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Principles of Islamic Economics

Masudul Alam Choudhury

The objective of economic analysis has changed significantly since the nineteenth century. One can associate three major foci of development in it.¹ In the first half of the nineteenth century economic analysis was concerned with the problem of distribution. After 1870 it became concerned with the problem of optimal allocation of resources among competing ends. Finally, since the rebirth of macroeconomic theory in the hands of Keynes economic science has concerned itself with the problems of economic policy relating to employment, the generation of aggregate demand for goods and services and price stabilization. In short, modern economics has been preoccupied by the idea of one goal — the satisfaction of the economic man, Marshall's 'homoeconomicus', based on total, free and perfect competition.

Against this advanced and rather impressive façade of modern economics we have a new economic order in the making. The central issue of this economic order is efficient allocation of resources in the light of a more transcendental consideration — that of a righteous community promoting the laws of God on earth. This brings us to the central issue of the new system of economic thought commonly being termed as Islamic Economics.

The main objective of this paper is to delineate in non-technical language the principles of Islamic economics in as far as they constitute the philosophical basis of this economic system. We shall then look at some of the key economic instruments that translate the Islamic economic principles into action. The paper will be of an introductory nature in these areas and no elaborate economic analysis of the issues is undertaken for the benefit of the common reader.

PRINCIPLES OF ISLAMIC ECONOMICS

1. The Principle of Tawheed and Brotherhood

Islamic economics is not content with the conventional viewpoint of economic analysis. It is motivated by its first cardinal principal — the principle of 'Tawheed' and Brotherhood. 'Tawheed' literally means unit. In the economic context it summarizes the crux of the entire essence of Islamic economics in that it teaches man how to relate and deal with other men in the light of his relationship with God. It says that behind the workings of an economy based on market exchange, the allocation of resources, the maximization of utility and profits, is a more fundamental truth — that of social justice. In Islam the capacity to understand and dispense this social justice emanates from the knowledge and practice of the principles of the Quran. In this way the principle of Tawheed and Brotherhood links up our duties to men with our duties to God. In more practical terms the essence of Tawheed and Brotherhood lies in equality and cooperation. The Quran verily says, 'O

mankind! be mindful of your duties to your Lord who created you from a single soul and from it created its mate and from them twain has spread abroad a multitude of men and women'.²

An immediate corollary of the principle of Tawheed and Brotherhood is the predominant note of Islamic economics, that to God alone belongs whatever is in the heavens and in the earth, and that He has made the good things for the service of man.³ Man has been created as the vicegerent of God on earth entrusted with the just use and distribution of His resources.⁴

2. *The Principle of Work and Productivity*

The second basic principle of Islamic economics is that of work and compensation for work performed. It states that an individual's wages must be proportionate to the amount and category of labour performed by him. The amount of labour would be measured in, say, man-hours of work and the category of labour would be specific to different professions. The wages in the latter case would be constrained by the minimum of the rent determined for the category of labour in demand.

Whenever an individual acquires income greater than what is due to him by dint of his input of labour and other resources, which produce this income, he commits what is known as 'rububiyah', that is, sole proprietorship of the means of production. Because Islamic economic ideas hold that fundamentally all means of production belong to God, so an individual by transgressing this limit commits a form of excess.

Under this category of excess are included rent on land and sharecropping, but rent on money capital is permitted.⁵ As regards the prohibition of the rent on plain land we have the *hadith* (saying) of Prophet Muhammad, that 'He who has a land should cultivate it and should not rent it — not even for a third or fourth of its crop and not for a specific amount of food'.⁶ Inherent in this *hadith* is the problem of value. Uncultivated land has not received the labour of the owner and is therefore, not liable to a price until it is exploited to produce. Thus, in the first case we have the idea of value in use and in the second case the idea of value in exchange.

It must be noted that rent was prohibited only on plain land, and not on land in which there has been input of labour and capital by the owner. In the latter case it would be an act of injustice towards the landowner to have him forego for nothing in return, the exchange value created in the land by his labour and capital inputs. However, it is suggested strongly that this rent cannot be in crops, but in money terms. In this regard we have the following tradition mentioned by Abu Dawud, who quoted Sa'd Ibn Waqqas, a companion of Prophet Muhammad, as saying, 'We used to rent land and pay the owner as rent the produce on the banks of the irrigation canals. The Prophet prohibited this and ordered us to pay rent in gold and silver'.⁷ Thus, while rent was prohibited on plain land, it was allowed in cultivated and used land. Sharecropping was prohibited.

3. *The Principle of Distributional Equity*

The third major principle of Islamic economics is the right of society to

redistribute private property. This is amply supported in several Quranic verses.⁸ The chief items of national income and transfer payments used for redistributive purposes in an Islamic economy are *zakah* (tax on wealth exceeding a certain exemption level called *nisab*), *sadaqah* (voluntary charity), *ghanimah* (war booty), *fai* (property acquired in war without fighting), *fidth* (a part of *fai* whose distribution pattern is similar to *zakah*), *kharaj* (tax on lands conquered during war), *'ushr* (*zakah* on crops).

There is no order in the Quran that the various sources of funds must be spent in strict accordance with the practice during the early period of Islam. It is just the broad principles of expenditure of these funds as laid down in the Quran and further elaborated through the Islamic legal sources, such as the *hadith* (traditions of Prophet Muhammad), *fiqh* (legal study based on original sources) and *shariah* (Islamic law as it pertains to different affairs of life), that must remain invariant. For example, the way the four-fifths of *ghanimah* was distributed among the Muslim soldiers in the early period of Islam was only an exigency at a time when wars were thrust on the Muslims before an Islamic state could be established. In these conditions there existed no standing army nor a state treasury to finance a standing army. Therefore, the Muslim soldiers during that early formative period were allowed their share of the war acquisitions. However, in a modern Islamic state the army could be regularly paid as are civil servants and war acquisitions would be added to the state treasury.

Similarly, the remaining one-fifth of *ghanimah* can go to the state treasury to supplement organized forms of social assistance programmes. The part due to the Prophet and his near kin during the early period of Islam can now be returned to the government for public works.

Similar is the case with *zakah* expenditure in the form of an organized social assistance programme undertaken by the state. The stated categories of expenditure of the *zakah* fund can be extended to cover programmes of employment creation, family welfare, rehabilitation of the aged, unemployment insurance, income support during times of economic losses and others. Even the rate of *zakah*, originally fixed at 2.5 per cent on all forms of assessed wealth exceeding *nisab* level at any given point of time can be varied but only marginally.⁹

At the more micro-level the Islamic law of inheritance helps to redistribute private property. The Quran is clear on this point.¹⁰ The primary motive of the law of inheritance is to put a final check on the concentration of material assets in the hands of a few.

In short therefore, equitable redistribution of income and wealth is incumbent upon the Islamic state and the individual, and has to take place fundamentally on the basis of Tawheed and Brotherhood. The objective of this redistribution is to increase the productive transformation of national income and wealth to the employment and welfare of the citizens. Thus, when the early Muslim refugees, evicted from Mecca found refuge in the city of Medina, they became members of that society and were treated on equal terms and not confined to camps and charities. If a refugee could cultivate land he was given land to do so; if he had traits of a trader, he was allowed to open a business; whoever could not manage, had the help of a brother in faith.

ANALYTIC IMPLICATIONS OF THE ISLAMIC ECONOMIC PRINCIPLES

The viability of the three major principles of Islamic economics must be tested on two grounds in order to establish the workability of an Islamic economic system. First, they must be capable of rational economic analysis. This rational economic analysis may not be of modern economics but must be consistent with economic assumptions and behaviour, normative or positive, at the micro and macro levels. Then they must also be capable of translating themselves into practical applications with the help of suitable Islamic policy instruments.

Let us first investigate the viability of the principles of Islamic economics in terms of rational economic analysis.

1. *Analytic Implications of the Principle of Tawheed and Brotherhood*

In order to establish the principle of Tawheed and Brotherhood, Islam makes the elimination of *riba*, that is, interest, and the redistribution of individual and national wealth imperative. The Islamic state has established institutions to bring these policies into effect. These are discussed in the next section.

According to the neo-classical economic theory the distributive components of the total annual gross product of the nation are used in three ways: one goes to acquire more real capital inputs for further production; the other goes to wages; the third is taken by the entrepreneur in the form of profits, interest and rents, forming in this way the capitalist's surplus value. The presence of interest rate and an initial outlay of capital then give rise to a continuous accumulation of capital. In fact, the capitalist earmarks his income for this accumulation. As capital accumulates, the rate of profit either falls or becomes constant. The rate of interest rises and consequently investment falls. In order to maintain the levels of his profits the capitalist lowers real wages or causes unemployment.

Therefore, to facilitate the accumulation of capital in the hands of a few at the expense of lowering wages and of unemployment, exploitation of the labour force sets in. The principle of equality and cooperation is therefore, disturbed by the presence of interest in the accumulation of capital.

Riba in Islam does not mean interest on loan capital only. Any raising of individual or state claim of ownership beyond what Islam considers lawful is therefore, to be considered as a limit to the ownership of the means of production. This is, however, not tantamount to a socialist economic doctrine on the exploitative nature of interest. The abolition of interest in Islam is considered important so as to provide a check on the exercise of the right of private proprietorship, and thereby, to end the oppression and exploitation of the labour force, while a free enterprise cooperative system is maintained.

2. *Analytic Implications of the Principle of Work and Productivity*

In the framework of a pure exchange economy, it can be shown that the marginal conditions for the existence of Pareto optimality (the first order conditions of efficiency in a perfectly competitive market in modern economic analysis) in the Islamic exchange system depends not only on the ratio of the

marginal utilities of product and wages for the two individuals, but also on the ratio of the marginal utilities of the two individuals, owner and labour, with respect to the level of product and wages. The significance of this result lies in the fact that under the principle of equality and cooperation and the institutions which translate this principle into practice, marginal utility of the owner depends not only on his returns from rents, but also on the wages which he has to give to the labourer equitably. Likewise, the marginal utility of the labourer depends not only on the amount of wages he receives but also on the amount of rents, which he must justly give to the employer. Clearly, with respect to the ordinary exchange situation, the presence of product and wage variables in the utility functions of the two individuals introduces a distortion in the ordinarily known economic system. Therefore, with respect to the ordinary solution for the first order conditions of Pareto optimality the Islamic solution to the exchange problem given above leads to what is known as a Second Best Solution, but only with regards to the ordinarily known concept.

A Second Best Solution is an economic expression denoting a state of resource allocation that is not efficient, but where efficiency can be improved by certain external actions. Such corrective actions can be wielded by the government, through taxes, subsidies and government expenditures, by a powerful politically conscious populace, through their demands for certain value systems, and other non-market forces. In an Islamic economy, as aforementioned, it is the essence of cooperation between labour and employer in a productive work environment, that constitutes the corrective force of a Second Best situation. An economic Second Best Solution is indeed a more realistic state of the market economy.

Once the allocational principle with regard to land rent and profit-sharing has been established, Islam then allows profits on the produce of the land. Therefore, the value of the product sold in the market is determined by wages, rents and profits. Mark here the Smithian concept of the 'natural price' of a commodity.

The essence of cooperation referred to above while discussing the labour-employer relation in the work environment, is more extensive than only this in the Islamic economy. It tends to replace the idea of competition in a modern market economy. The principle of cooperation involved here, is that when certain firms in the Islamic economy find themselves at odds in competing with other firms, they are encouraged to enter into partnership with owners of more viable enterprises. Such partnerships then entitle the owners and partners to set their mutually agreed upon profit-sharing rates. Such a system of profit-sharing in fact, pervades both the private and the public sectors in an Islamic economy, and is referred to in the Islamic literature as, *mudarabah*. We discuss this in more detail later on in this paper.

In a modern market economy, technically, whenever such partnerships occur, some degree of efficiency in resource allocation is considered to be lost, for instance, in the case of mergers and oligopolistic competition. The perfectly competitive conditions of the modern market economy then fail to exist.

This elementary idea of the difference in the principles of cooperation in an

Islamic economy versus the principle of competition in a modern market economy is an important one. This difference brings about further differences in the functioning of the institutions in the two systems and on the concept of economic efficiency as ordinarily understood.

3. Analytical Implications of the Principle of Distributional Equity

The analytical relations developed by the author elsewhere¹¹ on the relationship of *zakah* to per capita income and *zakah* to labour force activity can be succinctly summarized here to show the role of *zakah* in economic activity. *Zakah* is found to be associated with an income multiplier effect. This can be explained via the relationships between *zakah* rate and earnings through changes in the investment level. Since *zakah* is imposed on idle assets only, which can be put to productive use, so economic rationality will call for a depletion of all idle stocks to make room for investment flows. Increased investment will thereby, cause increasing income through the multiplier effect, calculated at the end of the *zakah* fiscal year. Therefore, if the *zakah* rate increases it will cause holders of idle capital to put them into productive use. Investment flow will cause income to rise through the multiplier effect. Hence, the multiplier is a positive function of the *zakah* rate. Since the *zakah* rate and the income multiplier are positively related, therefore, an increase in the *zakah* rate brings about increased income through increased investment flow, which in turn creates higher labour force participation rate.

The principle of distributional equity implies that there is serious responsibility on the state efficiently to distribute national output among the people and institutions. This further implies that there is allowance for a good degree of government intervention in the Islamic economy. Unregulated freedom of enterprise and the earning of exorbitant profits may at times prove reprehensible to society. Some may earn inordinate wealth out of profits and the availability of labour and capital in production, while others would not be able to have such easy access to the factors. But on the other hand God has allowed equal right of usage of these factors to all. In such circumstances the strictly public common pool like the *Bait al-Mal* (public treasury in an Islamic state) serves to control and distribute wealth and national output according to the principle given above. Therefore, besides the obligatory tax, that is, *zakah*, the individual has also to spend in the path of God for the propagation of truth. Finally, if he still has private property, this cannot be concentrated on a single hand after his death. Children and near relatives, or failing these, distant relatives, whether male or female, are lawful heirs and their shares are given by fixed percentages as stated in the Quran. Islam also recommends him to make a will for welfare projects, which normally shall not exceed one-third of his property.

POLICY BASIS OF THE ISLAMIC ECONOMIC PRINCIPLES

Let us now address ourselves to the second test of viability of the three fundamental principles of Islamic economics, namely, how they can be translated into practical application. The three major principles of Islamic economics are put into effect by four key instruments of policy on which other

policy instruments can be built. They are (1) the abolition of *riba*, meaning interest on capital; (2) the institution of *mudarabah*, meaning profit-loss-sharing system in Islamic economic ventures; (3) the abolition of *israf*, meaning wasteful consumption, and (4) the institution of *zakah*, which is an organized form of social assistance in an Islamic society financed by tax on all forms of income and wealth exceeding a certain minimum exemption level called *nisab*.

1. Abolition of Riba

Islam categorically disapproves of the existence of interest in all economic transactions. The Quranic concept of *riba* is not limited to loan interest. Literally, *riba* means excess over and above a thing, be it in money terms or in physical units of goods. When money is involved in exchange, *riba* refers to the form of excess that was taken by the pre-Islamic Arabs over and above the principal loaned out for a period of time. When commodities are exchanged by weight or measure, then there must be strict equality in such weight and measure, and immediate delivery of both goods. However, if the commodities are of different species, then equality is not insisted upon but delivery must be immediate.¹²

Modern exchange economy justifies the need for interest in order to achieve allocative efficiency as interest is assumed to cover the cost of capital in production. By thus maintaining the recovery of capital depreciation in production an initial outlay of capital becomes a source of a continuously increasing stock of capital in future periods of time, and this promotes the production process. This idea would indeed be acceptable in Islamic economics of *riba* if interest was in fact truly related to the actual proceeds from production, for in that case the rate of interest would be the same as the rate of growth of output. But in reality, the rate of interest being a pre-fixed percentage on capital, measuring speculative and not actual cost of capital, is an exogenous variable. It is determined outside the production system.

In the Islamic economy only the actual cost as determined by production cost can be taken into account in compensating capital depreciation, and not the speculative cost component. Therefore, the rate of interest is replaced by the rate of profit, which in turn is determined by contractual percentage shares in an Islamic profit-loss-sharing mechanism known as *mudarabah*.

2. Institution of Mudarabah

In the absence of interest in economic transactions Islamic banks would not function as modern banks do. That is, unlike the modern banking system the Islamic banks would not be in a position to create unlimited liquidity based merely on the notion of expected demand by creditors. This has its logical explanation — if expectational demand for liquidity is not satisfied when it becomes due, there will be recessionary pressures in the economy. The economy remains below potential rate of growth, under-utilization of production capacity puts upward pressure on the cost of production. Consequently, market prices for goods and services rise. On the other hand, if the supply of money exceeds the demand for money, there will be inflationary

pressures on the economy, for now there is too much money around, but producers decide to cut back on production capacity and investments are subsequently not forthcoming. Incomes rise, but not due to the force of labour productivity or technological change, but due to the supply effect of money on prices and incomes.

In the search for monetary policies to control such recessionary or inflationary situations banks either move to an easy money supply policy or to a tight money supply policy, respectively. The interest rate goes down and then gets pegged in the case of easy money supply, and moves up and then gets pegged in the case of tight money supply.¹³ The interest rates thereby, continuously swing between the two ends over long periods of time in the hope of creating the balance between ex-ante demand and ex-post supply of money.

If there was no interest the purchasing power of money would be used up either in consumption or in investment, directly through banks operating on the principle of profit- and risk-sharing in a joint enterprise in an Islamic economy. This is the institution of *mudarabah* in Islamic economics. In the presence of *mudarabah* the rate of interest is replaced by a positive rate of profit.¹⁴ A positive rate of profit arrests the problem of speculative demand for cash balances, because the ex-ante demand for money capital is reduced to an actual demand and this is based on a pure contractual sharing of profits from a joint venture in accordance with relative costs or relative capital outlays in a given production or investment.

The institution of *mudarabah* when applied to public-private sector joint ventures is a powerful medium of risk diversification. Public enterprises are found to be only marginally risk-averse in their investment behaviour, particularly because they can easily diversify the total risk capital in the public enterprise by distributing it over a large number of investment projects.¹⁵ Risk neutrality on the part of the public authority encourages real investment in the economy. Increased allocation of money capital into real investment reduces the amount available for consumption expenditure but only to a certain desired level, so as to maintain an optimal allocation of capital between consumption and investment intact.

Excessive consumption is emphatically discouraged by Islam and the means to do it is the institution of *mudarabah*, that automatically brings about a desired allocation of money capital between consumption and investment activity while encouraging investment in real capital.

3. Abolition of *Israf*

Excessive or wasteful consumption, be it of necessities, comforts or luxuries, and of goods or services is called *israf*. The point mentioned above that the prospect for high rates of return in real investment in a *mudarabah* system, increases real investment and reduces relatively consumption expenditure, is found to control the practice of *israf*.

A lower propensity to consume and a higher propensity to invest negates the basis of the neo-classical consumption theory of interest. A brief look at the Islamic investment-consumption behaviour is warranted at this point:

- (i) An Islamic society gives consumption priorities to the necessities and

comforts of life in this order. It is widely agreed upon by many Islamic scholars that the production and consumption of luxuries is prohibited in as far as this is tantamount to *israf*.

- (ii) Excessive production and consumption of any type of good is not recommended, for this creates wastage of factors of production and of produced goods.
- (iii) Savings in the form of real investment to produce the necessaries and comforts of life and more capital goods that increase the productive capacities in the following periods of time is highly encouraged.

In an Islamic economy therefore, the approach to the study of inter-temporal allocative efficiency of modern consumer theory is replaced by the welfare analysis of income allocation predominantly into real investment. A priority area of Islamic economic theory¹⁶ would therefore, be Islamic welfare economics. One would first have to develop carefully the axioms of a choice theoretic approach to individual and social ordering, based on the principles of the Islamic integrated value system, particularly as they apply to the issue of investment-consumption allocation of resources.

4. Institution of Zakah

One of the most important Quranic injunctions on Muslims is the payment of *zakah*, that is, a capital tax on accumulated wealth. *Zakah* is one of the five immutable pillars of Islamic faith. Literally, the word, *zakah* means sweetening and it is meant to purify wealth from its evil tendency to accumulate more and more in fewer and fewer hands on account of the unequal opportunities which men enjoy. Through *zakah* the wealthy Muslims are made responsible individually and collectively for providing for the basic necessities of all members of the society. Islam does not object to the earning of large sums, but makes it a bounden duty of the wealthy to see that not a single soul is deprived of the basic needs of living.

A special economic significance of *zakah* is that it is the avowed enemy of hoarding. A man's wealth according to Islam has to be spent partly on the necessaries of living and comfort, in productive investment, in charity, for the benefit of Muslims in general and in the way of God. After these whatever remains standing for a year is liable to be taxed under *zakah*. *Zakah* revenue consists of a levy of 2.5 per cent on all idle wealth, one-tenth to one-twentieth of all agricultural produce, one-fifth of all mineral wealth, and a tax on the entire earning from capital of the nation. *Zakah* fund is payable: (1) to the poor, (2) to the needy, (3) for the propagation of Islam, (4) for those in bondage, (5) for those in debt, (6) for the wayfarer, (7) to the functionaries who collect and distribute *zakah*, as their remuneration, (8) to other noble causes for which money is required. It must however, be clearly understood that it is only the principle behind *zakah* that remains immutable in Islam, but not so the ways of collecting and distributing it in the broadest possible aspects of the eight categories of expenditure mentioned above.

CONCLUSION

The foregoing has been a brief outline of the principles of Islamic Economics. By the word 'principle' we have meant the fundamental philosophy of this system of economics. This, therefore, does not include the specific assumptions, or structure, or an exhaustive coverage of the instruments of policy that would characterize the functioning of the different sectors of the Islamic economy based on the above-mentioned principles.

The principles of Islamic economics would play a major role in the shaping of a new development programme for Muslim nations, if they are accepted as the new value system of economics. We conclude this paper by recommending that while Muslim nations are now at the threshold of a new era in joint national science and technology policies,¹⁷ they should clearly identify their national priorities in social values and link them soundly with their economic development strategies. The harmonious blending of the two alone can put Muslim societies on the path to a sustained, productive and meaningful growth.¹⁸ Reddy¹⁹ has recommended the establishment of a New International Economic Order for the fusion of the different objectives of development with the social and ethical values that found societies. In Muslim societies such values must inevitably be the Islamic values, and any form of economic development must seriously consider the potentials of Islamic economics as the basis of the New International Economic order.

NOTES

1. J. Schumpeter, *History of Economic Analysis* (New York: 1968).
2. Quran, Surah 4, verse 1.
3. Quran, Surah LV, verse 9.
4. Quran, Surah II, verse 30–31.
5. A. H. A. Sulayman, 'The theory of economics of Islam', *Proceedings of the Third East Coast Regional Conference*, Muslim Students Association of the United States and Canada, April 1968.
6. Ibn-al Qayyim, *Tahdhib Sunan Abu Dawud*, Vol. 5, Cairo.
7. Ibn-al Qayyim, op. cit.
8. Quran, Surah 59, verse 7–9.
— Surah 8, verse 41.
9. S. W. A. Hussaini, *Principles of Environmental Engineering Systems Planning in Islamic Culture: Law, Politics, Economics, Education, and Sociology of Science and Culture*, Stanford University, Report EEP-41, December 1971.
10. Quran, Surah 4, verse 17.
11. M. A. Choudhury, 'A social service model in the I-economy', *Proceedings of the Seventh Annual Conference*, Association of Muslim Social Scientists, Marion College, Indiana, USA, July 1978.
12. M. Muslehuddin, *Insurance and Islamic Law* (Lahore: 1969).
13. M. Bailey, *National Income and the Price Level* (New York: 1971).
14. M. A. Choudhury, 'A mathematical formulation of the principle of Mudarabah, the profit sharing in Islam', *Proceedings of the Third National Seminar*, Association of Muslim Social Scientists, Gary, Indiana, May 1974.
15. M. A. Choudhury, 'The rate of capitalization in valuation models in an Islamic economy', (forthcoming) *Proceedings of the Follow Up Seminar on Monetary and Fiscal Economics of Islam*, Islamabad, 6–11 January 1981.
16. M. A. Choudhury, *A Specification of the Social Welfare Function in an Islamic Economy with*

Application to Cost-Benefit Analysis (mimeo), International Centre for Research in Islamic Economics, King Abdulaziz University, Jeddah, Saudi Arabia, September 1980.

17. The Islamic Foundation for Science and Technology for Development (IFSTAD) is now a member body of the United Nations Program on Science, Technology and Development (see reports of IFSTAD presented at the 10th and 11th Islamic Conferences of Foreign Ministers, Organization of Islamic Conferences, Jeddah, Saudi Arabia).
18. S. N. H. Naqvi, 'Ethical foundations of Islamic economics', *Journal of Development Studies*, University of Peshawar, Vol. 1, No. 1, 1978.
19. A. K. N. Reddy, 'Methodology for selection of environmentally sound and appropriate technologies', (unpublished), United Nations Environment Program.