*) increases / decreases, rent also increases / decreases proportionally. From the ABS perspective, the incremental rate or the extra benefit obtained by the company should be provided to the community. Here one should also note that, in certain situations the rent becomes negative too; for example, if the demand / price of the *Jeevani* falls and the company can no longer earn a normal return / profit. In this circumstance, one would expect these companies that insure higher-cost to exit the industry.

Under normal conditions, a manufacturing company can easily provide / may be willing to pay a certain amount of the rent or the abnormal gain to access a resource. However, conceptually, the rent still exists when it is not paid for. In this circumstances, the rent is with the resource users.

This is the exact scenario, for the bio-resource case which is sourced from the wild by the communities and supplied to the traders / industries at its collection point. The local communities put lot of hard work and their unique knowledge in collecting these resources. On most occasions, the ownership rights of the land or site such as forests, ocean and wetlands, where bio-resources have been collected, are with gthe government, but the 'user rights' rest with the community that collects the resources. When large numbers of communities are collecting the same resources the possibilities for high competition, market distortion and low level price equilibrium exist, which help the company to earn a substantial rent or benefit. However, as per ABS, the rent must be shared and the questions arise as to how much resource rent is being captured by the users (business companies), and how much can be paid to the owners of the resource (community).

Application of Rent in Natural Resource Case

While resource rents exist in all kinds of resources, the economic significance of the recovery of rent from non-renewable and renewable resources is somewhat different. According to Glenn and Daniel (1997), non-renewable, or exhaustible, resources like minerals will eventually be depleted, and the employment and incomes generated by this activity will come to an end. This will also happen with renewable resources like fisheries, if they are not managed sustainably or experience over extraction. A major objective of governments is to

recover the resource rent and use it for the benefit of the country. According to policy makers and experts, it is especially important that rents from non-renewable, or renewable resources, be invested in other kinds of economic activity, which can replace the employment and incomes of the resource-based industries, once the resources are exhausted.

However, the above approach emphasises on economic sustainability in the form of employment and income generation, rather than on biological sustainability (as in the form of continuous provision of ecosystem goods and service). But the CBD's attention through the ABS mechanism was slightly different, and attempted the welfare or economic enhancement of the country through sustainable management and utilization of the biological resources. In other words, through ABS one can retain or maintain the stock of the bio-resources intact, without compromising its flow. Hence, the key message is maintain stability in bio-resources' extraction within its renewability.

Resource Rent for Bio-resources (Fisheries) Extraction

DFID (2004) proposed the concept of resource rent in the fisheries sector, as a policy option towards its sustainable exploitation and management. The study stated that, fish resources are inherently valuable but this value is often disguised by their overexploited state. If a single person, or company, were to be given control of a fish resource, he or she would be able to charge people to use the resource, in exactly the same way that people do who own private property such as apartments or cars, and the way the governments do for the use of many natural resources such as oil.

Generally, the amount that could be charged depends on the implicit resource rent – the amount which is left over when all exploitation costs, including a "normal" return have been deducted from the revenues. In brief, the costs cover all the elements used for a given level of exploitation in a fishery, including an acceptable level of return on the capital, and the resource rent is any revenue received in excess of this amount. Since both costs and prices vary, it will be apparent that the resource rent is not some fixed amount, but is also variable. The resource rent does not only vary through time, but also varies with the level of fishing effort.

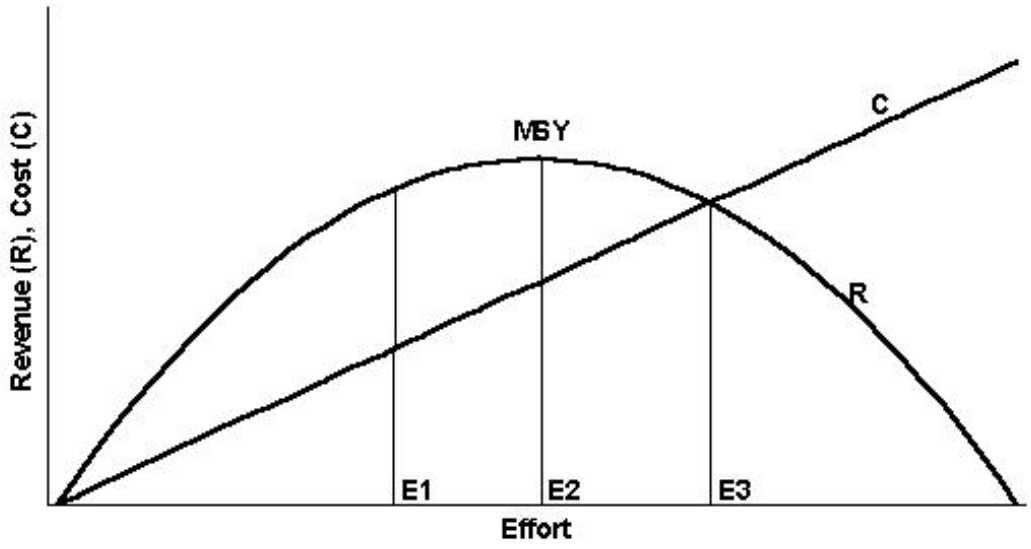
Generally, as we explained in earlier an section, the concept of resource rent is debated by economists in the context of land. However, the major difference between land and fish is

that the former tends to stay where it is, whereas the latter are notoriously mobile. In the case of land, the “property rights” is relevant but in the case of fisheries the “use rights” is significant. The major policy challenge in the case of fishing is the future development of property and “use right” systems. Such systems will have major implications both for the generation of resource rent and for its sharing between different stakeholders.

However, access to fishing has long been considered free and open, and the concept of having to pay a rent to use the resource can be hard to implement from a policy perspective. Because of its free and open nature, fishing has often been an activity of the last resort.

This issue is similar in the case of many other bio-resources – which are the public land or state property. In these circumstances, moving towards management based on rent generation and restricted access appears to offer the best hope for improved fisheries exploitation in the future, but requires careful policy development given the difficult social welfare issues that are raised (DFID, 2004). This is exactly the concern behind the ABS process proposed by the CBD and the Biological Diversity Act (2002).

The following diagram (Figure 1) presents a simple model of a fishery, on the assumption that the price of fish is independent of the quantity sold; the parabola shows that as an effort increases so does sustainable yield up to a maximum (the maximum sustainable yield - MSY) at effort level E2. Beyond this point, further increases in effort result in reductions in the sustainable yield. Generally, MSY was considered the biological optimum.



Resource rent is the vertical difference between the revenue (shown by the parabola marked R) and the costs (shown by the straight line from the origin marked C). The resource rent also initially increases as the effort increases, reaching a maximum at effort level E1. This level is called the maximum economic yield (MEY). Increases in effort beyond this point reduce the economic return from the fishery. Note that the maximum resource rent, or MEY, occurs at an effort level somewhat below MSY, and therefore a policy aimed at achieving the maximum resource rent (the economic optimum) would be more ecologically friendly than a policy targeting MSY.

Since fishing is usually undertaken in pursuit of profit, it might be thought logical that fishermen would use the fishing effort so that the resource rent is maximised. Recall, however, that the cost line includes "normal" profit. As a result, at levels of effort below that where the revenue and cost are equal, fishermen will be earning above normal profits. As with any industry, such profits will attract new entrants and, if access is free and open, this process will continue until all resource rent has been dissipated, at effort level E3. In equilibrium then, the fishery will operate at the point where revenue equals cost. Fishermen will earn normal profits but the fishery is overexploited both economically and biologically.

For calculating the resource rent, the key data requirements include the biological productivity function, and costs and earnings associated with the various segments operating in the fishery. A basic formula for calculating the resource rent might be:

RR = TR – (IC + CE + CFC + NP) NP = r x K ; where:
RR is Resource rent
TR is the Total revenue
IC is the Intermediate consumption
CE is the Compensation of employees
CFC is the Consumption of fixed capital
NP = r x K
NP is Normal profit
r is the opportunity cost of capital
K is the value of the fixed capital stock invested in the industry for each fishery.

However, each element in the above equation may be treated as a module capable of further development. For instance, the revenue from the catch will depend on the price of fish and the quantity caught. The price, in turn, will depend on the demand for the product which itself

depends on a variety of factors. A detailed bioeconomic model might include a demand module, designed to try to predict the prices for different levels of catch and different demand parameters (such as consumer incomes). Similarly, the quantity caught will depend on the biological situation of the fishery, and this also may be modelled (DFID, 2004).

The above discussion provides a clear insight on the resource rent and its emphasis with respect to resource collection and fishing effort, basically on the access of the resources; hence, it is more relevant to access fee. In a broader sense, this is the first stage of bio-resources' extraction or collection. When the fishermen sells the fish to the user (like a fish processing unit) who manufactures the value added product (like cod liver oil) the ABS issues will emerge.

Rent Collection: Principles and Concerns

For a broader interest of the nation with sustainable economic development, the rent collection for renewable natural resources like bio-resources is significant. However, rent collection is a tricky exercise and needs to consider balancing the economic significance of the industry as well as the sustainability of the resource availability. This analysis reveals that future bio-resources based economic activities as well as the ecological functions associated with bio-diversity, go hand in hand. Therefore, when designing a rent collection mechanism, it is important to take into account the following considerations.

(1) Avoiding or minimising economic distortions is a key issue for rent recovery. An economic distortion is a situation which affects the quantity or value of the output so that it is no longer efficient. According to Sharp (2003), auctions and tendering have the least negative effects, from the economic distortions perspective.

(2) A poorly designed rent collection mechanism can negatively affect innovation. For instance, an immature / prior bio-resource based drug manufacturing company may face huge challenges as well as competition from the well-established industries. Attempting to collect rent from the pioneer unit could prevent it from developing because, the initial costs may be very high and only the potential to generate and capture rent would justify development. In this situation, a government might choose to forego rent for a period of time (thereby providing a 'rent holiday'), with the prospect of collecting rent in the future (Jim Sinner and Jorn Scherzer, ----).

(3) There may be cases in which rent recovery would be unfair to the resource user. For instance, where resource rent has already been fully captured through an initial allocation mechanism such as an auction for tradable permits, subsequent rent recovery would amount to double dipping - unless the amount is known to bidders before the auction, so that they can determine their bids accordingly (Sharp, 2003).

However, rent fixation and collection criteria may vary, depending on the type of resources as well as their purpose in bio-prospecting. For genetic resources in a particular area, economists frequently refer to the economic rent in terms of the value of the land where they are located, that is rupees per hectare. But, in the case of pharmaceuticals we can work backwards. The value of any drugs produced from a genetic base, less the costs of production, less the costs of classifying and testing the genetic materials, gives the economic rent (Markandya, 2008).

In the case of drug manufacturing, the costs of development are enormous, and the current estimation revealed around US$800 million per drug. At the same time, revenues from the final products are also large. A successful drug can generate revenues of billions with an average of around US$1.2 billion. And the amount of genetic material needed to be evaluated per ´hit´ is around 10,000 samples. These estimates are based on the value of the genetic resources to the users (Markandya, 2008).

Rent Recovery and Methods

It is very clear that the bio-prospecting companies take up the full or substantial share of resources rent, which is not fair. Further, for the successful implementation of the ABS principle, this rent should be identified, measured and recovered. One can argue that at least some or a reasonable rent recovery from the bio-prospecting companies by the concerned government agencies (such as NBA, SBBs and BMCs) is appropriate, when the company (particularly private units) uses public resources. However, it does not follow that *all* rent should always be recovered in these circumstances, since in a broader sense; the total rent is not the exclusive contribution of bio-resources.

Broadly, the prospect of a business has been capturing some resource rent (i.e. above normal profits), which always acts as an incentive for entrepreneurs to continually improve various components (particularly R&D) of the business through innovation. If the government takes

all the rent, including entrepreneurial rent, it would remove the incentive to improve. In these circumstances, the business would always be left only with the 'normal' return. Conversely, as explained above, collecting no rent can reduce the pressure to innovate or distort the nature of innovation (Jim Sinner and Jorn Scherzer, ----). In this regard, in a broader or comprehensive sense, rent recovery is a tricky exercise and becomes a matter of negotiating the right balance, ensuring a fair share to the resource owner or community as well as a return to the owner of the company.

These conditions act in achieving the dual objectives or incentive mechanism: (a) incentive for the resources owners (community) in conservation and sustainable use of the resources, and (b) incentives for the companies to proceed with innovations, which can even offer a better product at a lower price to the consumer. Through this effort, the ecological as well as economic sustainability will be achieved.

The collection of rent, particularly for the ABS mechanism, usually comes about through negotiation between the resource owner (local communities and BMCs) and the resource user (bio-prospecting industries). A variety of mechanisms can be used for determining the rent, and the predominant ones are auctions and royalties.

Auctions: In an auction, the resource owner sells the access rights to the user through a competitive process. The rental price would be determined by the offers of the bidders/buyers, which in turn, reflect the bidders' willingness to pay. However, for operationalizing the ABS mechanism, the resources provider should obtain the amount equivalent to the maximum willingness to pay of the user. But these circumstances would occur only in a situation, where large number of users would compete for the resources, which are scarce. Anyhow, through an effective auction one can easily assign the real value of the bio-resources which are collected from the common people.

Royalties: Royalties are of different types including: (a) specific royalty, (b) ad-valorem royalty and (c) accounting profits royalty.

Specific royalty A specific royalty is a levy applied to the per unit volume of production. Here, one can assign a royalty rate for the bio-resources on a volumetric basis. For example, Rs. 1000 per tonne for a particular medicinal plant, or honey collected from the wild, or fish caught from the ocean. Specific royalty is more or less similar to the 'levy charge' system

followed by the BMCs as per the Biological Diversity Act. However, it is doubtful, how far the specific royalty approach can become an effective valuation method for ABS. Normally, different bio-resources have different values and sometimes the same bio-resource provides different values to different users. Since ABS places / emphasis on the commercial and economic significance of bio-resources, just assigning the value based on the quantity of bio-resources used by the industries, is insufficient.

Ad-valorem royalty: An ad-valorem royalty is a percentage applied to the annual value of production. Here, the concerned authority can ask for a particular percentage of the resources value extracted from the particular geographical area. For example, the BMC or the Forest Department can ask to pay 12.5% of the value of the honey collected from the forest. Ad valorem royalty can also fix for the bio-resources based products (say drugs, cosmetic items, health care items etc.) the final value. However, the complexity is that for any final product, bio-resources are not an exclusive input but a mix or number of other inputs. Further, research and development also plays a significant role in shaping the product. Hence, the company may have strong objection to accepting ad-valorem royalty methods for implementing the ABS.

Accounting profits royalty: An accounting profits royalty is a mechanism, whereby the resource owner receives a share of the profits once all the significant costs have been recovered (as a percentage of annual profits). However, in the case of bio-prospecting companies, the profit accumulated by them are not exclusively through bio-resources, but various other aspects such as skilled labour, better technology, efficient entrepreneurship etc.

In brief, the resource rent tax takes a portion of the rent after deducting all the capital and operating costs from the revenue. However, it also allows any losses to be carried forward, and only taxes the positive cash flow of a particular operation.

Sharing Rent and ABS

For the successful ABS, whatever the rent collected should be shared with the provider of the resources. At present, all the rent does not go to the people (community) directly involved in managing the land in developing countries. It is partly appropriated by the companies and the users of the products the companies produce. Current arrangements for transferring some of

the rent to the countries where the resources are located represent a small effort, against the background of an essentially free access (Markandya and Nunes, 2007).

Generally, rents are private values, based on market gains. To get the social value we should not take the market revenue but the value in the use of the drugs. People would pay much more for life saving drugs than they actually do. There are ways of raising the economic value and the possible rent from genetic resources to owners, which include:

(a) Improve prior information on the quality of the material
(b) Reduce the transaction costs between the supplier and the consumer of genetic material
(c) Create increased bargaining power on the side of the countries where genetic resources are located.
(d) Reducing the production / manufacturing costs

Rausser and Small (2000) estimate a possible increase in the economic rent, if prior information can be improved. Measures to improve prior information include: advances in receptor and mechanism-based screening technology (on-going since 1990s), and (b) improving efficiency in collection, and taxonomic identification activities (Markandya and Nunes, 2007) (M, 2008).

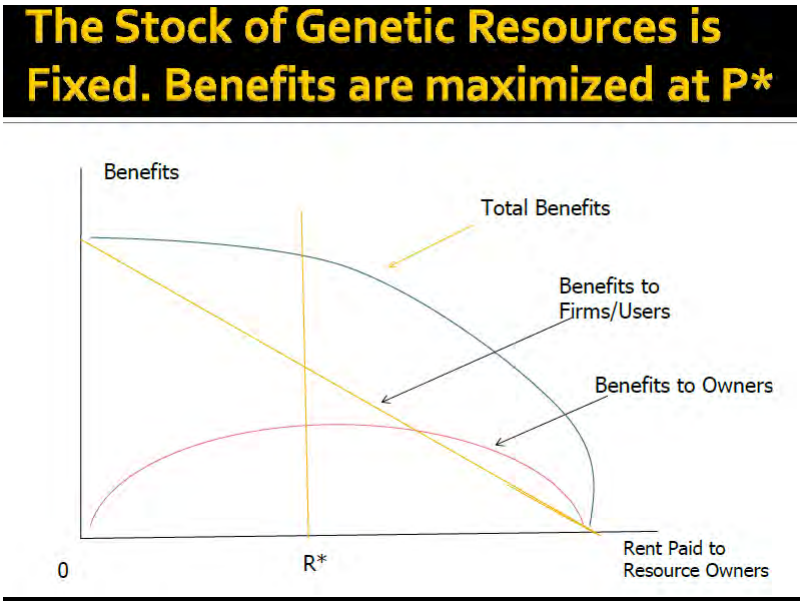
These services are largely provided by the public sector in developing countries and because of inadequate resources they are inefficient and underprovided. It could be made a fee based service, including possibly creating an intermediary market for these services.

Increase the Share of the Rent for the South

Generally, the developing countries in the Southern emensphere possess a substantial volume of biodiversity. These resources are historically provided to the North by the South from colonial times. In those periods the trade policies and administrative mechanisms of the bio-resources traders in the country were meagre. Hence, the rent generated by the North is high and not shared with the South. However, in the ABS regime, if the South could negotiate a price for the genetic resources, it could get a higher share of the rent. But there is a trade-off: the higher the price, the less will be the demanded for these resources, which will affect the revenue. In social terms a higher negotiated price may be justified, on equity and efficiency grounds (Markandya, 2008.

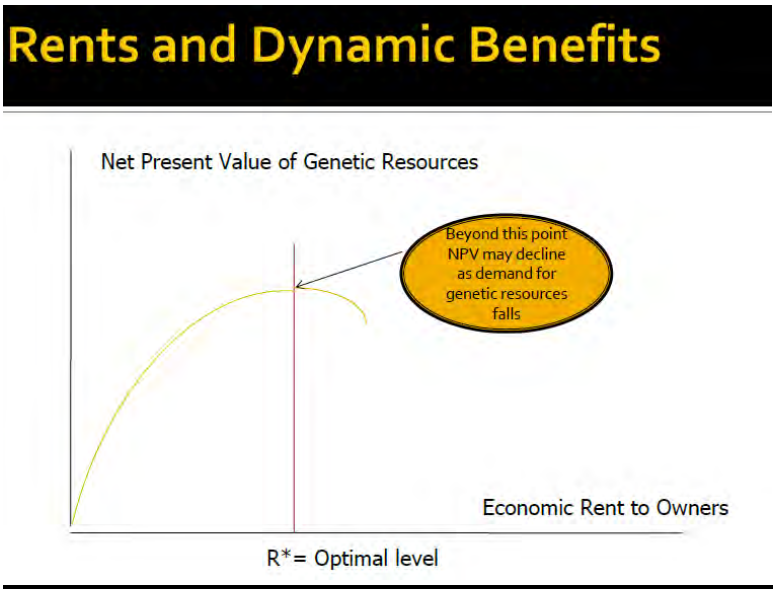
Increase the Share of the Rent for the South: Different Scenarios

Assume a fixed level of resources. At the price of zero, all rents go to the producers/users of the goods using genetic resources (see figure 2). As the price increases, part of the benefits goes to the owners, but the benefits to the producers / users decline. With equal weights to the benefits of users and owners, a certain rent is welfare-maximizing, but with different weights a higher rent may be justified.



Dynamic Considerations

In the previous example, we assumed that the quantity of genetic resources was fixed. But it is not. Under current arrangements the volume is declining. As more of the rent is passed on to the providers of the resource, the decline will be arrested, or at least slow down. That would be a social advantage. See the following graph.



Conclusion

In bio-prospecting the users of the bio-resources (business entrepreneurs) are well aware about the significance and value of the bio-resources, which they are using in their business. However, many a time, this economic value is hardly understood by the providers or owners, that is, the local communities or government. This becomes a fundamental problem in arriving at meaningful and suitable ABS agreements. In this context, the valuation of bio-resources for ABS is significant, and the valuation base must be based on the commercial prospects, and benefit acquisition capacity of the resources.

For bio-resources managers, the concept of rent and its applications need to be cleared. This paper is an attempt to increase the understanding of the term 'economic / resources rent to biodiversity stakeholders, and managers, and to provide a basis for the successful application of the concept in practice for an effective policy such as ABS.

Generally, natural resources are the gift of nature and they may be very scarce or very abundant with respect to the quantity demanded. When resources are scarce, the scarcity may be reflected in rising extraction costs and high rents (Larry, 1990). Resources such as bio-resources are available with private and / or public undertakings. In private land the decisions regarding the management and their sustainable utilization are taken by the concerned private party such as individuals and companies. But in public land much more careful management strategies are required. Otherwise the 'free rider' problems may adversely affect the sustainability of the resources, which is exactly the concern over the bio-resources available in a country like India.

Genetic resources have an increasing value in a growing number of applications. The benefits of exploiting these are currently not equitably shared between the owners of the resources (community) and the users (bio-prospecting industries). Here, the users of those resources may exploit the providers. In this way a considerable portion of the rent is confined with the users of the resources, that is the bio-prospecting industries.

One can increase the amount of rent to be obtained from genetic resources through improved prior information, better screening technologies and efficiency in collection. We can also

increase the rent by regulating the intermediaries to reduce the transaction costs. Intermediaries can also help negotiate better terms for resource owners and indeed are being used. Improving prior information through the use of traditional knowledge is also a valuable route for raising rents. This can be done through benefit sharing arrangements.

The current arrangements for benefit sharing for bio-resources do not favour efficiency. Increasing the share of rents going to owners is beneficial to all the parties, as it increases the supply of these resources in the long run. Determining what is most efficient, however, is difficult –there is a trade-off between greater equity and efficiency – although the two are not as much in conflict as is sometimes supposed. In the long run it is good for the users (industries) to ensure significant rents going to the owners (community). That is the key message of ABS, which facilitates the conservation and sustainable use of bio-resources.

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