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DEVELOPMENT MODELLING FOR INDIA IN THE PRESENCE OF STRUCTURAL DUALISM AND INCENTIVE INCOMPATIBILITY: AN APPROACH THROUGH APPLICATION OF STOCHASTIC PROCESS

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ABSTRACT----------
In India it is observed that due to rural-urban duality the rural areas fail to participate in the development process properly. One of the way outs to overcome this structural duality is decentralized participatory planning. But decentralised participatory planning suffers from serious problems related to implementation. Apart from many reasons behind the implementation problem it is the incentive incompatibility which creates serious impediments in the path towards the said implementation. Unless this problem of incentive incompatibility is minimized the idea of decentralised participatory planning will not be able to implement itself successfully. This type of inclusive decentralised planning can help India to become a super power through the path of holistic growth. To wipe out the structural duality it is needed to evolve a method where the problem of incentive incompatibility is minimized along with accommodating the preferences of beneficiaries with in the top down method. This work wants to show that the problem of incentive incompatibility can greatly be minimized through the application of stochastic computing within the bottom-up participatory planning. To that respect an interface model has been developed with the help of stochastic process under the current study. Subsequently the developed model is tested over a sample collected through primary survey. It is found that the stochastic process converges to an identical row vector after certain iterations. This convergence says that the social choices converge to homogeneous beneficiary preferences after a series of social interactions. This study shows that, as the choice pattern of the society becomes non-probabilistic or certain, so the problem of incentive incompatibility along with structural dualism can be successfully minimized with the help of Object Oriented Paradigm.

KEYWORDS: *Rural–urban Dualism, Incentive Incompatibility, Object Oriented Paradigm, , Interface Planning, Stochastic Process.*

JEL code :B16,B23,B41,B55,C02, C63,C88,D71,D74,O21----------

INTRODUCTION

It is observed that due to rural-urban duality the rural areas fail to participate in the development process properly. It is one of the main reasons behind the systematic backwardness of the rural areas. This work wants to explain this structural phenomenon through Object Oriented Paradigm (OOP). It is deduced that this backwardness arises due to the non-existence of abstract relationship between the urban and rural areas. This impediment can be corrected through the development of interface space with the concept of artificial neural network. The development of these interactive planning techniques will open new vistas of development planning through due importance to localisation.

Rural urban dualism is the existence of two separate economic sectors within one country, divided by different levels of development, technology, and different patterns of demand. The concept was originally created by Julius Herman Boeke (Boeke, 1953) to describe the coexistence of modern and traditional economic sectors in a single economy. Dual economies are common in less developed countries, where one sector is geared to local subsistence needs and another to the modern market-oriented needs. These characters are not homogenous throughout the economy and vary substantially from space to space.

One of the major mechanisms to address the problem of dual economy is the bottom-up decentralised development planning (Pal, 2008). A decentralized-planned economy is a type of economic system based on decentralized economic planning, in which decision-making is distributed amongst various economic agents or localized within different geographical spaces. Decentralized planning is held in contrast to centralized planning where economic information is aggregated and used to formulate a plan for production, investment and

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resource allocation by a central authority. Recent proposals for decentralized-economic planning have used the term participatory planning to highlight the cooperative and democratic character of this system (Rao, 1989). Proponents present decentralized and participatory economic planning as an alternative to urban centric market oriented growth.

But in parallel it has also been observed that the decentralised planning has failed to deliver desired result due to existence of centralised components inside the method and incentive incompatibility (Rao, 1989). A mechanism is called incentive-compatible (IC) if every participant within a set can achieve the best outcome to him/herself just by acting according to his/her true preferences (Ledyard, 1989).

The failure to deliver optimum result by the planning procedure may be compared with the non-existence of abstract behaviour (Schildt H. , 2002)between the urban and rural areas. A relation which is declared at abstract class and defined at derived class is called abstract relationship. A class whose objects or instances cannot be created elsewhere is known as abstract class. Here it is considered that urban area is the parent abstract class and rural is the child class. Here the method which is declared in abstract and defines on the derived child class acts on data according to their access control specifications. With the help of OOP (Lafore, 1999)this relationship can easily be constructed.

The object-oriented paradigm took its shape from the initial concept of a new programming approach, while the interest in design and analysis methods came much later. Object-oriented programming uses objects, but not all of the associated techniques and structures are supported directly in languages that claim to support OOP. The object-oriented design paradigm is the logical step in a progression that has led from a purely procedural approach to an object-based approach and now to the object-oriented approach. The progression has resulted from a gradual shift in point of view in the development process. The procedural design paradigm utilizes functional decomposition to specify the tasks to be completed in order to solve a problem. The object-based approach, typified by the techniques of Yourdon, Jackson and Booch, gives more attention to data specifications than the procedural approach but still utilizes functional decomposition to develop the architecture of a system. Abstract relation and abstract class, Polymorphism, inheritance are three of the main features provided by OOP.

Abstract base classes are useful for creating polymorphic methods. An abstract base class defines an interface without an implementation. Each abstract base class has one or more well-defined derived classes. Derived classes implement the interface defined by the method of abstract base class. Graf and Saidi (Graf & Saidi, 1997) developed a technique for automatically creating a finite-state system (for which a fixed point analysis will terminate) from an infinite-state (or very large finite-state) system (for which a fixed point analysis will, in general, not terminate). With abstraction relationship, the concrete states of a system are mapped to abstract states (or classes) according to their valuation under a finite set of predicates. Predicate abstraction has been used to construct abstractions of hardware and protocol designs in the model-checking community. In this work we have also followed the same technique where the polymorphic method failed to find the finite state.

Smith (Smith, 2002)has proposed the use of runtime polymorphism in An Elemental Design Pattern Catalogue. Starting from the initial pattern designing of 16 patterns, they are broken down into three main groupings: Object Elements, Type Relation, and Method Invocation. In our proposed work these patterns can be treated as polynomial. These patterns are precisely important in possible formalization. Here the object elements can be treated as data of our defined class and type relation is treated as methods, invocation of method can be treated as technique as polymorphism.

Tandon (Runjhun Tandon, 2016)has applied polymorphism in pharmaceutical compounds and their intermediates. It is very important and an integral part of drug development. He has tried to explain the isomerism properties of different drugs through polymorphic methods. As a corollary of this work we can also formulate different technique and methods through the polymorphic technique as has been used by this cited work.

Abrahams (Abrahams, 2003)has used Runtime polymorphism to Build Hybrid Systems with Boost.Python. Boost.Python is an open source C++ library which provides a concise IDL-like interface for binding C++ classes and functions to Python. The author developed meta programming techniques which is achieved entirely in pure object oriented programming without introducing a new syntax. Like our work we can treat it as a technique of polymorphism such that in different cases we can construct different polynomials.

These polymorphic methods can fail due to the mismatch of data and method. This mismatch appears due to the wrong approximation of the child class by the abstract class. This failure can be treated as the failure of alternative

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development plans or abstract relationship. To rectify the problem of broken abstract relationship we introduce here a new concept of interface planning. Where the existing methods will interface with the agents and the new methods would be evolved. The existing methods would be improved through the influence of the agents of the child class. Here the child agents will influence the original methods and new methods will be evolved. This new method is nothing but a new technique represented by a new polynomial. Now the child class will implement that the evolved method with the help of this interface instead of inheritance (Lafore, 1999).

An interface contains definitions for a group of related functionalities that a class or a structure can implement. When the primitive goal is to include some behaviour from different sources, interface comes into action. In C# there is no possibility to introduce multiple inheritances. Here interface plays a important role. Any class or structure that implements the interface must contain a definition for the method that matches the signature that the interface specifies. When a class or structure implements an interface the class or structure must provide an implementation for all of the members that the interface defines. The interface itself provides no functionality that a class or structure can inherit in the way that it can inherit base class functionality. However, if a base class implements an interface, any class that's derived from the base class inherits that implementation (Schildt H. , 2002).

In Visual Basic *Interfaces* define the properties, methods, and events that classes can implement. Interfaces allow to define features as small groups of closely related properties, methods, and events; this reduces compatibility problems because the programmer can develop enhanced implementations for interfaces according to need without jeopardizing existing code. One can also add new features by developing additional interfaces and implementations if needed (Jerke, 1999).

An interface in the Java programming language is an abstract type that is used to specify a behaviour that classes must implement. They are similar to protocols. Interfaces cannot be instantiated, but rather are implemented. A class that implements an interface must implement all of the non-default methods described in the interface, or be an abstract class. Object references in Java may be specified to be of an interface type; in each case, they must either be null, or be bound to an object that implements the interface. Implementing an interface allows a class to become more formal about the behaviour it promises to provide. Interfaces form a contract between the class and the outside world, and this contract is enforced at build time by the compiler. If your class claims to implement an interface, all methods defined by that interface must appear in its source code before the class will successfully compile (Sarang, 2012).

In object-oriented paradigm, the term interface is often used to define an abstract type that contains no data or code, but defines behaviours as method signatures. A class having code and data for all the methods corresponding to that interface is said to implement that interface. Furthermore, a class can implement multiple interfaces, and hence can be of different types at the same time.

The creation of new technique through interface can follow the techniques of artificial intelligence. N.Ben Yahia et.al. (N. Ben Yahia; F. Fnaiech; S. Abid; B. Hadj Sassi, 2003) developed Computer Aided process planning system with the help of feed forward Neural Network Intelligent System. For this purpose, they used string of technical activities on the different characteristics of different ingredients. In our proposed work these string of activities, different characteristics, and different ingredients are treated as different operations, different agents, and different observation of different agents from different domain respectively. They also concluded that these new method of process planning has capability to generate an optimal sequence which is really hard in real manufacturing environment. Law & Au (Law & Au, 1999) generated a new model which forecast about the arrival of Japanese tourist in Hong kong. To construct this model they used a feed forward neural network. In this model they consider six nodes as input in input layer. These nodes are Service price, Average hotel rate, Foreign Exchange rate, Population, Marketing expenses and gross domestic expenditures. In our proposed work we have also consider different observation of different individual as different domain. They also concluded that in output layer a single node of the neural network expressed the demand of Japanese for travel to Hong kong. They also investigate that the accuracy rate of this model is depend on seasonal data.

This technique considers different observation of different individuals as different domains. These domains are consider here as input set in the input layer of ANN and in intermediate level these elements are interacted with each-other with the help of different operation and different methods are constructed. From these newly created methods one method is selected as optimum.

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Context

It appears from the above discussion that the poverty level and the development status of the rural areas are significantly different from that of the urban areas. The main reason behind this divergence can be attributed to the idea of rural-urban dualism. Till date different forms of development planning have tried to address this dualism though all the efforts have culminated to sub-optimal output. One of the major components of these development plans is the participatory decentralised planning. But due to the existence of incentive incompatibility in the benefit delivery process the final receivers fail to participate in the bottom-up information gathering system and the planning execution fails to deliver the optimum output. Here the relationship between the planner set and the receiver set can well be documented through abstract relationship as developed by Object Oriented Paradigm. It can be said that the planning methods declared at the abstract class are defined at the derived rural class through the techniques of runtime polymorphism. Thus the rural urban dualism is nothing but the non-existence of this abstract relationship and the failure of rural development plans are failure of polymorphic methods. In this perspective this work wants to develop a new method of development planning called 'interface planning'. Under this conceptual procedure an interface space would be created where the existing plans or methods will interface with the beneficiary agents. This interface instead of inheritance between the methods and the agents will develop new planning techniques or methods by incorporating the actual characteristics of the agents. This interface can proceed successfully with help of stochastic processes like Markov Chain analysis. To that interface artificial intelligence can deliver desired support to construct the optimum method. Such that the specific objective or hypothesis of this study is

Hypothesis

Rural-urban dualism exists due to the failure of abstract relationship between the urban and rural areas. Successful decentralised development planning procedures can be developed on interface space through stochastic process with the help of artificial intelligence.

Interface Model

It is accepted that urban and rural areas are two distinctly different spaces with respect to their development status. Let us assume that the rural class has been inherited from the urban class following the idea of Core-periphery Hypothesis, such as the urban class can be denoted as the abstract class and the rural class as the derived class or the child class. A class whose objects or instances cannot be created elsewhere is known as abstract class. This abstract class consists of method as well as data whereas the derived class only consists of data or agents. The methods are declared at the abstract class and defined at the rural class. A relation which is declared at abstract class and defined at derived class is called abstract relationship. Here the method which is declared in abstract and define on the derived child class acts on data or agents of the derived class according to their access control specifications. With the help of Object Oriented Paradigm this relationship can easily be constructed (Lafore, 1999).

Here the urban class is denoted by UC and child class is denoted by RC and the methods are denoted by M_i and the data are denoted by d_j. Here i and j both lies from 1 to n. i,e $1 \leq i \leq n$ and $1 \leq j \leq n$. Here the polynomial is denoted by PM and polymorphism is denoted by PP. So we can write

$UC=\{M_i,d_j\}$, . i,e $1 \leq i \leq n$ and $1 \leq j \leq n$. $R \subset M_i \times D$. where R is the relation between method set and data set.
i,e the Cartesian product between methods set and data set.
$RC=I(UC)$ ie,$I:UC \rightarrow RC$. her I is a function which maps RC to UC.
$PM=PP(d_i)$, where i=1 to n and PP: $d_i \rightarrow PM$
As the polymorphic operations act on the data of the child class, the child class can be considered as a finite group. Let us assume RC as a group and the operations are PP. So RC is as a finite group which can be denoted as (RC,PM).

This very relationship can be treated as development plan. The type of this linkage is determined centrally and executed at rural areas. The abstract relationships as describe here or the development plans may fail to deliver desired outcome when the methods fail to find proper agent for execution. This mismatch between the method and the agent is nothing but the failure of the development programs. So the construction of the abstract relationship is very important for delivery of optimum desired output. Any breach of abstract relationship will make the planning process void. The declared planning methods are executed through runtime polymorphic methods. Polymorphism (Schildt H. , 2002) means ability to make more than one form. Actually it means that same function performs different operations on different circumstances (considering different parameters). Under runtime polymorphism (Mat Marcus, 2007) the binding between data and function is occurred at the run time, that is at the execution time. In this situation the code of a particular method to be executed is not decided at the time of function call, it is decided only at the run time with respect to call of that particular method or function. It

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may happen that in some scenario all the polymorphic methods declared, may not work at all or fail. Failure of each of the polymorphic method is nothing but the failure of abstract relationship.

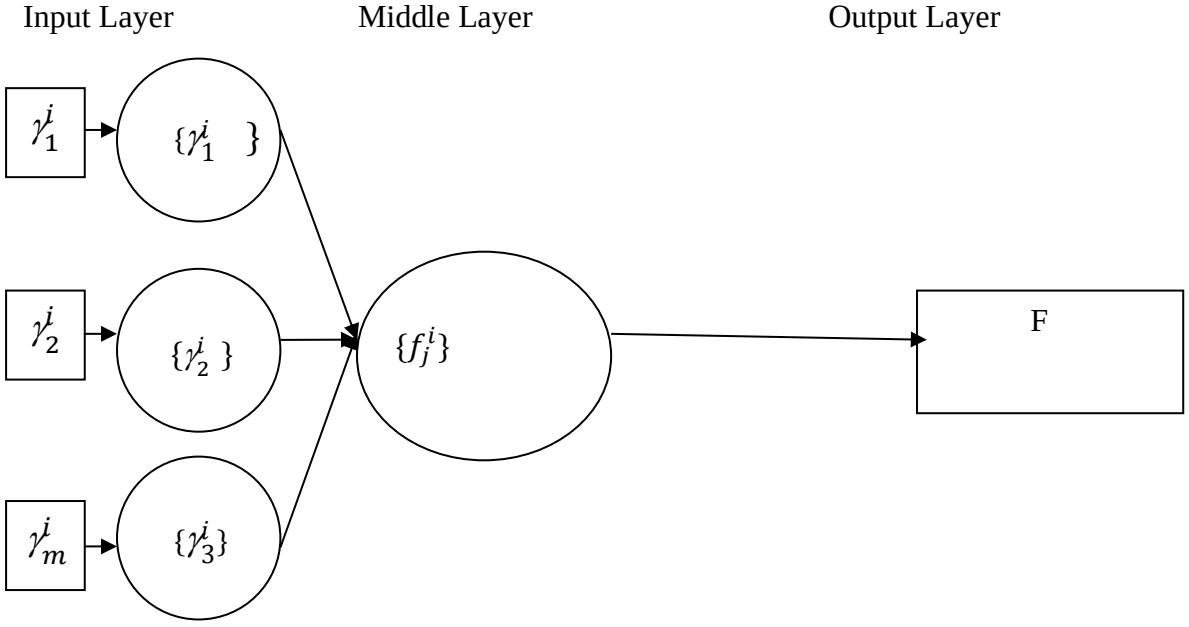
Let us consider f(x) as a development method declared at the urban class. Let us assume that this method is defined as randomised polynomial at the derived class as $\sum a_i(x_j)^n$ where $0 \leq i \leq n$ and $0 \leq j \leq n$.Here a_i(where i=1,2,3,…….n) are coefficient and x_j (where j=1,2,3…n) are parameters. Through polymorphic methods we can form more than one polynomial and each polynomial can be treated as single method. Let us assume that f_j(where j=1,2,3..n) are different defined methods and they are defined as $f(x_i)=fj$. Here i=1,2,3…n and j=1,2,3, …….n.

The breaking of the abstract relationship or the proper interface between the agents will create dynamic loop of backwardness. This vicious circle of backwardness which arises out of improper abstract relationship can only be rectified through due information about the child class to the parent class. Again the incentive incompatibility of the derived class can also be minimized through acquiring proper development requirements of the agents.

To rectify the problem of broken abstract relationship we introduce here a new concept of interface planning. Where the existing methods will interface with the agents and the new methods would be evolved. The existing methods would be improved through the influence of the agents of the child class. Here the child agents will influence the original methods and new methods will be evolved. This new method is nothing but a new technique represented by a new polynomial. Now the child class will implement the evolved method with the help of this interface (Schildt H. , 2017) instead of inheritance (Lafore, 1999). Due to the existence of interface set the problem of incentive incompatibility will disappear or be minimised to a greater extent.

Let us consider IN as an interface which contain only data and abstract method. Where the method and data are already denoted so IN can be considered as a set of method and data ie, IN={ M_i,d_j} , $M_i(d_j)$ is not valid i.e. $M_i \rightarrow d_j$ does not exist. Let us consider that R is a relation which is define as R⊄ M_i X D. where D is the data set which is defined as D={d_j} where $1 \leq j \leq n$.

The creation of new technique through interface can follow the techniques of Artificial Neural Network. Let us assume that there are i agents and j domains of development indicators. So we have mn total observations if i=1, 2, ….n and j = 1, 2, …..m. Then the ith observation of the jth domain is γ_j^i which can be treated as an element of the first layer. Through operations in the second layer mn outputs marked as f_j^i . In the third layer from mn f_j^i one efficient method termed as F will be generated. This is depicted through the following flow chart.



The essence of this modelling is that the rural areas can be pulled at the status of the urban areas when plans are formulated through continuous interface between the development plans and development outcomes. This interface planning method is unique in the discourses of development planning and will open new vistas of development planning ideas as well as methods through the application of computational techniques.

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Model

Let us assume that there are n alternatives to choose. If, for instance alternative 1 is chosen in the first round then in the second round any one from the same basket of alternatives can be chosen. But the probability to choose any alternative in a particular round depends upon the choice of the preceding choice. So, leaving the first choice, the choice of subsequent rounds depends upon the conditional probabilities.

Let p_{ij} is the conditional probability of choosing j after choosing i and this conditional probability depends upon direction. Where i, j = 1,2,3 …, n but $i \neq j$. Thus the conditional probability matrix in the presence of n alternatives is given bellow:-

$$\Pi = \begin{bmatrix} p11 & p12 & p13 & p14 & \ldots & p1n \\ p21 & p22 & p23 & p24 & \ldots & p2n \\ p31 & p32 & p33 & p34 & \ldots & p3n \\ \ldots & \ldots & \ldots & \ldots & \ldots & \ldots \\ pn1 & pn2 & pn3 & pn4 & \ldots & pnn \end{bmatrix}_{nXn}$$

Let us now assume that in the first iteration event E_1 is chosen . So the row vector related to the choice of E_1 becomes

$\Pi_1 = (1 \quad 0 \quad \ldots \ldots \quad 0)$

Now the first iteration following the Marcov process can be written as

$\Pi_1^1 = \Pi_1 . \Pi$

$$= \begin{bmatrix} 1 & 0 & 0 & 0 & \ldots & 0 \end{bmatrix}_{1Xn} . \begin{bmatrix} p11 & p12 & p13 & p14 & \ldots & p1n \\ p21 & p22 & p23 & p24 & \ldots & p2n \\ p31 & p32 & p33 & p34 & \ldots & p3n \\ \ldots & \ldots & \ldots & \ldots & \ldots & \ldots \\ pn1 & pn2 & pn3 & pn4 & & pnn \end{bmatrix}_{nXn}$$

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$$= \begin{bmatrix} p11 & p12 & p13 & p14 & \ldots & p1n & 1Xn \end{bmatrix}$$

In the second iteration the conditional probability to accept any event subject to the acceptance of E_1 in the first iteration is

$$\Pi_1^2 = \Pi_1^1 . \Pi$$

$$= \begin{bmatrix} p11 & p12 & p13 & \ldots & p1n \\ \ldots & \ldots & \ldots & \ldots & \ldots \end{bmatrix}_{1Xn} \cdot \begin{bmatrix} p11 & p12 & p13 & p14 & \ldots & p1n \\ p21 & p22 & p23 & p24 & \ldots & p2n \\ p31 & p32 & p33 & p34 & \ldots & p3n \\ \ldots & & & & & \\ pn1 & pn2 & pn3 & pn4 & \ldots & pnn \end{bmatrix}_{nXn}$$

$$= \begin{bmatrix} (p11.p11 + p12.p21 + \ldots\ldots + p1n.pn1) & \ldots\ldots & (p11.p1n + p12.p2n + \cdots . + p1n.pnn) \end{bmatrix}_{1Xn}$$

Like wise in the third iteration the conditional probability will be

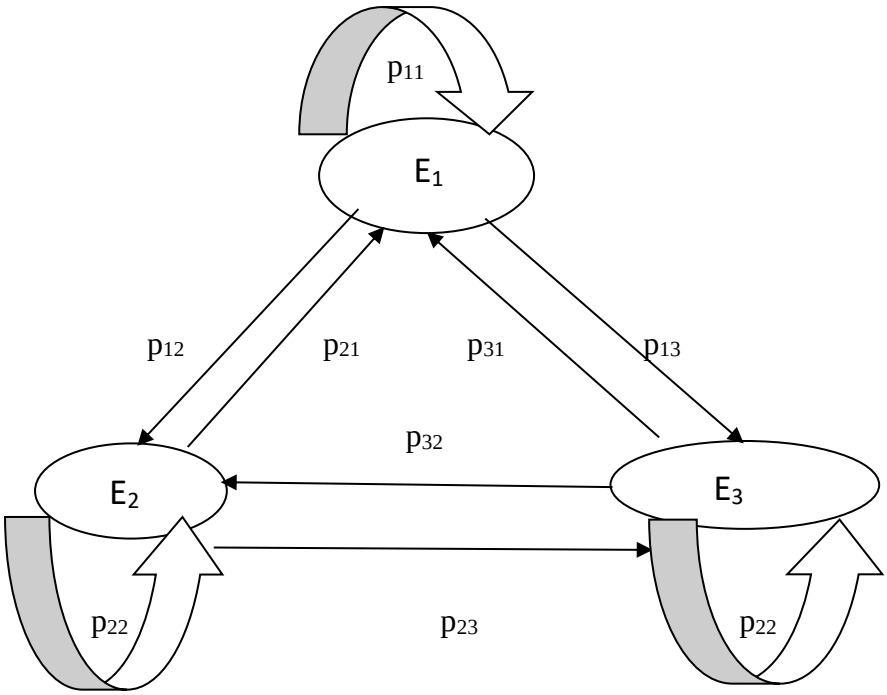
$$\Pi_1^3 = \Pi_1^2 . \Pi$$

In this way the stochastic process will continue till Π_1^n.

Testing

Let there are three alternatives, namely E_1, E_2, E_3. The probability of occurrence of E_i is c in the first iteration where i=1,2,3. The conditional probability to choose j th alternative after i th alternative in subsequent iterations may be defined as p_{ij} . the conditional probability matrix or the transition matrix to carry forward the Markov process can be illustrated through the following flow chart.

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thus the constructed 3 x 3 conditional probability matrix can be defined as follows

$$\begin{pmatrix} p11 & p12 & p13 \\ p21 & p22 & p23 \\ p31 & p32 & p33 \end{pmatrix}$$

Within the current study the above conditional probability matrix is constructed through collection of information through primary survey. A questionnaire based primary survey is conducted over a sample of 100 households. The constructed transition matrix or the conditional probability matrix is

$$\Pi = \begin{pmatrix} .2 & .6 & .2 \\ .3 & 0 & .7 \\ .5 & 0 & .5 \end{pmatrix}$$

Now if alternative 1 is chosen initially then the first iteration becomes

$\Pi_1^1 = \Pi_1.\Pi$

Where $\Pi_1 = (1 \quad 0 \quad 0)$ and $\Pi = \begin{pmatrix} .2 & .6 & .2 \\ .3 & 0 & .7 \\ .5 & 0 & .5 \end{pmatrix}$

Then $\Pi_1^1 = (.2 \quad .6 \quad .2)$

Now $\Pi_1^2 = \Pi_1^1.\Pi$

In this way the stochastic process will continue till it is converged. Within the the current study the present process converged after -18--- iterations.

Here the converged row vector is: [.352113 0.211268 0.436620]

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Likewise the process taking 2nd alternative as initial choice converged after 17 iterations.

Here the converged row vector is [0.352113 0.211268 0.436620]

The process taking 3rd alternative as the initial choice converged after 16 iterations.

Here the converged row vector is [0.352113 0.211268 0.436620]

Thus it is observed that the process converged after18 iterations for the first alternative as initial choice, after 17 iterations for the second alternative as initial choice and after16 iterations for the third alternative as the initial choice.

The computation process is described as follows.

Outcome with 1st alternative as initial choice:

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 enter row=1 and column for row matrix
1 3

 enter the row and column for transit matrix
3 3

 enter value of row matrix with single 1 and 0
1 0 0

 enter value for transit square matrix
.2 .6 .2
.3  0 .7
.5  0 .5

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200
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 This indicate assignment finished  i=200
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0.000000        0.000000        0.000000

 now differentiate finished and converge so many time ago
```

```
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
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0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000

 now differentiate finished and converge so many time ago

 convege itteration=18

 converge prefference
0.352113        0.211268        0.436620
```

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Outcome with 2nd alternative as initial choice:

```
 enter row=1 and column for row matrix
1 3

 enter the row and column for transit matrix
3 3

 enter value of row matrix with single 1 and 0
0 1 0

 enter value for transit matrix
.2 .6 .2
.3  0  .7
.5  0  .5

 enter no off itteration for meeting
200_
```

```
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620

 after itteration s=200
_
```

EPRA International Journal of Agriculture and Rural Economic Research (ARER)- Peer-Reviewed Journal
Volume: 12 | Issue: 6 | June 2024 | Journal DOI: 10.36713/epra0813| Impact Factor SJIF(2024): 8.391| ISSN: 2321 - 7847

```
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
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0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620

 This indicate assignment finished  i=200
```

```
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000

 now differentiate finished and converge so many time ago
```

EPRA International Journal of Agriculture and Rural Economic Research (ARER)- Peer-Reviewed Journal
Volume: 12 | Issue: 6 | June 2024 | Journal DOI: 10.36713/epra0813| Impact Factor SJIF(2024): 8.391| ISSN: 2321 - 7847

```
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
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0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
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0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000

 now differentiate finished and converge so many time ago

 convege itteration=17
```

```
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000

 now differentiate finished and converge so many time ago

 convege itteration=17

 converge prefference
0.352113        0.211268        0.436620
```

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Outcome with 3rd alternative as initial choice:

```
 enter row=1 and column for row matrix
1 3

 enter the row and column for transit matrix
3 3

 enter value of row matrix with single 1 and 0
0 0 1

 enter value for transit square matrix
.2 .6 .2
.3  0 .7
.5  0 .5

 enter no off  itteration for meeting
200_
```

```
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620

 after itteration s=200
_
```

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```
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
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0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620
0.352113        0.211268        0.436620

 This indicate assignment finished  i=200
```

```
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
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0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000

 now differentiate finished and converge so many time ago
```

Volume: 12 | Issue: 6 | June 2024 | Journal DOI: 10.36713/epra0813| Impact Factor SJIF(2024): 8.391| ISSN: 2321 - 7847

```
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
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0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
0.000000        0.000000        0.000000

 now differentiate finished and converge so many time ago

 convege itteration=16

 converge prefference
0.352113        0.211268        0.436620
```

Thus it appears from the above numerical analysis that the process from each alternative converges to a fixed value row vector after certain iterations. This means that the choice pattern of the society becomes non-probabilistic or certain. Once the choice pattern is understood with certainty the problems arising out of top down methods and incentive incompatibility ceases to exist. Thus following stochastic processes with the help of computational techniques we can conclude with a viable decentralized planning.

CONCLUSION

Thus it appears that after certain number of iteration the variation in row vector ceases to exist. This means that the variability in the choice of the heterogeneous beneficiary agents about the benefit alternatives ceases to exist after certain iterations. This number of iterations after which the variability starts to leave depends upon the character of transition matrix and row vector. Here the row vector can be treated as method *aquired* from the abstract class or the urban society which has interfaced with the choice pattern of the rural agent class. The invariability in row vector means that the planning authority becomes able to know the preference pattern of the beneficiary agent class after the certain number of iterations. This means that incentive incompatibility of the beneficiaries ceased to exist after certain number of interfaces. The variability in row vectors simply shows that the polymorphic method to draw the best beneficiaries choice pattern. Thus from the above analysis it becomes clear that the problem of incentive incompatibility along with structural dualism can be successfully minimized with the help of Object Oriented Paradigm.

REFERENCES

1. *Abrahams, D. (2003). Building Hybrid Systems with Boost.Python.*
2. *Blunch, N.-H., & Verner, D. (1999). Sector growth and the dual economy model - evidence from Cote d'Ivoire, Ghana, and Zimbabwe. World Bank. Retrieved DEC 08, 2017, from http://documents.worldbank.org/curated/en/343991468749746215/Sector-growth-and-the-dual-economy-model-evidence-from-Cote-dIvoire-Ghana-and-Zimbabwe*
3. *Boeke, J. H. (1953). Economics and Economic Policy of Dual Societes as Exemplefied by Indonesia. New York: Ams Press Inc.*
4. *Egenhofer, M. J., & Frank, A. U. (1992). Object-Oriented Modeling for GIS. URISA Journal 4, 3-19.*
5. *Graf, S., & Saidi, H. (1997). Construction of Abstraction with PVS.IN CAV 97: Computer aided verified. Lecture Notes on Computer Science, 1254, 72-83.*
6. *Hitz, M., & Montazeri, B. (1995). Measuring Coupling and Cohesion In Object-Oriented Systems. 25-27.*
7. *Iserles, A. (1996). A First Course in the Numerical Analysis of Differential Equations. Cambridge: Cambridge University Press.*
8. *Jerke, N. (1999). Visual Basic 6: The Complete Reference. New Delhi: Tata McGraw-Hill Education.*

Volume: 12 | Issue: 6 | June 2024 | Journal DOI: 10.36713/epra0813| Impact Factor SJIF(2024): 8.391| ISSN: 2321 - 7847

9. *Lafore, R. (1999). Object Oriented Programming in C++. New Delhi: Galgotia Publications Pvt. Ltd.*
10. *Law, R., & Au, N. (1999). A neural network model to forecast Japanese demand for travel to Hong Kong. Tourism Management, 20(1), 89-97.*
11. *Ledyard, J. O. (1989). Incentive Compatibility. In J. Eatwell, M. Milgate, & P. Newman, Allocation, Information and Markets (pp. 141 - 151). London: The New Palgrave Macmillan.*
12. *Lee, D. G., & Kafura, H. K. (1989). Inheritance in Actor Based Concurrent Object-Oriented Languages. The Computer Journal, 297-304.*
13. *Lewis, J. A., Henry, S. M., Kafura, D. G., & Schulman, R. S. (1991). An empirical study of the object-oriented paradigm and software reuse. 91 Conference proceedings on Object-oriented programming systems, languages, and applications (pp. 184-196). New York: ACM SIGPLAN.*
14. *Lieberherr, Karl, Holland, I., & Riel, A. (1988). Object-oriented programming: An objective sense of style. ACM SIGPLAN Notices 23, 232-234.*
15. *Maddala, G. S. (2001). Introduction to Econometrics. New York: John Wiley & Sons, Ltd.*
16. *Mat Marcus, J. J. (2007). Runtime Polymorphic Generic Programming—Mixing Objects and Concepts in ConceptC++. GPCE '07 Proceedings of the 6th international conference on Generative programming and component engineering , (pp. 73-82). New York.*
17. *N. Ben Yahia; F. Fnaiech; S. Abid; B. Hadj Sassi. (2003, February 6). Manufacturing Process Planning Application using Artificial Neural Networks. IEEE International Conference on Systems, Man and Cybernetics.*
18. *Pal, M. (2008). Decentralised Planning and Development in India (1st ed.). New Delhi: Mittal Publications.*
19. *Rao, C. H. (1989, February 29). Decentralised Planning: An overview of Experience and Prospects. Economic and Political Weekly.*
20. *Runjhun Tandon, N. T. (2016). Effect of seeding on sucrose polymorphism. Journal of Chemical and Pharmaceutical Research, 531-546.*
21. *Sarang, P. C. (2012). Java 7 Programming . London: Oracle Press.*
22. *Schildt, H. (2002). The Complete Reference C++. New York: McGraw-Hill Education.*
23. *Schildt, H. (2017). Java: The Complete Reference. New York: McGraw-Hill Education.*
24. *Siek, J. G. (1995). Gradual Typing for Functional Languages. Journal of functional programming, 111-130.*
25. *Skinner, B. F. (1953). Science and Human Behaviour. New York: Macmillan.*
26. *Smith, J. M. (2002). An Elemental Design Pattern Catalog.*
27. *Wooldridge, J. M. (2013). Intoductory Econometrics: A Modern Approach. Mason: South-Western Cengage Learning. Retrieved from http://economics.ut.ac.ir/documents/3030266/14100645/Jeffrey_M._Wooldridge_Introductory_Econometrics_A_Modern_Approach__2012.pdf*