Sustainable Development Goal 12 (Sdg12) Under Asymmetric Information: A Game Theoretic Approach

Arnab Mahapatra

Department of Economics, University of Burdwan, West Bengal, India

Abstract:

Sustainable development promotes economic activities without any harm to environment. Question arises about adoption of strategy. How do we reduce harm to environment or protect it? Millennium development Goals (MDG) has fulfilled some targeted goals as set it in globally, however, still there are certain gaps to ensure sustainable development. Sustainable Development Goals (SDGs) are set to meet some challenges that world facing currently. Within 17 SDGs, 12th SDG (SDG 12) is "responsible production and consumption" that ensure every economic agent should minimise to zero resource waste within the year 2030. It needs to modify the wasteful production and consumption processes, which is the cornerstone of the SDG 12. One of the major hurdles in achieving the gainful production and consumption is the presence of asymmetric information regarding process of production or preferences of consumers which createsbarrier to gainful production and consumption. This paper discusses how the interplay of producers, consumers and government that can be capable enough to arrest the asymmetric information and move towards the SDG 12 in a game theoretic framework.The asymmetric information can be removedthroughco-operation and co-ordination among economic agents. Co-operative strategy is necessary and sufficient to arrest asymmetric information about distribution of resources and usage gainfully.

Keywords: Asymmetric Information, Co-operation, Co-ordination, Interplay, Interlocution, MDG, Optimal Strategy, SDG12, Zero waste.

1. Introduction

Sustainable development promotes certain economic activities without any harm to environment so that development can be propelled in all generations to come along with the existing generations. In this context, question arises about adoption of development strategy. How do we reduce harm to environment or protect it? What will be the strategy adoption policy for harmless environment in the process of production and consumption? Millennium Development Goals (MDG) has fulfilled some targeted goals as set it in globally, however, still there are certain gaps to ensure sustainable development. Sustainable Development Goals (SDGs) have been set to meet certain challenges that the world facing currently. Within 17 SDGs, 12th number SDG is "*responsible production and consumption*" that ensure every economic agent should minimise waste or zero resource waste within the year 2030. Hence, it is important to modify the processes of wasteful production and consumption and develop these into gainful ones, which is the cornerstone of the Sustainable Development Goals 12 (SDG 12). One of the major hurdles in achieving the gainful production and consumption is the presence of asymmetric information. The asymmetric information arises about the process of production or the tastes and preferences of consumers that create barrier to gainful production; whereas information regarding nature of goods, product origin, availability of goods on demand etc. make certain barrier to gainful consumption. Co-operation and co-ordination between producers and consumers are the need of the hour to overcome these barriers. Through continuous co-operation and co-ordination such asymmetric information can be made symmetric and available to a large extent in the short run but in the long-run co-operation is necessary and sufficient to arrest asymmetric information for distribution of resources and usage gainfully. Moreover, in the long-run any deviation from co-operation becomes the bone of contention of the deviant. In this context the government intervention is essential andthe society allows the government to act as a mediating party or interlocutor. Such an interlocution would surely come in handy in terms of enforcing various rules to punish the offending party. In this way, any short-term gain through deviation can be neutralized in the long-run and no party would not dare to deviate from the path of co-operation. In the long-run, co-operation is the panacea for asymmetric information and optimal production and consumption. Also mediating government plays an important role in developing rules to curb deviation, if any.The present paper underpins how the interplay of producers, consumers and government can be capable enough to arrest the asymmetric information and move towards the sustainable development goal 12 in a game theoretic format.

1.1 Motivational Background of SDG

The United Nations (the UN) addresses several critical issues which are hitherto left unaddressed and untouched. Such issues cut across political and geographical boundaries. Recently, the UN has put forwarded the Sustainable Development Goals (SDGs) with setting possible targets in 2015. There are lots of doubts on it. The SDGs, as an evolution of the Millennium Development Goals (MDGs), evoke a number of reactions from different quarters. The striking argument which remains pertinent is the human resource argument. The Millennium Development Goals propose to create human resource while

the SDGs underpin inclusive uses of the human resources in a judicious manner. Moreover, SDGs extol the necessities to preserve lives and livelihoods, maintain equilibrium among all components of societies and make possible development with keeping ecological balance intact. In a nutshell, sustainability has become the moot point whenever it comes to any development aspect. In other words, sustainable development, in its true sense mandates zero wastage. How do we achieve zero wastage? Consider a framework of judicious utilisation of resources, when zero wastage is taken cognisance of. Obviously zero wastage indicates that we should generate waste negligible or near to zero amount in our sustainable production and consumption. The sustainable production is nothing but the production with optimal usage of resources whereas sustainable consumption underlines the consumption with maximum satisfaction with minimal loss of produced goods over a period of time.

The SDGs have 17 goals and 169 targets of which Goal 12 is one of the most important goals which focuses on responsible production and consumption. The term 'responsible' implies gainful production and consumption without harming environment. In other words, it becomes gainful for both producers and consumers as well as for environment. However, such gain is marred by the presence of asymmetric information. It is asymmetric information which actually makes the access to accurate information by people from different strata regarding production and consumption. The producers are in the dark about the exact sentiment of the consumers in association with the products and they are also in a dilemma to choose the process of production that would reduce costs and maximise profits. Similarly, consumers are very much in the uncharted territory when it comes to the provision of exact information about nature of products and their easy availability. Here lies the importance of co-operation among them. Co-operation between producers and consumers in the long-run would be a well-perceived solution. There is also certain aspect of breaking away of the co-operation where one of the parties (either producer or consumer) cheats for further gain in the short-run. In order to prevent such cheating, the mediating role of the government is important. The Government enforces various laws to stymie cheating and keep the process of cooperation swift to allocate resources optimally. Thus, co-operation must be made between producers and consumers under the supervision of government as a mediator in the short-run as well as long-run. This paper attempts to explain the necessity and sufficiency conditions for co-operation between producers and consumers under the mediation of government in the framework of a game theoretic model. The paper also highlights on role of the government which is to be critically evaluated in sustaining co-operation both in the sort-run as well as in the long run, especially in the long-run.

This paper is organised as follows. Next section discusses wastefulness in the context of conventional production and consumption. Section 3 provides literature review. Section 4 presents the game theoretic models. Section 5 explains theoretical perspectives and finally, Section 6 concludes with some policy suggestions.

2. Conventional Production and Consumption: A Saga of Wastefulness

Following the traditional methods and processes of production we usually adopt indulge in wastages. Resources are either over-utilised or under-utilised which may cause quick exhaustion or idle resource stock respectively. Over utilised resources lead to rapid exhaust valuable resources that may also deprive a large number of stakeholders. These activities may be the sub-optimal situation which may lead towards unsustainable environment. Such sub-optimal utilisation of resources put an unbearable burden on environment. Since 1980s the planet has been in 'ecological overshoot' as the world population uses resources[1] in a quantum which is more than that of being replaced. The un-utilised or over-utilised resources lead to greater loss of profit due to higher prices for the natural resources (Porfiriev, 2020). The conventional production and consumption do not take care of environmental aspects. Traditional production and consumption generate huge wastages. There is no room for such wastages being recycled and reused in the economy. One major aspect which stimulates such wastefulness of resources is the presence of asymmetric information. The presence of asymmetric information arises from the ends of both producers and consumers. The asymmetric information actually creates problem for the stakeholders for the even access to various relevant resources for production and consumption purpose.

As a stakeholder, the producers fail to muster accurate information about the sentiment of the consumers, their tastes and preferences, their prevailing demands. The producers are unable to identify exactly the sentiments of the consumers or the variations in the market. Such a failure invariably leads to over-production or under-production. In short, a disproportionate production takes place leading to unbridled exploitation of resources resulting in quick exhaustion.

On the contrary, the consumers fail to capture adequate information about the nature of products they are likely to choose to satisfy their needs. The most striking aspect is that the case of over-consumption or under-consumption is tantamount to wastages. It is so because the optimal use is impossible under asymmetric information condition. Thus, the conventional production-consumption ecosystem ensures wastages. To mitigate the wastage, we must fall back on co-operation where both producers and consumers are bound by some agreements both in the short-run and the long-run. Government's role must not be demeaned in the event of overseeing whether agreements are broken by any party to earn short-term gain at the expense of the other. The co-operation among these three parties works wonders to ensure optimal allocation of resources by reducing asymmetry.

3. Literature Review:

Literature deals with common pool resources, and role of asymmetric information regarding its extraction. Moreover, literature also focuses on optimal extraction mechanism of common pool resources by participating parties, and introduces the government as mediator in the extraction process for ensuring judicious extraction. The asymmetric information is hindering a judicious extraction which is cleared by the government as a mediating institution. The massive government control or any other form of direct intervention in regulating the extraction by participating parties that would lead to

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[1] see https://www.ces.vic.gov.au/sites/default/files/publication-documents/3.0_ProdConandWaste.pdf

unbridled corruption and large-scale centralization (Ostram 1990). The government as part of intermediation would be the key to economically optimal distribution (Balandand Plateau 1996).

Literature highlights and appreciates the institutional role in overseeing the distribution of common pool resources. The common pool resources extraction optimally is quite impeded by the presence of asymmetric information. That is why, the exploitation by one user reduces the availability for others (Ostram 2006). It simply leads to 'tragedy of commons' (Hardin 1968). Thus, this asymmetry in the information about the production-consumption framework and the subsequent removal of it coupled with judicious distribution of common pool resources could be achieved when the selfishness of the appropriators will be eliminated (Sajio et al. 2017).The problem of common pool resources extraction and the subsequent difficulty in determining the optimal path of extraction in the backdrop of asymmetric problem could be solved by unitizing the producing firms into a single one and charting out or rolling out strategies to distribute among parties (Taylor 1992).

The problems of common pool resources extraction and the question of its judicious management eliminating asymmetry is significantly dealt with in terms of successful community management (Ascher 1995, Bromley 1992, McCayand Acheson 1987, Peters 1994, Tang 1992). Co-management programmes assign local communities a control and subsequently benefits would be achieved from such community management of the resources (Agrawal andRibot 1990, FAO 1999). This co-management programme for judicious utilisation and extraction of resource also makes individual decision-maker to contribute to resources extraction according to needs (Cheung 1970, Dasgupta and Heal 1979, Runge 1984, Ostram 1990). The co-management among the members of the community would also take care of environmental protection (FAO 1990)

The extraction of common pool resources and its subsequent management can be made efficient and checking of asymmetric information in relation to it that depends on the extent of social capital. It is also noted how the management leads to new generation of social capital in the economy (Katz 2000, Muldavian 2000, Robbins 2000). In short, the literatures on common pool resources deal with a number of diverse viewpoints of management and through these ways symmetry could be ensured and optimal extraction path could be realized. A brief review of selected papers is discussed in the following:

Baland and Platteau (1996) lay stress on the regulated extraction of common pool resources. They point out that strict regulation enhances the efficiency of the common pool resources. Ostram(1990) underpins the role of government to manage and allocate the common pool resources in place of the strict private or public control. Strict public or private control encourages massive corruption and unequal distribution of resources. Only government promotes centralized distribution of resources.Whiteford (2002) categorically points out the role of government to act as a trustee and defend the common pool resources from rash and reckless exploitation.He vouches for sufficient institutional support and ropes in the principle of reserved rationality for protecting the resources against the unbridled exploitation. Tamilsina, Kotani andKamijio (2017) sheds ample light on the fact that as the society moves towards capitalism, it loses the sustainability in the use of the common pool resources. They attribute it to the losing co-operation among individual in the ever-increasing capitalist set-up. They mince no words

about the importance of co-operation for proper allocation of common pool resources where there is no assignment of property rights.Boonen, et al. (2019) rope for the role of institutions in handling the common pool resources to mitigate any adverse impact like climate change, food security, transmission of knowledge etc. They refer to the importance of self-organization and community management through co-operation[2] for better and efficient allocation.However, the common pool resources are fundamentally uncertain and have potentially high costs because of asymmetric information[3]. A game theoretic model is set up to solve such problems.

4. The Model:

The role of co-operation in allocating resources optimally in the backdrop of asymmetric information is to be taken cognizance of. In this context, information asymmetry may arise regarding waste creation in production process. Producers do not disclose either over exploitation of natural resources or waste generation in process of production, whether consumers are aware about environmental dangers or not. Consumer may reject the product which generates more waste in the production process. In order to find out how sustainability is maintained in the backdrop of asymmetric information through optimal strategy choice for the economy. This is demonstrated in the following models. Model-I discusses the choice of resource allocation strategy among producers in both short-run and long-run. Model II discusses about the information sharing strategy choice between producer and consumer.

4.1 Model 1

We set up game theoretic model and discuss the resource allocation strategy. We demonstrate it in terms of a model,which finds out how sustainability is maintained in the allocation of resources against the backdrop of asymmetric information[4] through optimal allocation of resources.

Our model is built up following assumptions:

a. There are three players – ProducerI, Producer II and Government.

b. There is only one type of resource – common pool resources[5].

c. There are two strategies: Co-operation (C) and Non-co-operation (N-C).

d. Only resource allocation for extraction concern is considered here.

e. Government acts as a mediator. Government only oversees the implementation of laws and orders along with safeguarding the interests of two parties.

f. Government does not change tax and other functioning laws.

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[2]**Saunders** (2014) argues that the co-operation among parties must be in place to address the needs and necessities of individuals in communities. It leads to 'unfulfilled expectation'. Thus, he marks the importance of co-ordination instead of single extraction. **Gelcich, et al.** (2013) has made arguments in the context of Chile. Here fishing is done through cooperation in order to earning a livelihood.

[3] See also Whiteford (2002).

[4] Information is not equally distributed to all.

[5] Resources having multiple groups of users with no proper definition of property rights.

Under the above-mentioned assumptions we can delineate the model as follows:

Since there is only one type of resource and two parties exist an extraction of resources by one party will definitely exhaust the reserve of resources for other one by the amount extracted by one party. Thus, there is a tendency of each party to maximize individual gains and there remains every probability to break away from core of co-operation in the short-run. Again, in the long-run the urge to maintain individual profits throughout will motivate such a deviation. A deviation may well lead to a gain in terms of individual profits. However, trigger strategy of the game is at play in our model. A trigger strategy underlines how any deviation from co-operation at any stage may lead to a short-term gain of concerned stage while it would lead to lower pay-offs in subsequent stages as non-cooperation of a party at any stage leads to non-cooperation from other parties. In this context the government steps in as a mediator. Government oversees to control unwarranted defection. If defection happens, the order of co-operation will be dwindled and a lopsided outcome becomes imminent. Thus, in the context of common pool resources, lack of co-operation intensifies inequality in the distribution of resources. That is why; a proactive role of government to implement laws and necessary regulations must be taken cognizance of.

		Producer I	
	Strategy	C	N-C
Producer II	C	X, X	Z, P
	N-C	P, Z	Y, Y

Here we consider $P > X > Y > Z$

In the short-run there is a temptation for both producers I and II to deviate to N-C strategy as it yields greater pay-off in comparison with the situation in the long-run as $P > X$ and $Y > Z$. It is rational to choose (N-C, N-C) strategy as Nash-equilibrium condition implies so. However, it might be economically inefficient as through co-operation both would gain (X, X) pay-off. That is why, in the short-run both would be placed in a lower pay-offs in comparison with what had been gained through co-operation. Thus, in the short-run both parties suffer a jolt in terms of lesser pay-off in the absence of co-operation.

On the other hand, if the game is played for a long period of time, the deviant party (any one deviant party) would come under the trigger strategy. It refers to the fact that a deviant party would be satisfied with the lower pay-off of (N-C, N-C), i.e. (Y, Y) if it starts non-co-operation from a particular stage in anticipation of a short-term benefit from such deviation. Once the deviant deviates, the concerned deviant is no longer co-operated by the other participant in the subsequent stages under trigger strategy.

Thus, from the above game theoretic model it is clear that both short-run and long-run imply that co-operative strategy is the optimal strategy for both the parties. In other words, (C, C) is the optimal strategy or (X, X) is the optimal pay-off.

Remarks 1: Producer and consumer, being two parties of an economic set-up must co-operate with each other to enjoy the fruits of common pool resources extraction.

Remarks 2: A particular framework of assignment of property rights is mandatory for the optimal resource allocation.

4.2 Model 2

The asymmetric information and the resultant difficulty in extracting common pool resources by the producer and the level of consumption of the consumer will be illustrated in the form of a very simple game theoretic model. It also demonstrates how asymmetric information could be solved by means of institutional intervention in terms of government.The model has certain assumptions. Our model is built up following assumptions:

 i. There are three players – Producer, Consumer and Government.

 ii. There is only one type of resource – common pool resource.

 iii. There are two strategies – co-operation (C) and Non-co-operation (NC).

 iv. Environmental issues are main concern.

 v. Government acts as a mediator.

 vi. Government keeps tax and other functioning laws intact throughout.

Under these assumptions we explain the model as follows:

From the point of views of both producer and consumer there is asymmetric information. The asymmetry is in the distribution of information that stands in the way of proper management of extraction of resource and/or its consumption.

The producer does have no exact information about the pattern of behaviour of the consumer. The producer does not have any information about current market demand as well as future market demand. Along with it the producer remains in the dark about whether the consumer is concerned with the environment or not. In other words, the producer wants to know whether the consumer is aware of the clean or dirty products.

Similarly, the consumer wants to know the amount of resource extracted by the producer and its protective measurements. Besides, the consumer attempts to know the nature of techniques used in the production. Along with it the consumer is also eager to know the amount of waste produced in the process of production. The consumers always look for a technique which minimises waste production with maximising output production using fewer inputs. However, the consumer has no proper information about these associated with production.

All these happen because the flow of information is asymmetric. Here comes the importance of co-operation in management of the resources between producer and consumer. This co-management is to be overseen and supervised by the government as a mediator between producer and consumer. This is

how symmetry in the information can be ensured and the use of resources for production and consumption can be optimized.

We can explain so in a game theoretic approach in a quite simple framework where both the players, producers and consumers are bound by co-operation. Both they take the strategies of 'Co-operation' (C) and 'Non-co-operation' (N-C)

↱	Producer	
Consumer	C	N-C
C	θ, θ	φ, ρ
N-C	ρ, φ	γ, γ

Here we consider ρ>θ>γ>φ

In the above game structure, (θ, θ) is the most economic or optimal pay-off since co-operation between the producer and the consumer through government mediation would result in it. If both non-co-operate, they would have received (γ, γ) pay-off which is far less than the optimal pay-off.

In this framework, common pool resources are to be used judiciously for sustainable purpose and responsible co-management between the producer and the consumer which is possible in presence of the government. The Government intervention is both necessary and sufficient conditions for this co-management which removes asymmetry in the information. Thus, (C, C) is the optimal strategy.

If the producer continues to non-co-operate with the consumer but the consumer co-operates, then the producer would be gainer exclusively and the consumer would be a loser (as ρ > φ). Again, if the consumer non-co-operates, the producer co-operates, then the consumer would be the gainer exclusively but the producer loses out (as φ < ρ). Thus, the two parties cannot use the resources for sustainable purpose. However, both parties would be gainers if they had chosen to co-operate. Thus (C, C) is the optimal pay-off as Nash equilibrium is achieved here.

The co-operation in sharing information between producer and consumer would make the optimal extraction and possible utilization. It ensures sustainable production and consumption as co-operation brings about symmetry in information with government mediating the two parties.

Remarks 3: In order to keep the spirit of co-operation intact throughout there must be a concrete mechanism to implement laws and the government does it appropriately.

5. Theoretical Perspective:

The sustainable development broadly implies intergenerational equity. It delves into the fact that the traditional developmental strategy itself repudiates the possibility of proper utilisation of resources. In fact, sustainable development underpins the ethos of sustaining civilization over time (Dinda 2017). The core of sustainable development is to ensure sustainable production and consumption (Akenji and Bengtsson 2014). In other words, the sustainable production and consumption are at the core of

sustainability in the resource utilisation, which succinctly points out the optimal utilisation of resources and minimal wastage of resources (Goswami et al. 2017). The root of sustainability, in a sense, is the affinity towards the resource utilisation and recycling, if anything is left unused.

It is the core of sustainable development. It is also pertinent to lay stress on developing economic, social, ecological, technological, environmental and developmental aspects with comprehensive policy framework to overcome socio-economic constraints (Dinda, 2014). In other words, sustainable development takes cognisance of stricture on the development policies on all fronts with keeping environmentintact or/and unaffected. Thus, the cornerstone of sustainable development is to ensure the fact that all will be better-off with none worse-off across generations. In another sense, sustainable development in general and sustainable production and consumption in particular go in tandem with the Hicks-Kaldor Compensation Criterion which states that people with better fortunes must compensate the affected to convey the fruit of overall development. It is applicable to resource extraction. The resource extraction must be in line with sustainable production and consumption which can be described as the optimal extraction of resources and minimal wastages of it.

We consider the case of common pool resources where no property rights are assigned. No assignment of property rights means no individual could extract resources particularly to a definitive extent. There are multiple groups of users. In such a situation, common pool resources pose a serious question on how optimal extraction is possible.

The resource extraction remains a critical issue when there are no definite rights assigned to resources. It is the case of negative externalities when it comes to no proper assignments of property rights. If one party extracts resources, other party stands deprived of enjoying amountsof resourcesextracted by the previous party. It poses negative externalities. Thus, the asymmetry in information about the availability of resources among the participants. On the other hand, the unbridled extraction of resources will simply exhaust the resources since such common pool resources are not reproducible. Thus, the question of sustainable management of common pool resources comes to the forefront.

We consider two parties: producers and consumers. We also take into account the aspect of both the parties engaged in using common pool resources. The producers, when they deal with common pool resources are searching for the optimal amount of extraction. On the other hand, the consumers are also in the dark about the optimal consumption of resources. Such a lack of co-ordination wrecks havoc on the optimal utilisation of resources. It defeats the very core of responsible production and consumption. It inhibits sustainable production and consumption.

In the backdrop of such un-sustainable resource management efforts must be made towards co-operation. The co-operation between producers and consumers will create an ecosystem of cordiality and it helps optimal utilisation of resources. The co-operation leads to a higher pay-off in comparison with non-cooperation. If there be any deviation both in short-run and long-run, the deviant would be

left with lower pay-off as trigger strategy[6] is at play. It is another very important dimension to consider the role of government. The deviant party must be tackled by the government. When the government faces such a situation or senses such a situation to be imminent it does not sit idle. The Government must act as a mediator to keep the spirit of cooperation going as cooperation gives us optimal strategy.

The Government, as an interlocutor must take cognizance of the legal aspects of safeguarding the spirit of cooperation. The violator must be meted with adequate preventive measures. It also helps protect the rights of both producer and consumer (Rananavare, 1964). The effort of the government could be summarized as follows:

As an interlocutor and an implementing agency, government does not interfere the courses of action of both the producers and consumers. Rather the government is looking at safeguarding the importance of cooperation. It means that the violator is tackled sternly. Government mediates between the producer and consumer. In fact, government protects the sense of cooperation and thus, optimal allocation of resources is possible under the protective shield offered by government. In the absence of any concrete property rights the mediation of the government upholds the spirit of cooperation between the two parties. Under the control of government there is no possibility of cooperation. Thus, government emerges as a very significant party to be reckoned with. The producer and consumer truly emerge as primary two parties but the government needs to act proactively in order to uphold cooperation to allocate resources efficiently under the circumstances of no property rights assigned to the common pool resources.

6. Conclusion:

This study examines how the interplay of economic agents like producers and consumers are capable enough to arrest the asymmetric information and leads the economy towards the sustainable development goal 12 (SDG12) in a game theoretic framework. This paper has set up two models – one is game between two producers and other one is game between producer and consumer while the government is observer or mediator only.

The policy of extracting common pool resources is designed in such a manner that it won't deprive anyone. In absence of property rights on common pool resources, there is a possibility to infringe on one's rights to extraction by other one; both are affected. The co-operation is essential in the absence of concrete property rights and both the parties will ensure higher pay-off at the optimal strategy. Since, the trigger strategy of the game is at play, any deviation of any player at any stage wouldlead others not to co-operate with the deviant, resulting in lower pay-off. So, the co-operative strategy would be the key to having optimal extraction path. The co-operation of both the parties would be the optimal pay-off in short-run as well as in long-run. Without property rights multiple groups of users are engaged in extracting resources, no single private or government entity or organisation or initiative would bear fruit. Only co-operation is the way out. Thus, information asymmetry between

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[6]Strategy that succeeds the outcome triggered by one participant which will be applicable to succeeding strategy.

the engaging parties could be done away with the co-operation between parties. In this context, this study suggests the following points:

a. Institutional support should be made strong to avert any flouting of co-operation norms.

b. Laws must be made more stringent to counter any deviation.

c. The interlocution of government should be more stringent and a legal framework should be made for overseeing the cartel of the producer and consumer so that no deviation would be made under all circumstances.

d. Mutual understanding and co-operation should be enhanced and an incentive-like approach might be put in place.

e. Mass Awareness Programme on SDG and especially SDG12 is essential in all sections of the society to reduce wastages due to asymmetry on knowledge about resource extractions and production processes.

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