

AGRICULTURAL DEVELOPMENT INNOVATION: ADOPTING SUSTAINABLE SOIL MANAGEMENT PRACTICES AMONG RURAL FARMERS IN IMO STATE, NIGERIA

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ABSTRACT

This paper examined the current issues on adopting sustainable soil management practices among rural farmers in Imo State as a way of encouraging agricultural development innovation. The paper adopted qualitative research design to gain insight into the matters of agricultural development innovation in Imo State. The researchers used content analysis, therefore, the paper which is theoretical in outlook draws its debate basically from secondary data. Rogers diffusion of innovations was adopted in drawing out the theory that formed the foundation of this study. The study identified adopting innovations particularly in sustainable soil management practices among rural farmers as a prerequisite to agricultural development. The paper suggested that agricultural development innovations as the way out of the present economic doldrum in Nigeria.

Keywords: Development, Innovation, Sustainability, Soil Management, Rural Farmers.

INTRODUCTION

The renewed call by the present administration to focus on agriculture as a way to salvage our economic recession has redirect the attention of the academic debate on agriculture. This is because the present economic reality, unprecedented crash of the crude oil

price from the global market, subsequent devaluation of naira and official declaration of the nation's economy as being into recession by the federal government have been described as a pointer to the fact that the salvation of the Nigerian economy in the future depend on agricultural development innovation. The present change slogan is that, Nigeria need to go back to agriculture (land/soil) and reinvent the glorious days when Nigeria could fend for itself in all ramifications before the oil boom, which led to massive influx of petro-dollar after which people turned their back on agriculture. In such times as 1950s and 1960s, Nigeria was self-sufficient in food production and was indeed a net exporter of food to other countries especially within the African continent. Nigeria was a major exporter of cocoa, groundnuts, cotton, palm oil, palm kernel and rubber (Obiah, Duru, Akalonu & Onyeagoro, 2016).

However, everywhere in the world throughout the ages, the place and import of agriculture have always been on the front burner of national priority. As agriculture does not only provide food, employment and security; it reduces the prevalence of poverty, promotes self-sufficiency and reduction in crime rate. Agriculture still employs more of the world's aggregate manpower than all other occupations combined (Oforibika, Ezekiel & Uzor, 2015). This line of thought was followed by (Edward & Amugo, 2016) when they said that "Agriculture is the main pillar of any economy because of the many significant roles it play. It is a major source of food to the population, provides employment opportunities, foreign exchange earnings as well as sources of industrial raw materials for the nation's industries." "In the past," they noted, "effort of government on agriculture was centered on export crops to the neglect of food production and hence low productivity in the area of food crops. There are other factors that could account for this low productivity since after independence. Among this is the 'oil boom' of the seventies which resulted in the migration of labour from agricultural sector to other parts of the economy rendering many indigenous land owners landless and in some cases a reduction of

social amenities. Many middle-aged men moved to the urban centers in search of white collar jobs because of the disparity in amenities that existed between urban and rural areas hence women and their children were left behind to carry on agricultural production activities which resulted in many households been headed by women," particularly in the rural areas. In all the neglect of agricultural development in Nigeria, the worst hit is the land and indeed the soil management. Land which is the major resource of agriculture as a livelihood for the rural farmers has not being catered for. As important as land to farmers' livelihood, rural farmers in Imo State are with a lot of problems in integrating many of the land management practices. Since rural areas are completely agrarian in nature, rural farmers participate in crop farming, fishing, forestry and livestock keeping being the major occupation off the majority.

Looking at the importance of agriculture in employment generation almost all rural farmers depend directly or indirectly on agriculture, and given the large contribution of the sector to the overall economy, agriculture is a key component of growth and developments, and depends upon land for the production. This buttressed that agricultural development in Nigeria is linked primarily with rural farmers, which Imo State in not an exception. These rural farmers in the system are responsible for a large chunk of the total agricultural productivity, cultivated and even Nigeria's farming population. Therefore, the importance of rural farmers in agricultural development innovation in Imo State is derived from their dominance in the agricultural sector of the state which is mainly practiced on the soil. This has called for putting in place sustainable soil management practices.

RESEARCH METHODOLOGY

The study adopted qualitative design to gain insight into the matters of agricultural development innovations in Imo State. Thus, the study relied much on secondary source of data collection for the analysis. Secondary data are derived from academic journals,

newspapers, magazines, conference proceedings, seminar papers, textbooks, website materials, etc. The study adopted content analysis which made the data in line with the systematic and scientific organization. This method was used because it enhanced access to information especially in areas in and aspects that the researchers may not have been able to have direct contact with respondents on various issues relating to agricultural development innovation: adopting sustainable soil management practices among rural farmers in Imo State, Nigeria.

STATEMENT OF THE PROBLEM

Rural farmers all over the world are the centre stage of all agricultural development innovations. If this central role of rural farmers should be recognized in Imo State in particular, and accorded due attention, it naturally will follow that for meaningful success to be achieved in agricultural development innovation, sustainable soil management practices should be articulated and employed in planning, implementing, monitoring and evaluating agricultural cultivations. For many extension workers, what rural farmers know about soil management practices is assumed to be primitive, unscientific, or overtaken by development due to their level of knowledge and so formal research and extension must transform what they know so as to develop them. Understanding and supporting these processes of agricultural development innovation and experimentation have become an important focus on facilitating more sustainable agriculture with its strong locality-specific nature. That is the focus of this paper, the thrust is to seek and encourage the involvement of rural farmers in Imo State in adopting sustainable soil management practices for agricultural development innovation.

On the other hand, although the management of change within complex systems is a key challenge to agricultural policy makers, the dynamics of innovation in agricultural development remain to be fully understood. So far, not much comparative analytical attention has

been devoted to the policies related to agricultural development innovation, the knowledge base on which they draw, and their ultimate effectiveness. Innovations are perceived directions as well as signals of advancement of agricultural development. Undoubtedly, 21st century is described as a millennium of knowledge explosion as a result innovation has been describe as a roaring flame that overturns institutions, shift the value and directs the people's lives in the direction of the change. Agricultural development innovation include all kinds of improved techniques and practices which affect the growth of agricultural output of rural farmers, particularly in Imo State. Increasing agricultural productivity is critical to meet expected rising demand and, as such, it is instructive to examine recent performance in cases of modern agricultural development innovations as it relates to soil management practices. Every concept has not lend itself to a particular meaning. To this effect, major concepts in this study will undergo differing meanings as postulated by researchers, authors, etc. in the related discipline.

Generally, development is conceptualized as a process by which any group of people or community in a rural area harness, mobilize and utilize indigenous resources available to it, human and material, for purpose of transforming economic wellbeing of the community for the ultimate improvement in the overall quality of life of the society (Obiah, Nwaneri & Nwachukwu, 2016). Development is a social process whereby there is a perceptible and cumulative rise in the material standard of living for an increasing proportion of the total population in a country. It is about attaining a full and satisfying life for all, which involves, share responsibility of everyone regardless of age, sex, religion, or ethnicity (Ugorji, 2015). Innovation, on the other hand, is an idea, practice, technique, or object that is perceived as new by an individual or other unit of adoption. Innovation is at the basis of economic development and as such, it is instrumental for developing countries. However, the process of innovation is still a challenging area in agriculture, and most efforts have concentrated on the understanding of the process in advanced

world rather than in emerging economies. The developmental reality of the 21st century is one of complex socio-cultural, economic, political and technological leaps forward and intricate challenge. Hence, innovation which involves the creation and diffusion of new products, processes and methods can be a critical part of the solution to the challenges. Innovation is viewed as intentionally bringing into existence. Something new that can be sustained and repeated and which has some value or utility (Selman, 2009). It may be linked to performance and growth through improvement in productivity, quality, competitive positioning etc. (Okwusa and Soniran, 2015). Agriculture development innovation, therefore, can be described as all scientific, technological, organizational, financial and commercial activities necessary to create, implement and market new or improved agricultural products or processes.

It is equally an incremental, radical, and revolutionary changes in thinking, processes and improvement of agricultural productivity to enhance farmers wellbeing. Through this method, the rural farmers would become financially empowered, get higher protein intake and nutrients, get cycled inside the farm system. Innovation in this direction takes place in technological changes in fields of biotechnology and the associated advanced materials that will lead to transformations in the nature of agricultural production, employment, the location of agricultural activity, and the respective roles of the sector in the economy.

Sustainability is a term that has been exposed to trans-disciplinary variables and is inherently vague concept whose scientific definition and measurement still lack universal acceptance. However, the simplest explanation and most fundamental use of the word sustainability is the ability or capacity to sustain, support, keep moving or endure (El-Kalash, Mohammed & Aniki, 2016). The idea of sustainability stems from the concept of sustainable development which became common language at the world's first Earth Summit in Rio in 1992. The report describes three mutually dependent,

interrelated areas of sustainability: economy, environment and society. Soil is the loose material that covers the land surfaces of Earth and support the growth of plants. It is one of the principal substrata of life on Earth, serving as a reservoir of water and nutrients, as a medium for the filtration and breakdown of injurious wastes, and as a participant in the cycling of carbon and other elements through the global ecosystem. It has evolved through weathering processes driven by biological, climatic, geologic and topographic influences (Encyclopedia Britannica, 2012). In general, soil is an unconsolidated, or loose, combination of inorganic and organic materials. Soil management, the basis of all scientific agriculture, which involves six essential practices: proper tillage; maintenance of a proper supply of organic matter in the soil; maintenance of a proper nutrient supply; control of soil pollution; maintenance of the correct soil acidity; and control of erosion (Encarta, 2009).

Thus, sustainable soil management practice (SSMP) is the adoption of land use systems that, through appropriate management practices, enables land users to maximize the economic and social benefits from the land while maintaining or enhancing the ecological support functions of the land resources (FAO, 2009). It is the key point for improving land resource resilience and productivity within the context of the potentially devastating effects of climate change in Sub-Saharan Africa, bridging the needs of agriculture and environment, with the twin objectives of maintaining long term productivity and ecosystem functions (land, water, biodiversity); and increasing productivity (quality, quantity and diversity) of goods and services (including safe and healthy food) (Akalonu, 2015).

Igbokwe (2011) sees the concept "rural" as folk term and wish in general context designates backwardness and primitives. Rural farmers are the traditional farmers who uses crude methods of farm implements, equipment and inputs that makes them endemically with low productivity. Rural farmers are possess such

characteristics as small cultivable land, low per capita income, technical inefficiency of agriculture due to weak production methods. Again, the physical and institutional infrastructures such as transportation logistics/facilities, storage facilities, processing facilities, irrigation facilities, rural credit and financial institutions, cooperative societies and farmers unions, agricultural extension services, agricultural institutions are either poor, weak or ineffective. Ani (2013) noted that rural farmer's knowledge is often characterized as highly specific and context-bound, with knowledge emerging simply from localized, and practical experience. Meanwhile, a common philosophy in sustainable soil management is that a 'healthy' soil is a key component of sustainability.

This implies that a healthy soil will produce healthy agricultural produce that have optimum vigour and are less susceptible to pests. In sustainable soil management systems, the soil is viewed as a fragile and living medium that must be protected and nurtured to ensure its long-term productivity and stability. Methods to protect and enhance the productivity of the soil include using cover crops, compost and /or manures, reducing tillage, avoiding traffic on wet soils, and maintaining soil cover with plants and /or mulches (Agricultural Sustainability Institute, 2012 in Akalonu, 2015). Soil use in many rural areas in Imo State has been characterized by a significant amount of degradation.

Therefore, many rural farmers respond to declining soil productivity by abandoning existing degraded cropland, and moving to new land for crop cultivation. Innovative soil fertility is required to enhance this. Innovative strategies is very important in that it provides adequate means with which agricultural practices can meet up their inherent diverse roles at any point in time in accordance with global technological changes. It is aimed at having dynamic agricultural practices that are not at variance with the changing values and aspirations of the society.

OBJECTIVE OF THE STUDY

The overall objective of the study is to determine the adoption of sustainable soil management practices among rural farmers in Imo State. The specific objectives are:

- To examine agricultural development innovation in Imo State.
- To determine the factors that affect the adoption of sustainable soil management practices among rural farmers in Imo State.
- To ascertain the measure rural farmers can adopt to ensure sustainable soil management practices that will promote agricultural development innovation.

Factors Affecting Adoption of Sustainable Soil Management Practices

The use of agricultural development innovation and soil management practice determines how the increase in agricultural output impacts on food security and environmental degradation. The only way rural farmers in Imo State can benefit from these innovations is if they adopt them to be appropriate and proceed to implement them in their farms. In so doing, there will be increased agricultural productivity, expansion of rural financial market, increased capital and farmers' standard of living. Adoption of any innovation is a complicated process involving farmer's behaviour and acceptance towards soil management practices. Based on this fact, there are some factors that can limit adoption and this could be cultural limitation such as the norms and values, socio-economic characteristics like the farmer's age, educational background and income (Ekong, 2010). The innovation features can also pose its own limitation by its relative advantage, compatibility, complexity, inability and observability. We consider the above limitations as proposed by (Rogers, 2013).

- 1) **Relative Advantage:-** This is the degree to which an innovation is perceived as superior to the idea it supersedes. The degree of relative advantage maybe measured in economic terms, but social prestige, convenience, and satisfaction are also important factors. The greater the perceived relative advantage of an innovation, the more rapid its rate of adoption will be.
- 2) **Compatibility:-** This is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters. An idea that is incompatible with the values and norms of a social system will not be adopted as rapidly as an innovation that is compatible.
- 3) **Complexity:-** This is the degree to which an innovation is perceived as difficult to understand and use. New ideas that are simpler to understand are adopted more rapidly than innovations that require the adopter to develop new skills and understandings.
- 4) **Trialability:-** This is the degree to which an innovation maybe experimented with on a limited basis. An innovation that is trialable represents less uncertainty to the individual who is considering it for adoption, who can learn by doing.
- 5) **Observability:-** This is the degree to which the results of innovation are visible to others. The easier it is for individuals to see the results of an innovation, the more likely they are to adopt it. The observability of an innovation as perceived by members of a social system is positively related to its rate of adoption.

Therefore, the greatest threat to sustaining agricultural productivity among rural farmers in Imo State is the decline in soil productivity. Different factors determine the adoption of different agricultural development innovations. This is because farm size and location can affect and in turn be affected by the other factors influencing adoption.

THEORETICAL FOUNDATION

A study of this nature presupposedly focus on the theory of agriculture or development, but due to the importance of innovation to rural farmers information dissemination, the paper differs and go ahead to adopt diffusion of innovation by Everett Rogers, a professor of communication studies. This is a theory that seeks to explain how, why and at what rate new ideas and technology adoption. The concept of diffusion was first studied by the French Sociologist Gabriel Tarde in late 19th century, and since its start in rural sociology, diffusion of innovations has been applied to numerous contexts, including communications, marketing, development studies, complexity studies among others. However, in 1962, Everett Rogers popularized the theory in his published seminal work: *Diffusion of Innovations*.

Rogers argues that diffusion is the process by which an innovation is communicated overtime among the participants in a social system. As a result of increased scientific research and improved methods of communication, a great variety of new materials and ideas has been created and brought to the door of rural farmers and other rural dwellers. The assumption of this theory is that the rate at which people learn about innovations and adopt them however differ from one place and circumstance to another (2003). Rogers sees diffusion as a special type of communication concerned with the spread of messages that are perceived as new ideas. He proposes that four main elements influence the spread of a new idea: the innovation itself, communication channels, time, and a social system. This process relies heavily order to self-sustain and within the rate of adoption, there is a point at which innovation reaches critical mass. Rogers suggests a total of five categories of adoption in order to standardize the usage of adopter categories in diffusion. These categories are: innovators, early adopters, early majority, late majority and laggards.

- 1) Innovators:-** These set of adopters are willing to take risks, have the highest social status, have financial liquidity, are social and have closest contact to scientific sources and interaction with other innovators. Their risk tolerance allows them to adopt technologies that may ultimately fail. Yet, innovators are the first individuals to adopt an innovation. Their interest in new ideas leads them out of a local circle of peer networks and into more cosmopolite social relationships. Communication patterns and friendships among a clique of innovators are common, even though the geographical distance between the innovators may be considerable. Innovators, normally have substantial financial resources, and the ability to understand and apply complex technical knowledge.
- 2) Early Adopters:-** These are often opinion leaders, and serve as role models for many other members of the social system. They are instrumental in getting an innovation to the point of critical mass, and hence, in the successful diffusion of an innovation. They are more discreet in adoption choices than innovators as such use judicious choice of adoption to help them maintain a central communication position. They early adopters decreases uncertainty about a new idea by adopting it, and then conveying a subjective evaluation of the innovation to near-peers through interpersonal networks.
- 3) Early Majority:-** They adopt an innovation after a varying degree of time that is significantly longer than the innovators and early adopters. They have above average social status, contact with early adopters and seldom hold positions of opinion leadership in the system. The early majority's unique position between the very early and the relatively late to adopt makes them an important link in the diffusion process.
- 4) Late Majority:-** They adopt new ideas just after the average member of a system. These individuals approach an innovation with a high degree of skepticism and after the majority of society has adopted the innovation. Thus, adoption may be the result of increasing network pressures from peers. The wright of

system norms must definitely favour an innovation before the late majority are convinced to adopt innovation.

5) Laggards:- They are the last to adopt an innovation. They are the most localite in their outlook of all adopter categories; many are near isolates in the social networks of their system. Laggards typically have an aversion to change-agents, decisions are often made in terms of what has been done previously.

Above all, the rates of adoption for innovations are determined by an individual's adopter category. The criterion for the adopter categorization is innovativeness, defined as the degree to which an individual adopts a new idea (Rogers, 2003).

Measures of Improving Sustainable Soil Management Practices in Imo State

Whenever sustainability issues arises,, wherever there is a risk of difficult or irreversible loss of the things or qualities of the environment that people value and, whenever there are such risks, there is a degree of urgency to take action. Rural farmers use both agronomic, soil management and mechanical strategies of soil conservation to conserve and manage the soil. Either practice is important because they variously affect chemical, physical and biological properties of soil. Agronomic soil conservation practices for instance, include cover crops, mulching, crop rotation, fallowing use the effect of surface covers to reduce erosion by water and wind in order to conserve the soil, protect the soil from direct sun rays and enrich soil by the decay of their fallen leaves and some reduces the risk of serious pest and disease outbreaks. Therefore, some of the necessary measures as enumerated by Akalonu (2015) are discussed below.

1) Mulching:- This protects against erosion, suppresses weeds, increase water infiltration and promotes soil biological activities. International Society of Agriculture (2005) in Akalonu (2015) defines mulches as materials that cover the ground, much like

layers of leaves on the forest floor. They further explained that many farms use plastic mulches, though they have environmental issues related to their production and disposal. Organic mulches such as hay, straw and leaf mould can decompose in place, providing nourishment for the soil food web which in turn provides nourishment to the plants. So, mulching reduces the effect of heat from the sun, conserves soil moisture, has no environmental pollution, and enhances productivity, less expensive, increase soil microbial activities and increase water infiltration.

- 2) Composting:** - This is an organic matter that has been decomposed and recycled as a fertilizer and soil amendment. It is a key ingredient in organic farming. The process of composting requires making a heap of wetted organic matter (leaves "green" food waste) and waiting for the materials to break down into humus after a period of weeks or months. The compost can be rich in nutrients, hence, is beneficial for the land in many ways like soil conditioner, a fertilizer, addition of vital humus or humid acids, and as a natural pesticide for soil. Additionally, organic ingredients intended for composting can alternatively be used to generate biogas through anaerobic digestion. It is used in gardens, landscaping, horticulture and agriculture.
- 3) Cover Cropping:** - This is a simple indigenous practice whereby farmers use vegetative materials to cover their plants from direct sun. It also plays an important role in maintaining soil quality and productivity. Rural farmers practiced cover cropping because it suppresses weeds, reduces erosion, conserves soil moisture, enrich the soil by the decay of fallen leaves, reduces heat from the sun, adding organic matter to the soil, increase water infiltration, promotes soil biological activities and had no environmental pollution, which makes it potentially a resource for soil sustainability.
- 4) Crop Rotation:** - This is the practice of growing a series of dissimilar/different types of crops in the same area in sequential seasons. A traditional element of crop rotation is the replenishment of nitrogen through the use of green manure in

sequence with cereals and other crops. Crop rotation also mitigates the build-up of pathogens and pests that often occurs when one species is continuously cropped, and can also improve soil structure and fertility by alternating deep-rooted and shallow-rooted plants. In using some forms of crop rotation, rural farmers can keep their fields under continuous production, instead of letting them lay fallow, as well as reducing the need for artificial fertilizers, both of which can be expensive. It is also used to control pests and diseases that can become established in the soil overtime. It adds nutrients to the soil, and in rural farming, it also makes good nutritional sense to grow beans and grain at the same time in different fields.

- 5) **Liming:-** Soil pH is an excellent chemical indicator of soil quality. Rural farmers can improve the soil quality of acid soils by liming to adjust pH to the levels needed by the crop to be grown. Liming increase nutrient availability, improve soil structure, and increased rates of infiltration. Rural farmers understanding soil pH is essential for the proper management and optimum soil and crop productivity. It is the potential acidity that determines the amounts of agricultural limestone to neutralize soil acidity.
- 6) **Mixed Farming:-** This is an agricultural in which a farmer conducts different agricultural practices together, such as cash crops and livestock. The aim is to increase income through different sources and to complement land and labor demands across the year. Mixed farming systems can be classified in many ways. They can be based on land size, type of crops and animals, geographical distribution, market orientation, etc. Mixed farming systems maintain soil fertility by recycling soil nutrients and allowing the introduction and use of rotations between various crops and forage legumes and trees, or for land to remain fallow and grasses and shrubs to become re-established. It maintain soil biodiversity, minimize soil erosion, help to conserve water, provide suitable habitats for birds, allow intensified farming, with less dependence on natural resources and preserving more biodiversity

than would be the case if food demands were too be met by crop and livestock activities undertaken in isolation.

Other measures of improving sustainable soil management practices include: agro forestry and alley cropping, crop residue recycling, contour farming, strip cropping, control of erosion with vetiver grass, zero/minimum tillage practices, ridge and mound tillage and soil organic amendments.

CONCLUSION

The paper has revealed the necessity of agricultural development innovation by adopting sustainable soil management practices. The adoption of agricultural development innovation depends on a range of personal, social, cultural and economic factors, as well as on the characteristics of the innovation itself. The paper reviewed various factors affecting adoption level of an innovation by rural farmers. However, there is an emerging knowledge base on the effectiveness of strategies to close the knowledge-practice gap, less is known about how attributes of an innovation and other contextual and situational factors facilitate and impede an innovation's adoption (Edward & Amugo, 2016). The paper, unlike other researchers failed to subscribe to technology only as the basis of innovation, rather any system of innovation that will enhance sustainable soil management practices for rural farmers, particularly in Imo State. The study aligned with (Edward & Amugo, 2016) that new agricultural development innovations are adopted slowly and several aspects of adoption remain poorly understood despite being seen as important route out of poverty in most of the emerging economies. Further, that education levels, capital, income, farm size, access to information, positive environmental attitudes, environmental awareness and utilization of social networks are generally positively, associated with the adoption of best sustainable soil management practices among rural farmers. The study identified four categories of sustainable soil management practices as measures to mitigate challenges of rural farmers in Imo State in adopting sustainable soil

management practices. These include structural and mechanical erosion control practices, agronomic practices soil management practices and cultivation practices. These practices are discussed here under six sub-headings - mulching, composting, cover cropping, crop rotation, liming and mixed farming. In order to achieve the essence of agricultural development innovation by adopting sustainable soil management practices, there is need to embark on aggressive and sound policy and programmes geared towards proper financing and development of agriculture in line with the change mantra, thus, creating enabling environments for establishment of more network of agricultural development innovation centre especially in the rural communities. This will enhance rural farmers to an access agricultural development innovations and thereby, leading to increase in adoption of sustainable soil management practices. Again, programme intervention in natural resource conservation needs to focus on detailed characterization and identification of SSMPs that are both farm-and farmer specific. While specific programmes should be designed for various soil management practices that meet the peculiar needs of various categories of rural farmers, communities and crops. Farmers should make concerted efforts to avail themselves of training opportunities on appropriate use of SSMP for optimum production that would take account of costs of adoption of the various soil management practices adopted by the rural farmers. Such training programmes should be used as a springboard for updating the knowledge of the young farmers on appropriate soil management practices for their cropping systems.

ACKNOWLEDGEMENT

The authors are grateful to all that contributed in one way or the other to make this research work a reality. Particularly Mrs. Linda Nkeiruka Obiah of registrar's office Imo State Polytechnic, Umuagwo. Owerri, Imo State, Nigeria; who painstakingly typeset the manuscript.

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