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Recent Trends of Entrepreneurship and Industrialization for Rural Development

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CHAPTER-01

DIGITAL FABRIC TECHNOLOGIES AND RURAL DEVELOPMENT

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ABSTRACT

Digital fabric technologies the intersection of textiles, embedded electronics, sensors, connectivity, and data are transforming how goods, services, and information flow into and through rural communities. Digital Fabric Technologies offer more than just a new set of tools; they represent a paradigm shift in how we conceive of rural economic development. By empowering communities to harness their cultural capital through digital means, DFT fosters a form of place-based innovation that is resilient, inclusive, and sustainable. It moves beyond stopgap measures to create a self-reinforcing economic ecosystem where value is created, captured, and reinvested locally. In weaving together the threads of technology, tradition, and entrepreneurship, rural communities can truly craft a prosperous and vibrant future on their own terms. This article examines how digital fabrics (including e-textiles, sensor-integrated garments, wearable IoT, smart packaging, and programmable materials) can be deployed as enablers of inclusive rural development. It synthesizes technological building blocks, maps practical applications across agriculture, health, education, livelihoods, and governance, and explores implementation pathways, financing models, capacity-building needs, and ethical and environmental considerations. The article concludes with policy recommendations and a practical roadmap for stakeholders local governments, NGOs, micro-enterprises, social entrepreneurs, and research institutions to pilot, scale, and sustain digital fabric interventions in rural contexts.

Keywords : Digital Fabrics, E-Textiles, Rural Development, IoT, Precision Agriculture, Wearable Sensors, Livelihood Innovation, Inclusive Technology, Sustainability

1.1 INTRODUCTION

Rural communities across the globe stand at a critical juncture. For decades, they have grappled with a persistent and interconnected set of challenges: economic stagnation, the exodus of young talent (often termed the "brain drain"), a narrow base of employment opportunities, and the gradual erosion of unique cultural heritage. Traditional agricultural livelihoods, long the backbone of these economies, are increasingly precarious, threatened by the volatility of global markets and the escalating impacts of climate change. While development initiatives have historically focused on essential pillars like infrastructure, agricultural yield, and education, the digital age has introduced a new dimension of inequality. The "digital divide" has often relegated rural areas to the role of end-users consumers of technology and content created elsewhere rather than empowering them as producers and innovators in the digital economy. Simultaneously, a quiet revolution is reshaping the global textile and apparel industry, a sector with deep historical roots in both artisanal rural

production and urban industrialization. This shift is defined by the transition from analog to digital. The labor-intensive processes of manual screen printing and hand-drawn sketches are being rapidly replaced by digital inkjet printing and sophisticated Computer-Aided Design (CAD) software. The industry's century-old model of standardized mass production, which demanded colossal scale and centralized factories, is being challenged by agile, on-demand manufacturing that prioritizes customization and speed over volume.

The convergence of these two narratives the urgent need for a new rural development paradigm and the digital disruption of the textile industry creates a fertile ground for transformative change. At this intersection lies a powerful catalyst is **Digital Fabric Technologies (DFT).** DFT encompasses a suite of tools from digital looms and embroidery machines to direct-to-garment printers and CAD software that are becoming increasingly accessible, affordable, and less dependent on massive scale for economic viability. This technological democratization presents an unprecedented opportunity to reimagine rural development, fostering a model that is economically inclusive, environmentally sustainable, and culturally vibrant. Digital Fabric Technologies (DFT) represents a paradigm shift in the conception, design, and functionality of textiles. Moving beyond their traditional role of providing comfort and aesthetics, DFT encompasses the integration of advanced digital and material sciences into fabric itself. This field is characterized by the convergence of several key technologies:

- **Smart Textiles and E-Textiles:** These are fabrics that can sense and react to environmental stimuli (such as temperature, pressure, or light) or electrical inputs. They are embedded with conductive fibers, microcontrollers, and actuators, enabling functionalities like heating, lighting, or color change.
- **IoT-Enabled Fabrics:** By incorporating miniature sensors and wireless communication modules, textiles become nodes in the Internet of Things (IoT). This allows for the continuous collection and transmission of data from the wearer or the environment, enabling applications in remote health monitoring, asset tracking, and environmental sensing.
- **Nanotechnology:** The application of nano-sized materials or structures to textiles imparts novel properties at a molecular level. This can include self-cleaning surfaces, enhanced durability, UV protection, or even drug-releasing capabilities for medical textiles.
- **Embedded Sensors:** These are the core components that transform passive fabric into an interactive interface. They can be woven, printed, or laminated into the material to monitor a vast array of data points, from physiological signs (heart rate, muscle activity) to environmental conditions (humidity, chemical presence).

In essence, DFT transforms textiles from static, end-use products into dynamic, functional systems that bridge the physical and digital worlds.

1.1.1 BRIDGING THE DIGITAL DIVIDE: FROM CONSUMERS TO CREATORS

The core of this new paradigm is a fundamental shift in the role of rural communities within the global value chain. Instead of merely providing raw materials or cheap labour, communities can leverage DFT to become hubs of innovation and high-value production. Digital tools enable them to

design, prototype, and manufacture finished goods locally, capturing a significantly larger portion of the end product's economic value. This transition from being passive consumers to active creators is the key to reversing the "brain drain." By creating compelling, skilled, and digitally-native career paths rooted in local culture, rural areas can offer a viable alternative to urban migration, encouraging young talent to stay, build businesses, and rejuvenate their communities.

1.1.2 LEVERAGING CULTURAL HERITAGE AS A COMPETITIVE ADVANTAGE

In the homogenized landscape of fast fashion, authenticity and story hold immense market value. Rural communities are often repositories of unique cultural heritage—indigenous patterns, traditional weaving techniques, natural dyeing methods, and ancestral motifs. DFT does not seek to replace these traditions; rather, it augments and preserves them. A artisan can digitize a traditional pattern using a scanner and CAD software, allowing for infinite replication, adaptation, and scaling without losing the original's integrity. This fusion of heritage and technology creates a powerful unique selling proposition: mass customization with a soul. A weaver in a remote village can produce a limited-edition run of scarves based on a century-old design for a boutique in Paris, all managed through an online platform. This model transforms cultural heritage from a static artifact into a dynamic, living economic asset.

1.1.3 THE THREE PILLARS OF THE DFT-ENABLED RURAL ECOSYSTEM

The successful integration of DFT into rural development rests on three interconnected pillars:

1. **Digital Design and Prototyping:** The first step involves equipping local artisans and entrepreneurs with digital literacy and design tools. Training in CAD software allows for the creation and modification of designs with precision and efficiency. Digital prototyping—creating a single, perfect sample with a digital printer or embroiderer—dramatically reduces the time and material waste associated with traditional sample-making, enabling rapid iteration and response to market trends.
2. **Distributed and On-Demand Manufacturing:** Technologies like direct-to-fabric and direct-to-garment printing allow for small-batch or even single-item production to be economically feasible. A rural micro-factory can hold stock of blank, ethically sourced garments and print designs on-demand based on real-time orders from an e-commerce site. This "just-in-time" model eliminates the need for large inventories, reduces overproduction waste, and minimizes financial risk for small entrepreneurs.
3. **Digital Market Access and Storytelling:** Technology bridges the physical distance to global markets. E-commerce platforms, social media, and digital marketing become the storefront for rural producers. Crucially, these digital channels allow them to tell the story behind their products the artisan, the tradition, the community impact—forging an emotional connection with conscious consumers who value provenance and ethical production.

1.2. The Link: Industry 4.0, Digital Fabrication and Rural Development

The emergence of DFT is inextricably linked to the broader context of the Fourth Industrial Revolution, or **Industry 4.0**. This paradigm is defined by the fusion of the physical, digital, and

biological worlds, driven by technologies like cyber-physical systems, the Internet of Things, and cloud computing.

- **Digital Fabrication**—a pillar of Industry 4.0—refers to manufacturing processes that are controlled by digital design data, such as 3D printing and computerized knitting. This shift from analog (mass production) to digital (distributed, on-demand production) democratizes manufacturing, making it less reliant on massive, centralized factories.
- The link to **Rural Development** lies in this democratization. Traditional rural development challenges such as geographic isolation, lack of scale, and dependence on volatile commodity markets—can be mitigated by DFT. These technologies enable the creation of high-value, low-volume products that can be designed and produced anywhere there is digital connectivity. A rural community can leverage digital fabrication to produce smart agricultural nets that monitor crop health, or IoT-enabled fishing gear that tracks catches, thereby leapfrogging traditional industrial limitations and creating new, knowledge-based rural economies.

1.2.3 DFT as a Convergence: Digital Innovation and Traditional Craft

Perhaps the most transformative potential of DFT for rural development lies in its role as a bridge between cutting-edge digital innovation and deeply rooted traditional craft. This is not a story of replacement, but of **symbiotic enhancement**.

- **Traditional craft** embodies irreplaceable cultural heritage, unique aesthetics, sustainable material knowledge, and artisanal skill. However, it often faces challenges of scalability, economic viability, and relevance in a globalized market.
- **Digital innovation** offers tools for precision, efficiency, customization, and connection to global digital marketplaces.

DFT positions itself at the confluence of these two worlds. It allows for:

- **Augmentation, Not Replacement:** A hand-woven basket can be integrated with a moisture sensor to alert a farmer of optimal harvest conditions, adding functionality without sacrificing its artisanal nature.
- **Cultural Preservation through Digitization:** Traditional patterns and weaving techniques can be digitally archived and reinterpreted using CAD software, ensuring their preservation and enabling new applications.
- **New Value Propositions:** The fusion of a traditionally crafted garment with embedded smart technology creates a product that is simultaneously authentic, sustainable, and technologically advanced, commanding a premium in the global market.

1.3 NAVIGATING THE CHALLENGES: A PATH TO SUSTAINABLE IMPACT

For this vision to be realized, several challenges must be proactively addressed. The initial investment in hardware, software, and robust internet connectivity, while falling, remains a significant hurdle, requiring innovative financing models or public-private partnerships. Comprehensive, hands-on

training is essential to build not just technical proficiency but also business acumen in areas like digital marketing, logistics, and finance. Furthermore, the environmental footprint of DFT must be carefully managed. A commitment to using organic or recycled fabrics, along with eco-friendly, water-based inks, is paramount to ensure this new model aligns with principles of circularity and sustainability, rather than replicating the polluting practices of the old industrial model.

1.3.1 The Fabric of Our Future: From Loom to Microchip

For millennia, textiles have been defined by their fundamental purpose: to clothe, protect, and comfort. The tools were the loom, the spindle, and the needle. The materials were what nature provided—cotton, wool, silk. Today, a quiet revolution is weaving technology into the very fibers of our world, creating fabrics that are no longer passive, but active and intelligent. This is the era of digital fabric technologies, a journey from traditional textiles to smart systems that sense, communicate, and even think.

1.3.2 The Evolutionary Thread: From Craft to Code

The shift did not happen overnight. It began with the digitization of the design and manufacturing process. Computer-Aided Design (CAD) replaced hand-drawn sketches, allowing for intricate patterns to be created and modified with pixel-perfect precision. This was followed by digital printing, which uses inkjet technology to apply complex, full-color designs directly onto fabric, eliminating the need for traditional, wasteful screens and dyes. The true leap, however, came with the integration of electronics, giving birth to **smart textiles** or **e-textiles**. This evolution can be seen in three key stages:

1. **Passive Smart Textiles:** The first generation. These fabrics can sense stimuli from their environment, such as temperature, pressure, or light, but cannot react. Phase-change materials that regulate body heat are an early example.
2. **Active Smart Textiles:** These fabrics both sense *and* react. They incorporate actuators, such as micro-encapsulated compounds that release moisturizer, or shape-memory alloys that change garment structure in response to heat.
3. **Ultra-Smart Textiles:** The cutting edge. These systems feature a sense-react-adapt loop, often powered by a central unit. They can monitor a patient's vitals, analyze the data, and automatically alert a doctor all from the fabric of a shirt.

Underpinning this are **nanofabrics**, engineered at the molecular level. By manipulating fibers at the nano-scale, scientists can imbue them with extraordinary properties, such as being super-hydrophobic (self-cleaning), incredibly strong, or conductive.

1.3.3 Weaving Intelligence into Industry: Transformative Applications

The applications of these advanced textiles are dismantling traditional boundaries between sectors.

- **Healthcare:** This is perhaps the most life-changing domain. Smart garments with embedded sensors now provide continuous monitoring of heart rate, respiration, muscle activity, and glucose levels. This enables remote patient monitoring, reduces hospital readmissions, and allows for proactive healthcare. Smart bandages can monitor wound pH and release antibiotics only when needed.

- **Agriculture & Environment:** "Smart" geotextiles are used for soil monitoring, sensing moisture and nutrient levels to enable precision irrigation and fertilization. Large-scale energy-harvesting fabrics can be integrated into farming structures to power sensor networks.
- **Energy:** The dream of wearable power is becoming a reality. Fabrics integrated with photovoltaic cells can harvest energy from the sun, while piezoelectric fibers can generate small amounts of electricity from movement or wind. This can power everything from a soldier's equipment to remote environmental sensors.
- **Communication:** E-textiles are enabling "on-body" networks. Conductive threads woven into clothing can create flexible antennas, allowing for discreet data transfer between various wearable devices, from smart glasses to hearing aids, without the need for bulky wires.
- **Disaster Management:** For first responders, smart fabrics are a lifeline. Suits with integrated GPS, environmental sensors (for toxins or radiation), and vital-sign monitors can track a firefighter's location and physiological state in a hazardous environment, sending alerts if they are in distress.

1.3.4 Global Innovations Shaping the Next Wave

Several key innovations are pushing the boundaries of what fabric can do:

- **Self-Cleaning Fabrics:** Inspired by the lotus leaf, these nanofabrics are treated with nanostructures that cause water and dirt to bead up and roll off. This technology promises to drastically reduce the water and energy footprint of laundry.
- **Energy-Harvesting Fabrics:** Researchers have developed textiles that can generate power from both solar (photovoltaic threads) and kinetic (piezoelectric) energy. A jacket could theoretically charge your phone as you walk on a sunny day.
- **Medical-Monitoring Wearables:** Moving beyond fitness trackers, companies are producing FDA-approved smart garments. For example, the **Hexoskin** smart shirt provides clinical-grade cardiac, respiratory, and activity data, while **Sensoria**'s smart socks help prevent diabetic foot ulcers by monitoring pressure points.
- **AI-Driven Weaving Systems:** Artificial Intelligence is now optimizing the very creation of fabric. AI algorithms can design complex weaves for optimal performance, predict material behavior under stress, and control robotic looms to create custom, zero-waste textiles with unprecedented efficiency.

1.3.5 Digital Fabric Technologies: Weaving the Future Thread By Thread

The fabric of our lives is undergoing a revolution as profound as the invention of the loom itself. For millennia, textiles have been defined by their passive, protective, and aesthetic roles. Today, that definition is being radically rewritten. Digital Fabric Technologies (DFT) represent the convergence of material science, nanotechnology, and digital innovation, transforming inert cloth into dynamic, interactive systems. This global shift is moving us from traditional fabrics to intelligent textiles that can sense, communicate, and even power our world.

1.4 From Loom to Logic: The Evolution of Smart Textiles

The journey from traditional fabrics to smart textiles is a story of increasing integration and intelligence.

- **Traditional Fabrics:** For centuries, the primary function of cloth was utilitarian and decorative, defined by properties like warmth, durability, and pattern, derived from natural fibers and manual craftsmanship.
- **The Rise of Wearables:** The first wave of "smart" technology involved attaching rigid electronic devices *to* clothing (e.g., early MP3 player jackets). This was a clumsy marriage of two separate worlds.
- **The Integration of E-Textiles:** The true evolution began with the development of **e-textiles**, where functionality was woven into the fabric itself. This involved integrating conductive threads, flexible sensors, and microcontrollers directly into the textile matrix, creating garments that were both comfortable and capable.
- **The Age of Smart Textiles and Nanofabrics:** The current frontier involves true smart textiles that can perceive and react to their environment. This is powered by **nanofabrics** materials engineered at the molecular level to possess novel properties like water repellency, conductivity, or antimicrobial action, without compromising the fabric's feel or flexibility.

This evolution marks a transition from textiles as an end-product to textiles as a platform for innovation.

❖ A Tapestry of Applications: DFT in Action

The potential of DFT is being unlocked across a stunning array of sectors, demonstrating its role as a foundational technology for the 21st century.

- **Healthcare:** DFT is revolutionizing patient care through continuous, non-invasive monitoring. Smart garments can track vital signs like ECG, respiration rate, and muscle activity in real-time, enabling remote patient monitoring, early diagnosis, and personalized rehabilitation. Bandages with integrated sensors can monitor wound pH levels to detect infection.
- **Agriculture:** In the form of **smart agro-textiles**, DFT offers precision farming solutions. Nets and ground covers embedded with sensors can monitor soil moisture, nutrient levels, and pest activity, allowing for targeted water and pesticide use, optimizing yield and resource conservation.
- **Energy:** The field of **energy-harvesting textiles** is turning clothing into a power source. Fabrics woven with photovoltaic fibers can generate electricity from sunlight, while piezoelectric textiles can convert the kinetic energy from body movement into electrical power, potentially charging mobile devices for those in remote or off-grid locations.
- **Communication:** E-textiles are enabling seamless, on-the-go connectivity. Jackets with woven antennas can enhance signal reception, while gesture-recognizing sleeves can control devices without a physical interface, creating a new paradigm for human-computer interaction.
- **Disaster Management:** For first responders, DFT can be a lifesaver. Suits with integrated environmental sensors can detect toxic gases or extreme heat, while biometric monitoring can track a firefighter's stress levels and location, enabling coordinated rescue efforts and preventing casualties.

❖ Global Innovations Weaving the Future

Key breakthroughs from laboratories and companies around the world are pushing the boundaries of what fabric can do.

1. **Self-Cleaning Fabrics:** Inspired by the "lotus effect," these nanofabrics are coated with photocatalytic nanoparticles. When exposed to light, these particles break down organic dirt and microbes, reducing the need for water and detergent and offering immense potential for medical and hospitality textiles.
2. **Energy-Harvesting Fabrics:** Researchers have developed fabrics that integrate flexible, microscopic solar cells or triboelectric nanogenerators (TENGs) that generate power from the slightest friction or movement, paving the way for truly self-powered wearable electronics.
3. **Medical-Monitoring Wearables:** Beyond fitness trackers, companies are producing FDA-cleared smart shirts that provide clinical-grade ECG data. These wearables allow for long-term cardiac monitoring outside a hospital, catching arrhythmias that would be missed in a short clinic visit.
4. **AI-Driven Weaving Systems:** At the manufacturing level, artificial intelligence is being integrated with digital looms. These systems can autonomously optimize weaving patterns for strength and efficiency, detect defects in real-time, and even create complex, previously impossible 3D woven structures for composites and advanced apparel.

1.5 Economic and Social Empowerment: Weaving a Self-Reliant Future

The true transformative power of Digital Fabric Technologies (DFT) in rural contexts lies not merely in technological adoption, but in its capacity to foster profound economic and social empowerment. By establishing DFT as a new rural industry, we can catalyze a shift from dependency to creativity, from marginalization to market leadership, and from preserving craft to powering communities.

1.5.1 DFT as a Catalyst for a New Rural Industry

Traditional rural economies are often characterized by a limited set of low-skill, low-wage jobs. DFT shatters this paradigm by creating a diversified ecosystem of employment that blends traditional skills with the digital economy. This new industry generates jobs across the value chain:

- **Advanced Manufacturing:** Operating and maintaining digital looms, embroidery machines, and direct-to-garment printers requires a new class of skilled technicians.
- **Precision Stitching and Assembly:** The creation of smart textiles often involves the careful integration of electronic components, demanding high-precision stitching and assembly roles that command higher wages than standard garment work.
- **Coding and Design:** There is a growing need for local talent who can program the functionality of smart textiles (e.g., coding sensor data protocols) and use CAD software to create intricate digital designs rooted in traditional motifs.
- **Selling and Storytelling:** The shift to high-value products requires skills in digital marketing, e-commerce management, and content creation to effectively communicate the unique story of these rural, tech-infused crafts to a global audience.

This multi-skilled ecosystem ensures that economic benefits are distributed widely, creating a resilient local economy less vulnerable to single-sector shocks.

1.6 Empowering Women and Youth through Micro-enterprises

DFT is uniquely positioned to empower two demographics often on the margins of rural economies: women and youth.

- **For Women:** In many cultures, women are the custodians of traditional textile knowledge like spinning, weaving, and embroidery. DFT allows them to leverage this existing expertise and become micro-entrepreneurs. A woman's self-help group can pool resources to access a digital printer, transforming their hand-drawn designs into a branded line of smart accessories. This provides financial independence, enhances their status within the community, and ensures their cultural knowledge becomes a source of economic power.
- **For Youth:** DFT offers a compelling alternative to forced migration. It provides a bridge for tech-savvy youth to apply their digital fluency in a context that honors their heritage. A young person can become the "tech lead" for a community cooperative, managing the e-commerce website, using social media for branding, or programming the interactive features of a smart textile product. This reverses the "brain drain" by making the village a hub of innovation and opportunity.

1.6.1 Opening Global E-Commerce Opportunities

The digital nature of DFT production dovetails perfectly with the global reach of e-commerce. A rural producer is no longer limited to the local weekly market. Through online platforms, they can sell directly to a consumer in New York, Berlin, or Tokyo. The "story" of the product handcrafted in a rural village and enhanced with modern technology becomes a powerful marketing tool, allowing entrepreneurs to compete on authenticity and innovation rather than just price. This direct market access eliminates intermediaries, ensuring a greater share of the profits remains within the community.

1.6.2 Building Self-Reliant Villages (The Atmanirbhar Bharat Model)

The DFT model is a living embodiment of the **Atmanirbhar Bharat (Self-Reliant India)** vision, applied at the grassroots level. It promotes technology-driven craft to build vibrant, self-sustaining rural economies. This model fosters self-reliance by:

1. **Import Substitution:** Communities can produce high-value, technologically advanced products locally, reducing dependence on imported goods.
2. **Value Addition:** Instead of exporting raw cotton or silk, they export finished, branded smart textiles, capturing the maximum economic value within the village.
3. **Skill Sovereignty:** Developing a local workforce with advanced digital and technical skills makes the community a hub of talent, attracting investment and partnerships.
4. **Cultural Confidence:** It instills a renewed sense of pride, demonstrating that traditional crafts, when fused with technology, can be a source of global competitiveness and modern identity.

1.7 Sustainability & Environment: Weaving a Greener Future

The integration of digital fabric technologies (DFT) presents a powerful opportunity to align technological advancement with ecological responsibility. Its environmental impact is twofold: mitigating waste in traditional industries and pioneering new, sustainable material cycles.

1.7.1 Reducing Resource Wastage

- **In Agriculture:** The use of smart agro-textiles is a game-changer for precision farming. Sensor-embedded fabrics can monitor soil moisture, temperature, and nutrient levels in real-time. This data allows farmers to irrigate and fertilize *only when and where needed*, drastically reducing the overuse of water, fertilizers, and pesticides. This not only conserves vital resources but also prevents agricultural runoff, a major source of water pollution.
- **In the Clothing Industry:** The fashion industry is notoriously wasteful. DFT counters this through:
  - **On-Demand Production:** Digital textile printing allows for micro-runs and made-to-order manufacturing. This eliminates the massive inventory waste associated with traditional forecasting, where unsold clothes often end up in landfills.
  - **Zero-Waste Design:** AI-driven weaving and cutting systems can optimize pattern layouts to use nearly 100% of the fabric roll, a significant improvement over conventional methods that can waste up to 15-20% of material.
  - **Virtual Prototyping:** Brands can use digital sampling to perfect designs without producing countless physical samples, saving water, dyes, and fabric.

1.7.2 Pioneering Eco-Friendly Smart Fabrics

The concern of e-waste from smart textiles is being addressed through material science innovations:

- **Biodegradable Conductive Fibers:** Instead of relying on synthetic polymers and metals, researchers are developing conductors from natural materials. For instance, conductive inks based on silver nanoparticles can be replaced with graphene or carbon-based compounds derived from plant waste. Fibers coated with these materials can maintain functionality while being compostable at the end of their life cycle.
- **Sustainable Substrates:** The base fabrics for e-textiles are increasingly being sourced from organic cotton, hemp, bamboo, and recycled PET bottles, creating a fully sustainable product ecosystem.

1.7.3 Contribution to Climate-Resilient Rural Development

For rural communities, DFT is a tool for climate adaptation. Locally sourced, sustainable materials (like organic cotton or banana fiber) are valorized. The decentralized nature of digital hubs means production can be hyper-local, reducing the carbon footprint of long supply chains. Furthermore, by creating a high-value, knowledge-based economy around textiles, communities become less dependent on climate-vulnerable monoculture farming, building economic resilience in the face of environmental change.

1.8. Policy, Governance, and Digital Inclusion: Building a Supportive Ecosystem

For DFT to reach its full potential in transforming rural economies, a robust and inclusive policy framework is not just beneficial—it is essential. Technology alone cannot bridge the deep digital and economic divides.

The Critical Need for Government Support

A. **Research & Development (R&D):** Public funding for R&D is crucial for fundamental research into affordable, scalable, and culturally relevant DFT solutions. This includes grants for national research institutions to develop low-cost digital looms, biodegradable sensors, and energy-efficient production processes suited for rural infrastructure.

B. **Subsidies and Financial Incentives:** The initial capital investment for digital printers, embroidery machines, and CAD software is a significant barrier. Government subsidies, tax breaks, and low-interest loans can empower rural entrepreneurs and artisan cooperatives to acquire this technology.

C. **Rural Training Centers (R&D to R3 - Research, Rural, Resilience):** Establishing dedicated skill-development centers in rural districts is paramount. These centers would not just teach machine operation but would offer integrated curricula in:

- Digital literacy and CAD software.
- Traditional craft preservation and documentation.
- Entrepreneurship, branding, and e-commerce management.
- Basic machine maintenance and repair.

1.8.1 Leveraging National Missions: The Indian Context

India's flagship programs provide a ready-made architecture to propel DFT:

- **Digital India:** This mission ensures the foundational digital infrastructure high-speed internet in rural areas and digital payment systems that is the absolute prerequisite for running a digital hub and accessing global e-commerce platforms.
- **Make in India:** By promoting DFT, India can position itself not just as a source of cheap labor, but as a global hub for *innovative, culturally-rich, and sustainably-made* smart textiles. This aligns with the mission's goal of boosting manufacturing with a focus on innovation and sustainability.
- **Startup India:** This initiative can provide the specific support structure for DFT ventures—simplified registration, intellectual property rights (IPR) facilitation, and seed funding—nurturing a new generation of "tech-artisan" startups.

1.8.2 Public-Private Partnerships (PPP) : The Bridging Mechanism

The government cannot do this alone, nor can private industry reach the grassroots effectively without local partnerships. PPPs are the ideal model:

- **Role of Government:** Provide land, basic infrastructure (power, internet), and policy stability.
- **Role of Private Industry:** Provide state-of-the-art technology, advanced training modules, and market access through their established supply chains.
- **Role of Local Communities:** Provide the invaluable cultural IP, artisanal skills, and local stewardship.

A successful PPP would see a tech company providing digital looms to a rural hub, the government funding the building and connectivity, and a local artisan cooperative managing operations and sharing profits. This model ensures that research from labs is effectively translated into rural entrepreneurship, creating a virtuous cycle of innovation, inclusion, and income generation. This holistic approach ensures that the digital fabric revolution weaves a stronger, more equitable, and sustainable social fabric for rural India.

1.9 Challenges & Barriers: Navigating the Real-World Hurdles

While the potential of Digital Fabric Technologies (DFT) for rural development is vast, its path is fraught with significant challenges that must be acknowledged and strategically addressed to ensure equitable and sustainable adoption.

- **High Cost of Technology Adoption:** The initial capital investment for industrial-grade digital printers, conductive thread, sensor modules, and CAD software remains prohibitively high for most individual rural entrepreneurs or even community cooperatives. Beyond purchase, the ongoing costs of specialized inks, maintenance, and software subscriptions create a formidable financial barrier.
- **Lack of Infrastructure and Digital Literacy:** The DFT ecosystem is fundamentally dependent on robust and reliable infrastructure, which is often absent in rural areas. Unstable electricity grids can damage sensitive equipment, while limited or expensive high-speed internet hampers cloud-based design, software updates, and e-commerce operations. Crucially, there is often a **digital literacy gap**; the skills required to operate this technology—from digital design to machine troubleshooting—are not yet part of the rural skill set, necessitating extensive and ongoing training.
- **The Scalability Paradox:** Many successful DFT initiatives begin as small, donor-funded pilot projects. The critical challenge is scaling these into financially self-sustaining, low-cost business models that can be replicated across thousands of villages. This requires developing frugal innovation strategies, such as shared-hub models and pay-per-use services, to make DFT accessible at the grassroots level without relying on perpetual external funding.
- **Ethical Concerns: Data Privacy and Security:** As DFT, particularly in healthcare, involves the collection of intimate physiological data (heart rate, sleep patterns, location), serious ethical questions arise. Who owns the health data collected by a smart *sari* or vest? How is it stored, transmitted, and protected from misuse? Without clear data governance frameworks and robust cybersecurity measures tailored for rural contexts, there is a significant risk of exploiting vulnerable populations and violating personal privacy.

1.9.1 Future Directions: Weaving the Next Generation of Rural Innovation

To overcome these barriers and fully realize the promise of DFT, a forward-looking, collaborative strategy is essential. The future of rural DFT lies in moving beyond isolated experiments to building integrated, intelligent, and self-sustaining ecosystems

- **Integration of AI + IoT + Digital Fabrics for Rural Smart Living:** The next evolutionary step is the seamless fusion of these technologies. Imagine AI algorithms analyzing data from a network of IoT-enabled agricultural textiles (e.g., smart nets, soil-cloth sensors) to provide farmers with predictive insights on pest control and irrigation. In homes, AI-driven smart textiles could adjust insulation properties based on weather forecasts, optimizing energy use. This creates a holistic system of "ambient intelligence" that enhances rural quality of life and productivity.
- **Global Collaborations for Rural-Centric Fabric Innovations:** The development of DFT must not be a top-down process. Future progress depends on **global collaborations** between multinational technology firms, academic research institutions, and rural artisan communities. These partnerships can drive the R&D of affordable, durable, and context-appropriate technologies such as solar-powered digital looms or low-cost, biodegradable sensors that are specifically designed for the challenges and opportunities of rural settings.
- **Establishing Rural Digital Fabric Clusters:** Building on the hub model, the future lies in creatin formal **Rural Digital Fabric Clusters**. These would be geographic concentrations of interconnected businesses, suppliers, service providers, and training institutions dedicated to DFT. By clustering innovation, these hubs can achieve economies of scale, foster knowledge spillover, attract investment, and brand their region as a center of excellence for smart textiles, much like a "Silicon Valley" for rural tech-craft.
- **Moving from Pilot Projects to Sustainable Ecosystems:** The ultimate goal is to transition from donor-dependent pilots to market-driven ecosystems. This requires a conscious shift in project design from the outset, focusing on:
  - Developing viable business and financing models.
  - Building local capacity for management and leadership.
  - Creating strong market linkages and brand identity.
  - Fostering a policy environment that supports rural tech-entrepreneurship.

1.10 Conclusion: Weaving a Resilient Future

Digital Fabric Technologies (DFT) represents a profound fusion—a synergy where the deep-rooted threads of cultural tradition is interwoven with the luminous filaments of modern innovation. This convergence positions DFT not merely as a technological advancement, but as a **transformative force for holistic rural development**. As we have explored, the potential of DFT to be a game-changer is undeniable. It offers a new paradigm for rural transformation, one that simultaneously addresses critical challenges and unlocks new opportunities across key sectors: from enabling remote **health** monitoring and precision **agriculture** to generating decentralized **energy** and preserving vibrant **cultural** heritage.

Ultimately, this culminates in a restructured **economic** model that fosters entrepreneurship, creates skilled jobs, and reverses the debilitating "brain drain." However, this promising future is not pre-ordained. To bridge the gap between potential and tangible impact, a deliberate and ethical framework is essential. Success hinges on a collective commitment to

- **Inclusive Policies:** Governments and development agencies must craft policies that facilitate technology access, provide digital infrastructure, and create financial incentives for rural DFT enterprises.
- **Affordable Innovations:** The research and development community must prioritize frugal engineering, designing scalable, low-cost, and durable DFT solutions tailored for the resource-conscious rural context.
- **Participatory Design:** Ultimately, for DFT to be truly empowering, it must be co-created *with* rural communities, not delivered *to* them. Engaging artisans, farmers, and youth in the design process ensures that technologies are culturally relevant, practically useful, and truly owned by the people they are meant to benefit.

In harnessing the power of Digital Fabric Technologies through this collaborative, human-centric lens, we can move beyond mere development. We can actively weave a future for rural communities that is not only technologically advanced but also economically self-reliant, culturally vibrant, and profoundly resilient.

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CHAPTER-02

ENTREPRENEURIAL OPPORTUNITIES IN FOOD PROCESSINGIN INDIA

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2.1 INTRODUCTION

Entrepreneurial opportunities are defined as conditions where products and services can be sold at a price greater than the cost of their production. An 'entrepreneurial opportunity', thus, is a situation where entrepreneurs can take action to make a profit (Casson, 1982).

❖ 2.1.1 FOOD PROCESSING

Food processing involves set of methods and techniques used to transform raw ingredients into food or to transform food into other forms for consumption by humans or animals either in the home or food processing industry. Broadly, food processing industries include milling industry, bakery industry, confectionary industry, milk processing and packaging plant, meat packing& processing plant, slaughterhouse, sugar industry, canning industry, fruits and vegetable processing plants, industrial rendering, etc. Food processing is the transformation of agricultural products into food, or of one form of food into other forms. Food processing takes many forms, from grinding grain into raw flour, home cooking, and complex industrial methods used in the making of convenience foods.

Food entrepreneurship refers to people setting up their own businesses within the world of food and cuisine. This could encompass a wide range of business types, from starting your own catering business to being a culinary entrepreneur in food delivery. Food processing provides special benefits to the society. These include toxin removal, preservation, easing addition, all-season availability of many foods, easing marketing and distribution tasks, and makes many kinds of foods safe to eat by de-activating spoilage and pathogenic microorganisms. These days, more and more people live in the cities far away from where food is grown and produced. Increasing number of adults is living away from the families who gets little time for the preparation of food based on fresh ingredients. Not only that, the demand for nutritious food considering health conditions has also been increasing day by day. That there will be more and more demand for readymade or processed food in coming days. Thus, food processing industry offers yet more opportunities for entrepreneurship development to establish and run food-based industries. With growing consumer awareness, there is also an increasing preference for hygienically packaged and ready-to-consume products. Therefore, the food processing sector is emerging as one of the most dynamic and high-growth potential areas in the rural and industrial economy.

WHERE INDIA STANDS IN TERMS OF PRODUCTION?

India is largest producer of Pulses, Mangoes, Banana, Milk, ginger, Buffalo meat and second largest producer of rice, wheat, potato, garlic, cashew nut, groundnut, dry onion, green peas, pumpkin, gourds, cauliflowers, sugarcane, and tea in the world.

- India produces 17% of the global total of vegetables and 14% in the case of fruits**.** About 40% of the world's mangoes and 30% of the world's bananas and papayas are produced in India.
- India is net exporter of agricultural products**.** But value addition of Indian product remains quite low**.**

Food processing has potential to turnaround whole economy. Indian economy is still agrarian, because about 55% population is directly dependent upon agriculture**.**

2.2 ENTREPRENEURIAL OPPORTUNITIES IN FOOD PROCESSING SECTOR

Economic development of a country is supported by entrepreneurship in several ways. It is a key contributor to innovativeness and product improvement and plays a pivotal role in creating employment.

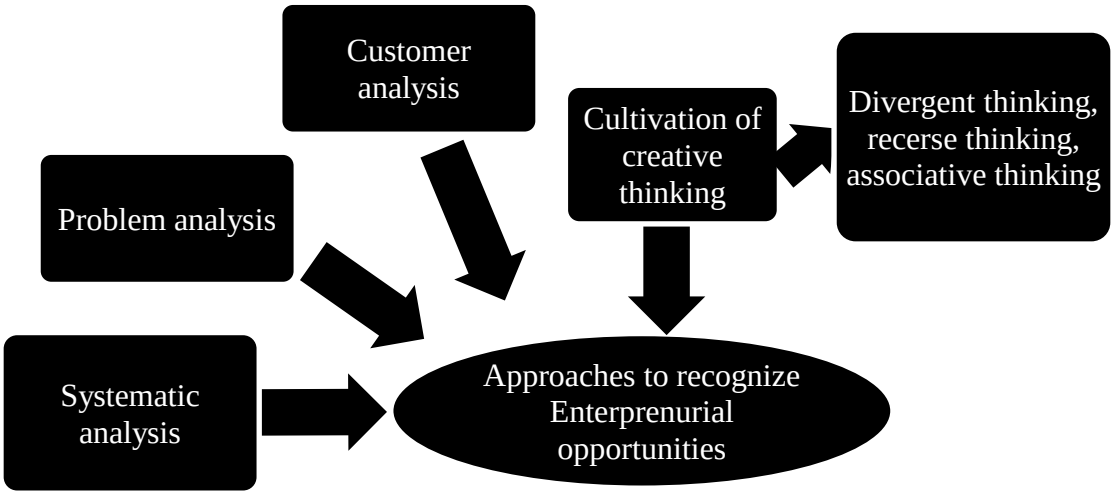

Figure 2.1: Identify entrepreneurial opportunities

1. FRUITS AND VEGETABLES

- Presently consumers spending on unprocessed fruits and vegetables.
- Supply chain losses are 10-25%.

OPPORTUNITIES

- Establish enterprises that provide alternative products
- Supply chain (Cold storage, Chilled frozen carrier etc.)
- Demand of organic fruits and vegetables

2. CEREALS

Cereal processing is only based on secondary processed products and wheat milling (wheat flour) and rice milling dominates in cereal processing. Processing of Cereal is mainly dominated by unorganized and unbranded players.

❖ OPPORTUNITIES

- Enterprises may be established on processing of tertiary value added products.
- There is a lot of scope of Ethnic snacks, Health foods, Infant foods etc.
- Alternative cereals like major millets, minor millets and can be processed.

3. BEVERAGE

Varieties of beverages are being prepared in this segment but still there is a demand of healthy beverages.

❖ OPPORTUNITIES

- Opportunities for enterprises to manufacture healthy beverages.
- Opportunities in enterprises for growing of organic fruits and vegetables and processing of herbs, health ingredients etc.
- Underutilized fruits and vegetables can also be taken as raw ingredients for production of health beverage.

4. MILK AND MILK PRODUCTS

Plenty of milk and milk based products are being prepared in this segment with minimal processing and consumed in original form, which is why there is a need of more processing as well as healthy products.

OPPORTUNITIES

- Opportunities for enterprises at village level (Bulk Coolers) to be sourcing point for big players.
- Opportunities in enterprises for value added health products (Prebiotics, Probiotics, Synbiotics etc.).
- Underutilized fruits and vegetables can also be taken as a raw ingredient for production of health beverage.

5. SOYBEAN PROCESSING SECTOR

Now a day there is a need to develop process technologies for products matching to conventional food habits of the country. Soy based food products has potential to provide the opportunity to upcoming entrepreneurs. The Food and Drug Administration (FDA) recommends that consumers incorporate at least 25 grams of soy protein each day for healthy heart.

The unique chemical composition of soybean seed, which includes the number of nutraceutical compounds such as isoflavons, tocopherol, and lecithin besides 20 % oil and 40 % protein, has made it one of the most valuable agronomic crops in the world. And this unique composition of soybean

seeds makes it best candidate for future designer foods. The multifaceted uses of Soybean at the national and global level are as follows:

a) WHOLE SOYBEAN PRODUCTS

- Seed
- Soy flour
- Soy sauce
- Soy paneer (Tofu)
- Soy milk

b) SOYBEAN OIL PRODUCTS

- Cooking oil
- Baking products
- Margarine
- Salad oil Soybean meal:
- Animal feed
- Poultry feed
- Feed for aqua culture

c) SOYBEAN PROTEIN PRODUCTS

- Textured vegetable protein
- Isolated soy protein

d) SOYBEAN BASED INDUSTRIAL PRODUCTS

- Printing inks
- Cosmetics
- Paints
- Soaps/detergents/toiletries Soybean food products
- Plastics and rubber industry

2.3 OPPORTUNITIES

Soy products find wide application as a versatile ingredient virtually in every food system, includingbakery, breakfast cereals, beverages, infant formulas, dairy analogue and meat analogue. Soy milkand tofu is the main value added products which can be prepared easily from soybean. Apart fromsoy milk and tofu different other products like soybean flour, soy nuts, textured soy protein, soyprotein isolate and soy protein hydrolysate can also be prepared from soybean.

2.3.1 PROCESSING OF SPICES AND CONDIMENTS

The processing and trade of spices has always been an important industry. Small-scale processing of spices can be economically and socially successful.

OPPORTUNITIES

Processing of spice can be a good opportunity for enterprenures because number ofvalue added products can be prepared from different spices:

- ❖ Black pepper – Oleoresin, Green pepper in Brine, dehydrated green peppers, canned greenpepper, white pepper powder etc.
- ❖ Paprika – colour, paprika flavour
- ❖ Ginger – powder, wines, dry ginger starch from spent ginger preserves, ginger in oilOleoresin
- ❖ Turmeric – Natural pigments, curcuminoids, oleoresins
- ❖ Coriander – Powder, oleoresins
- ❖ Cumin – powder, oleoresin
- ❖ Fennel – sugar coated fennel, oleoresin, whole etc
- ❖ Fenugreek – powder, dried fenugreek leaves etc
- ❖ Tree spices – obesity regulators, stimulators, neutraceuticals (cinnamom, cassia nutmeg,cloves)
- ❖ Chillies – powder, pickles, paste, oleoresin, oil, brined chilli, sauces.

CONCERNS

a) Other key challenges faced by the food processing sector are gaps in supply chain infrastructure which means inadequate primary processing, storage and distribution facilities; the insufficient connection between production and processing; seasonality of operations and low capacity utilizations.

b) Even at current level of production, farm produce valued at Rs 70,000 million is being wasted every year only because there is no adequate storage, transportation, cold chain facilities and other infrastructure supports.

c) An estimated 25% of fruits and vegetables valued at about Rs250bn-300bn is wasted annually due to poor post harvesting technology and inadequate storage and transportation. Cold chain facilities are miserably inadequate to meet the increasing production of various perishable products like milk, fruits, vegetables, poultry, fisheries etc.

d) In order to promote the food and allied industries,the Government of India has established, a few national level organizations, which in one way or the other support the industry.

POLICY INITIATIVES

a) Government is committed to enhance growth of food processing sector and put it on a robust footing. Government is actively encouraging investment in agro processing industries to reduce wastage and encourage value addition.

b) Accordingly, for giving a boost to FPI sector, Government has recently initiated several measures besides tax concessions.

c) The major focus of the Ministry aim at increasing Government investment in creating the farm to market supply chain, market processing infrastructure to attract more private investment.

d) It is also proposed to strengthen R& D, HRD, in the food processing sector, establish more food testing laboratories to ensure quality of food products and compliance of national & international standards, etc.

GOVERNMENT POLICY MEASURES

a) As per extant policy FDI up to 100% is permitted under the automatic route in the food infrastructure (Food Park, Cold Chain/warehousing). In so far as food retail is concerned the FDI policy does not permit FDI into Retail sector except Single Brand Product Retailing. This policy is uniform for all retailing activity.

b) No industrial license is required for almost all of the food & agro processing industries except for some items like: beer, potable alcohol & wines, cane sugar, hydrogenated animal fats & oils

c) MRTP (Monopolies & Restrictive Trade Practices Act) rules and FERA (Foreign Exchange Regulation Act) regulations have been relaxed to encourage investment and expansion by large corporates.

d) Most of the items can be freely imported and exported except for items in the negative lists for imports & exports. Capital goods are also freely importable, including second hand ones in the food processing sector.

e) Excise & Import duty rates have been reduced Many processed food items are totally exempt from excise duty. Custom duty rates have been substantially reduced on plant &equipment, as well as on raw materials and intermediates, especially for export production.

f) Indian currency (rupee) is now fully convertible on current account and convertibility on capital account with unified exchange rate mechanism is foreseen in coming years.

g) Food processing industry is one of the thrust areas identified for exports. Free trade zones (FTZ) and export processing zones (EPZ) have been set up with all infrastructure. Also, setting up of 100% Export oriented units (EOU) is encouraged in other areas. They may import free of duty all types of goods, including capital foods.

h) All profits from export sales are completely free from corporate taxes. Profits from such exports are also exempt from Minimum Alternate Tax (MAT).

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CHAPTER-03

ICT AND E-GOVERNANCE INITIATIVES FOR RURAL DEVELOPMENT IN INDIA

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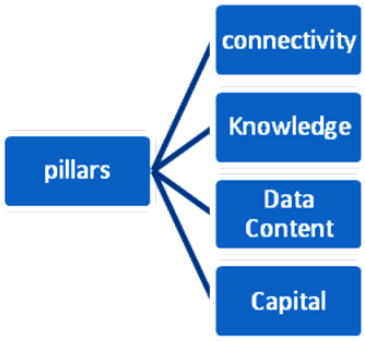
3.1 INTRODUCTION

Rural India has long been considered the spine of India's economy. Agriculture isn't just the most important contributing sector to the economy but also ensures food security during a constantly growing and developing country. Beyond food and economics lies another major (although understudied) dimension of sustainability and environmental conservation, of which the agri-economy is the primary stakeholder. Effective and efficient governance may be a key ingredient in ensuring all-round development of rural areas at par with the urban ones. As a result, the need for an all inclusive and sustainable development for rural areas has been felt much more strongly in recent years, bringing issues of rural governance to the forefront of policy discourse in our country. This year the state is marking 75 years of its independence with the 'Azadi Ka Amrut Mahotsav' campaign under which several celebrations and developmental initiatives are being undertaken for 75 weeks ending 15th August 2023. In this context, this piece unpacks the transformation of rural India over seven decades by specifically examining the governance and repair delivery frameworks to trace the progress made so far and the challenges that lie ahead. Strong leadership is essential in reviving rural areas, emphasizing the importance of rural governance. Villages exhibit a diversity of resources and social structures due to uneven socioeconomic development. Due to the diversity and complexity of the rural areas, a standardized approach to governance cannot be applied uniformly across all regions in India.

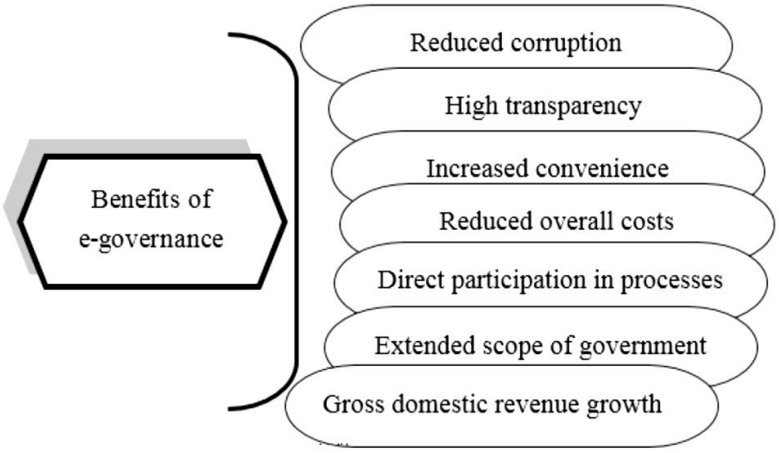
Therefore, exploring the path to effective governance grouping in villages is a key factor in achieving successful rural governance-revitalization and represents a major challenge. Good governance necessitates the consideration of variations in influential factors and the integration of participatory elements with guiding pathways. Effective governance hinges upon how participation is enabled and procedures are managed, necessitating an understanding of the intricate interplay between social practice and theory, as well as the state and rural society. By exploring these interactions, we can enhance our comprehension of the Indian framework of rural governance, thereby contributing to the cause of rural revitalization. Rural governance efficacy focuses on two primary dimensions. Firstly, it recognizes the significance of the existing governance system, such as the responsiveness of the state to the needs of farmers and grassroots governance facilitated by the autonomy of villagers. It emphasizes the value of strong leadership, participation from multiple grassroots party organizations, and in-depth analysis at the institutional and methodological levels. Secondly, rural governance efficacy aims to enhance the integration of moral authority, autonomy, and the rule of

law in rural governance. This objective is achieved by constructing a new rural governance system and outlining a pathway to successful governance. With rural revitalization being widely acknowledged, scholars have extensively explored the elements and mechanisms that promote effective governance. The studies of rural governance primarily focus on stimulating the intrinsic motivation of the participation of villagers, fostering connections between rural governance elites and the rural society, establishing innovative models of rural collective economies, cultivating sustainable "localized" rural lifestyles and cultures, strengthening the integration of rural industries and new technologies, and achieving the innovation of rural governance frameworks.

The key priority of rural governance lies in ensuring active participation and engagement of the people. Through the application of participatory rural development, successful interactions among key governance actors can foster endogenous activation based on local networks, mobilizing the self-governance of villagers, and empowering farmers to make decisions. A key role in rural areas today is played by elite participation, guiding the path towards sustainable development by actively engaging farmers. Rural organizations play an important role in establishing local industries and promoting rural development. Information and communication activities are a fundamental element of any rural development activity. Rural areas are often characterized as information-poor and information provision has always been a central component of rural development initiatives. One of the major components and driving force of rural development is communication. Conventionally, communication includes electronic media, human communication & now information technology (IT). All forms of communications have dominated the development scene in which its persuasive role has been most dominant within the democratic political frame work of the country. Information and Communication Technologies (ICTs) play a key role in development & Economic growth of Rural India. Political, Cultural, Socio-economic Developmental & Behavioral decisions today rests on the ability to access, gather, analyze and utilize Information and Knowledge. ICT is the conduits that transmit information and knowledge to individual to widen their choices for Economic and social empowerment. Information and Communication technologies have become imperative to the progress of rural India. They have become an integral part in the information-flow for catalyzing the development efforts in rural India. ICTs offer several strategies to achieve sustainable rural development. ICTs have been instrumental in empowering the rural India with technologies which help us to reach our goals of sustainable development. Good governance is fundamental and e-governance is instrumental. E-Governance is a tool. No E-Governance tool can be successful without focusing attention to process reforms for good governance. Good governance dictates the design and shape of s e-tools for improving governance outcomes and processes. E-Governance can be an effective and efficient tool for good governance if and only if the process reforms have been carried out. Automating complicated government processes will create more problems than it can solve. The emergence of the digital economy has affected both the role and functions of public institutions. While undertaking traditional functions such as defense, law and



order, justice, taxation, legislation, regulation, education, health care and social equity, the governments are now required to take new roles of harnessing the power of information technology and leading change. There has been a transformation of the role of the government from a buyer or producer of ICT services to that of a facilitator and a leader.



ICT has been instrumental in changing the way in which the government operates through horizontal and vertical interactions and information flows. It has provided unique opportunities to governments in terms of new ways of doing business through E-Government and E-Governance applications. E-Government is about leading the transformation of government to provide efficient, convenient and transparent services to citizens and businesses through the use of Information and Communication Technologies (ICT). E-Government concerns with the transformation of government, modernization of government processes and functions and better public service delivery mechanisms through technology. Citizens are the recipients in E-Government. E-Governance, on the other hand, comprises decisional processes and the use of ICT for wider participation of citizens in public affairs. Citizens are participants in e-governance. The purpose of implementing E-Governance is to improve governance processes and outcomes with a view to improving the delivery of public services to citizens. The United Nations distinguishes between the following areas where governmental operations can be improved by the application of ICT:

- **e-Government :** This applies to inter-organizational relationships, and includes policy coordination, policy implementation and public service delivery
- **e-Administration :** This applies to intra-organizational relationships, and includes policy development, organizational activities and knowledge management
- **e-Governance :** This applies to interaction between citizens, government organizations, public and elected officials and includes democratic processes, open government and transparent decision-making

3.2 ROLE OF GOVERNMENT IN ICT

Good governance, in the broadest sense, seeks to reduce corruption, take minority viewpoints into account, listen to oppressed community voices, and respond actively to community needs now and in the future. The World Bank, an international institution, has become the first to adopt the concept of good governance in lending arrangements for developing countries. To be successful in governance, institutions and processes must be able to meet the needs of all stakeholders in a reasonable amount

of time. Every decision-making process and institution must be capable of coming up with solutions that meet the needs of each community. ICT is the backbone of the development of any nation. It's undoubtedly the nervecentre and backbone for a developing country like India. Realizing the importance of ICTs in rural development in India, several government projects have been implemented to achieve universal access to ICTs. These projects mainly focus on bridging the digital divide between the urban and rural areas of India. The urgency to bridge this divide mainly comes from the fact that in India, the rural areas mostly lag behind the urban areas, when it comes to education, health and infrastructure. This leads to inequality of services and opportunities for the rural population which stops them from contributing to the development of the country. This kind of rural isolation can negatively impact growth and in turn affect the sustainable development of the country. ICTs can help to overcome the various constraints in infrastructure. Through the use of ICTs, people in rural areas can connect easily with the local, regional and national economy. They can make use of the banking facilities and also access the various job opportunities which would otherwise be beyond their reach. ICTs can help to create awareness among the rural public regarding new technologies in agriculture which would help them to contribute to the GDP of the country. The various ICTs can help to spread education among the rural masses and help them to connect easily with their urban peers.

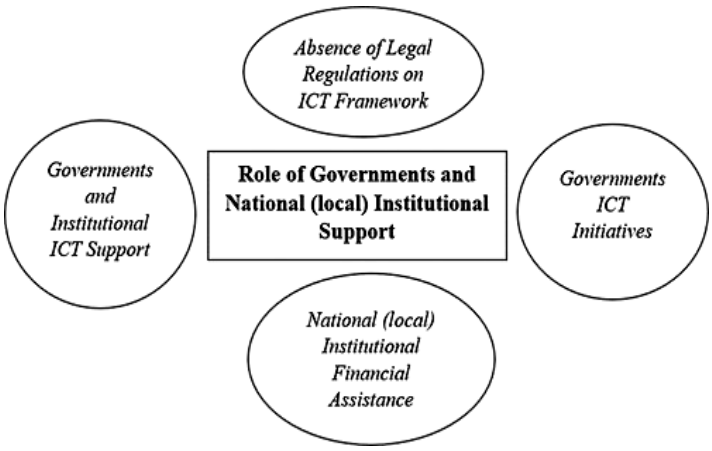
Thus bridging the digital divide not only helps in bridging the infrastructural gap but also to bring the rural population to the forefront. The development-landscape has been transformed by the explosion of ICT, especially the mobile phone technology. This technology has improved the life of the rural population by integrating the once isolated people into the economies and politics. The rural poor typically lack access to information vital to their lives and livelihoods. Building upon the concept of knowledge gaps and information problems, they are two types of information used by the rural poor to priorities their livelihood activities and investment decisions more effectively. The role of the government in ICT can be distinguished between the following categories :

- **G1 :** Laying ICT infrastructure, producing ICT equipment, financing public R&D
- **G2 :** Creating the macroeconomic environment for growth and innovation in ICT, including fiscal policies (cost, innovation, investment, venture capital), legal and regulatory environment (competition, independent regulator, rule of law, intellectual property protection) and channeling and mobilizing resources for ICT
- **G3 :** Education policy for the right amount and quality of manpower resources for a network-ready economy – curricula, ICT training facilities, wiring/networking of educational institutions.

- **G4 :** Addressing 'digital divide' domestically and internationally, giving signals to markets – articulating a national vision of ICT, according national priority to ICT, undertaking large projects, championing national interests in international forums
- **G5 :** e-government like services online, e-procurement, trade facilitation, civil society participation, accelerating the adoption of ICT by government departments and agencies and establishing credibility

To compete successfully in a network-based global economy, governments need to be both leaders and facilitators. The leadership and facilitation roles comprise the following elements

- Developing national e-strategy, making ICT adoption and network readiness a national priority, bridging "digital divide" and championing an e-readiness framework
- Undertaking innovative projects that make a difference to lead by example, adopting best practices and pushing for their adoption by others and developing public-private-people partnerships
- Implementing Right to Information (RTI) and committing to transparency in governmental operations
- Reforming government processes covering areas such as revenues, expenditures, procurement, service delivery, customer grievances etc.



- Tracking, storing and managing information, promoting production of national content online and through electronic media
- According high priority to protection of individual rights, intellectual property, privacy, security, consumer protection etc. and mobilizing the civil society
- Documenting "best successes" and "worst failures" – benefiting from knowledge
- Developing a supportive framework for early adoption of ICT and creating a regulatory framework for ICT-related activities, e.g. fixed and mobile communication, e-commerce and Internet services
- Promoting innovation and risk-taking through fiscal concessions and availability of venture capital creating an investment climate for domestic and foreign investment in ICT sector
- Promoting ICT training, education and research
- Negotiating and influencing the proper adoption of international frameworks, norms and standards by participating actively in the governance of the global information economy

Rural e-governance includes all those processes through which common people can access confidential data and information about the govt. and its various development projects, programs etc. Thus, we can say that providing govt. services at the doorsteps of the citizen through online

mode is known as e-Governance. Following definitions has been given by World Bank, UNESCO and the Council of Europe -

- World Bank explained the E governance as the use by government agencies of information technologies (such as Wide Area Networks, the Internet, and mobile computing) that have the ability to transform relations with citizens, businesses, and other arms of government. These technologies can serve a variety of different ends better delivery of government services to citizens, improved interactions with business and industry, citizen empowerment through access to information, or more efficient government management. The resulting benefits can be less corruption, increased transparency, greater convenience, revenue growth, and or cost reductions."
- According to international organization, UNESCO, "Governance refers to the exercise of political, economic and administrative authority in the management of a country's affairs, including citizens' articulation of their interests and exercise of their legal rights and obligations. E-Governance may be understood as the performance of this governance via the electronic medium in order to facilitate an efficient, speedy and transparent process of disseminating information to the public, and other agencies, and for performing government administration activities".
- The Council of Europe elaborated e-Governance as "the use of electronic technologies in three areas of public action such as relations between the public authorities and civil society, functioning of the public authorities at all stages of the democratic process (electronic democracy) and the provision of public services (electronic public services).

Through e-governance, information can be distributed to the public in a transparent manner. The most commonly used models can be described as under:

Government-to-Citizen (G2C) – This level of application creates an interface between the government and citizens enabling them to potentially benefit from a large range of public services. This expands the availability and accessibility of the government to an anytime, anywhere mode. This gives citizens the choice of when to interact with the government – 24 hours a day, 7 days a week; from where to interact with the government – service centre, unattended kiosk or from the comfort of one's home; and how to interact – through internet, fax, telephone, email, face-to-face, etc.

Government-to-Business (G2B) – This category of application helps the business community – providers of goods and services – to seamlessly interact with the government. The advantages

are it helps to cut red tape, saves time, reduces operational costs, cuts unnecessary delays and eliminates redundant data capture. It also creates a more transparent business environment when dealing with the government. The interactions can be transactional, such as in licensing, permits, procurement, and revenue collection. They can also be promotional and facilitative, such as in trade, tourism, investment and campaigns.

Government-to-Government (G2G) – This kind of interaction is only within the sphere of the government which can be both horizontal i.e. between different government agencies or vertical i.e. between national, 27 provincial and local government agencies. The primary objective is to share information in order to avoid duplication and reduce turn-around time; to increase operational efficiency; and to facilitate better integration on inter-governmental programmes and projects potentially leading to performance improvements.

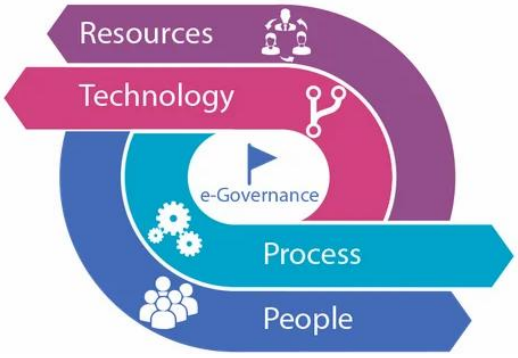
Government-to-Employees (G2E) – This (G2E) refers to the delivery of services by the Government to its employees (G2E). These types of services primarily relate to human resource areas. Essential Ingredients of e-Government fundamentally, e-Government projects would stand on four key – People, Process, Technology and Resource (PPTR), and in a holistic manner, to achieve the desired results of the project.

Thus "e-Government" or electronic government refers to the use of ICTs by government agencies for any or all of the following reasons:

- Exchange of information with citizens, businesses or other government departments
- Speedier and more efficient delivery of public services
- Improving internal efficiency
- Reducing costs or increasing revenue
- Re-structuring of administrative processes

3.3 ICT, PANCHAYATIRAJ AND E-GOVERNANCE

The Information and Communication Technologies (ICT) are being increasingly used by the governments to deliver its services at the locations convenient to the citizens. The rural ICT applications attempt to offer the services of central agencies (like district administration, cooperative union, and state and central government departments) to the citizens at their village door steps.



These applications utilize the ICT in offering improved and affordable connectivity and processing solutions. Several Government-Citizen (G-C) e-Government pilot projects have attempted to adopt these technologies to improve the reach, enhance the base, minimize the processing costs, increase transparency, and reduce the cycle times. A large number of rural E-Government applications, developed as pilot projects, were aimed at offering easy access to citizen services and improved processing of government-to-citizen transactions. e-Governance is a use of information and

communication technologies with the aim of improving information and service delivery (of government sector), encouraging citizen's participation in the decision making process and making government more accountable, transparent and effective.

Information technologies enhance the transformation of work culture by serving a variety of ends; and better delivery of government services to citizens. It is an e-Governance initiative for the rural sector providing comprehensive software solution attempting automation of Gram Panchayat functions. The Panchayat Raj System is playing an important role in rural development. E-Panchayat is the lowest tier for rural development. Use of Information Communication Technology (ICT) in e-governance/e-Panchayat is providing fast services to the citizens. These tools make delivery of government services to citizens in transparent and efficiency in effective way. The results of previous studies on E-Panchayat show that urban citizens are taking a lot of benefits from these services in comparison to rural population. The rural population is not getting advantages from modern ICT services. There are many reasons for this gap. It has been seen that this difference in utility of ICT services is because of local language problems, lack of awareness of public services and sometimes availability of proper infrastructure. It has been suggested by several scholars that these problems can be overcome by greater participation of the people in awareness related public functions at Panchayat level through dedicated ICT services that makes them aware about the proper use of available resources. They should be trained in such a way that knowledge about the government services is shared amongst them. Since rural communities are the closest to bottom level problems. Efforts must be made to provide information in local language of the community. It can benefit all participants belonging rural community may it be e-learning too. Services of accessibility empower the rural citizens and their participation can provide innovative solutions to the problems of rural areas and urban-rural gap can be reduced.

The Panchayat Raj System is playing an important role in rural development. E-panchayat is the lowest tier for rural development. Use of Information Communication Technology (ICT) in E-Povernance/E-panchayat is providing fast services to the citizens. These tools make delivery of government services to citizens in transparent and efficiency in effective way. The rural population is not getting advantages from modern ICT services. There are many reasons for this gap. It has been seen that this difference in utility of ICT services is because of local language problems, lack of awareness of public services and sometimes availability of proper infrastructure. It has been suggested by several scholars that these problems can be overcome by greater participation of the people in awareness related public functions at Panchayat level through dedicated ICT services that makes them aware about the proper use of available resources. They should be trained in such a way

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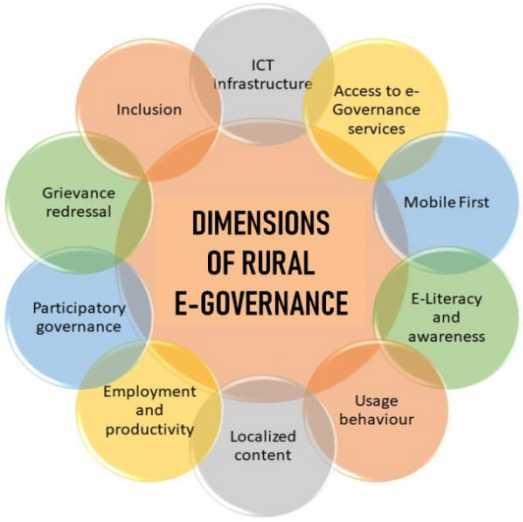
- Implementing Right to Information (RTI) and committing to transparency in governmental operations
- Reforming government processes covering areas such as revenues, expenditures, procurement, service delivery, customer grievances etc.
- Tracking, storing and managing information, promoting production of national content online and through electronic media
- According high priority to protection of individual rights, intellectual property, privacy, security, consumer protection etc. and mobilizing the civil society
- Documenting "best successes" and "worst failures" – benefiting from knowledge
- Developing a supportive framework for early adoption of ICT and creating a regulatory framework for ICT-related activities, e.g. fixed and mobile communication, e-commerce and Internet services
- Promoting innovation and risk-taking through fiscal concessions and availability of venture capital; creating an investment climate for domestic and foreign investment in ICT sector
- Promoting ICT training, education and research
- Negotiating and influencing the proper adoption of international frameworks, norms and standards by participating actively in the governance of the global information economy

3.4 RURAL E-GOVERNANCE DIMENSIONS

India is predominantly a rural country with two-third population and 70% workforce residing in rural areas. Rural economy constitutes nearly 50% of the National Income. Thus, the rural population's sustained growth and development is critical to the overall growth and inclusive development. Those living in rural areas deserve better living standards for sanitation, housing, piped drinking water, and electricity. Better education, health facilities, skills, jobs, and consumption are considered equally crucial by an archetypal Indian rural household. To address these issues, the efforts are being done by respective Governments in terms of development

initiatives, at individual and/ or family and/ or community level, and duly supported by e-Governance measures. The digital-first emphasis brought to the forefront by the Digital India Programme has highlighted the opportunity to catalyse and energise the rural development initiatives. There are several ICT systems which were rolled out to support the Government Schemes and programmes catering to the rural areas. ICT infrastructure was strengthened through rollout of digital connectivity and setting up of Telecentres in villages through which ICT applications would provide services. Rural e-Governance can be measured through the following dimensions:

- **(i) ICT Infrastructure** : It plays a foundational role in the rollout of e-Governance services. The success of ICT and e-governance projects lies in the availability of infrastructure by the Government for public accessibility. These can be measured through the presence of optical fibre backbone, telecom towers and 4G network availability, number of households with mobile connections or personal computers, amount of data consumed, availability of telecentres and kiosks etc.
- **(ii) Access to e-Governance Services**: Availability of the number of e-Governance services for rural areas and the ease of access of such services is an indicator to the success of the digital services. Better accessibility would lower the cost of availing such services.
- **(iii) Mobile First** : It is a practice of starting the development with respect to the mobile user or a mobile device first. It favours lightweight and low-bandwidth design that can be responsive based on-screen size and available capabilities. Rural users are more likely to have smartphone than laptops/desktops to access e-governance services.
- **(iv) E-Literacy and Awareness** : Level of education complemented by basic awareness of IT skills, awareness of the several e-Governance initiatives and services available.
- **(v) Usage Behaviour** : Pattern of usage in terms of consumption or utilization of the services, behavioural change in the rural society in seeking the e-governance services such as e-Health, online education, skills enhancement etc.



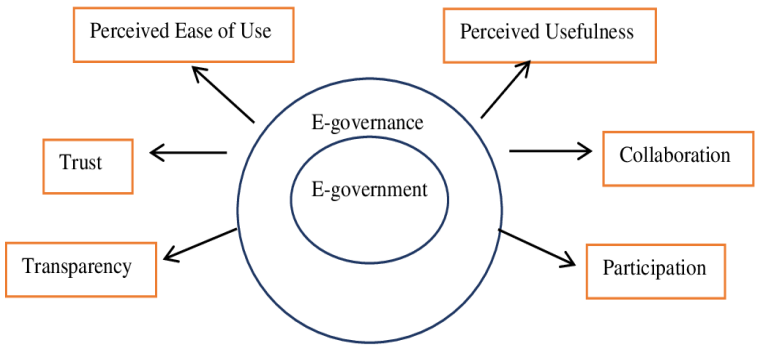
- **(vi) Localized Content** : Availability of localized content from rural areas for e-commerce, tourism, consumption of content by non-local and external players such as industries. This requires and can be facilitated by each rural unit having their own distinct & configurable website, managed by Village Secretary, such as being created in India for each Gram Panchayat (i.e. Rural Local elected Government comprising set of villages) as a part of National Panchayat Portal sponsored by Ministry of Panchayati Raj, Govt. of India

- **(vii) Employment and Productivity** : Generation of alternate source of income through employment locally or remotely, improvement in productivity through information available, innovations at the grassroot level
- **(viii) Grievance Redressal** : Ease with which grievance can be raised and resolved
- **(ix) Participatory Governance** : Feedback and regular participation in improving governance, shift in policy (devolution of fund, function & functionaries to rural local Government) and implementation by reciprocating to the actual needs of the locality. If devolution is of fair degree, the governance & services of local people is likely to be met by local Government unit and dependence on ICT is considerably reduced since geography gets shirked within a village so is gap between ruler/provider and ruled/consumer. Therefore, participatory & decentralised governance is indirectly reducing ICT intervention from certain perspective in local-to-local context.
- **(x) Inclusion** : Inclusive growth by reducing the social and economic inequalities, access to e-governance services by socially backward and marginalized communities, all genders, language, region, disability, age groups or other status. It would encompass financial, business, and regulatory inclusion. This is to ensure that e-Governance measures ensure balanced transformation of Information ecology of the rural unit with maximum gains.

3.5 ICT FOR GOOD GOVERNANCE

Several continuous measures, programs and initiatives aimed at bridging the rural-urban divide have been implemented across multiple levels, with renewed vigour in the last seven years. Beginning with the implementation of the Direct Benefit Transfer (DBT) to transfer monetary benefits directly into the accounts of beneficiaries (mostly rural residents) to opening over 40 crore bank accounts of the unbanked, mostly rural people, under the Jan Dhan Yojana and later combining their synergies under the Jan Dhan-Aadhaar-Mobile (JAM Trinity) to make sure seamless delivery of public services, rural India has been undergoing a silent revolution. Another notable initiative has been the setting up of Common Service Centres (CSCs) under the Digital India Mission, across rural India, to deliver essential public services to rural folk in one place. Currently, over 4,12,000 CSCs are operational in our rural areas. Some other factor are discussed here

- The advances in information and communication technologies and the internet provide opportunities to transform the relationship between governments and citizens and business in new ways that contribute to the attainment of good governance. They provide opportunities for people and business to involve in the process of governance at all levels. They facilitate better service delivery to clients, in terms of timelines and quality,



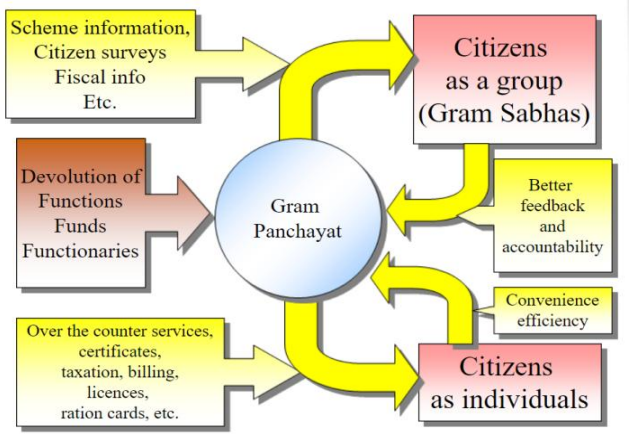
thus making governance more efficient and effective. In addition, the use of ICT may lower transaction costs both for citizens and government operations and public services can be made more affordable to the people at large.

- ICT presents many avenues for improving governance. It has opened up new opportunities for governments to manage things differently and in a more efficient manner by utilizing information effectively and re-engineering processes. ICT tools are emerging as important instruments towards the goal of “good governance". Many countries have launched specific initiatives for open government. Freedom of information is being redefined and supported by statutes. India’s Right to Information Act 2005 is a prime example in this regard. ICT has facilitated a conscious attempt to place the citizen at the centre of a governance network. Citizens are being perceived as customers and clients rather than beneficiaries. The Internet revolution has proved to be a powerful tool for citizen-centric governance. An important dimension of the Internet potential is the possibility of providing public services anytime, anywhere

- A defining characteristic of traditional public sectors has been the existence of a large physical infrastructure. This was to deliver programmes through a network of service delivery points and offices. Physical infrastructure was the most effective way to deliver public services directly to citizens. ICT now allows governments to experiment successfully with new ways of organizing themselves; cost-effective delivery of services is now possible without the service providers and clients being physically close to each other

- Large scale implementation of e-governance initiatives can lead to demystification of complicated government processes and empowerment of citizens. It can lead to enhanced government performance and generate a multiplier effect on economic progress. ICT has enabled citizens to demand information and better services from governments. With increased citizen awareness, governments today are under increasing pressure to deliver a range of services – from ration cards, motor driving licenses and land records to health, education and civic services – in a manner that is timely, efficient, economical, equitable and transparent.

- The application of ICT to government processes - e-Governance - can have a profound impact on the efficiency, responsiveness and accountability of the government, thereby, on the quality of life and productivity of citizens, especially the poor and ultimately, on the economic output and growth of the country as a whole. Electronic governance goes far beyond mere computerization of standalone back office operations. It is a means to fundamentally change how the government operates and this implies a new set of responsibilities for the machinery of the government.



ICT can act as a catalyst for organizational transformation and change in government by influencing governance in several ways as follows:

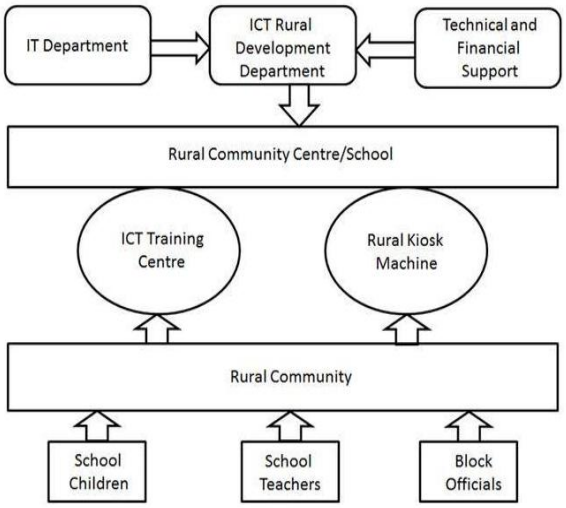
a) Managing large volumes of data and work flow connectivity between government operations, departments and agencies and significantly reducing errors;

b) Reaping scale economies and improving efficiency by automation of complicated and repetitive governance tasks and developing standard applications;

c) Reducing personal interface of citizens and business with public service providers, cutting delay, bureaucratic red tape, corruption and harassment and increasing speed of response; and

d) Enhancing transparency and accountability by making information available to citizens through websites, reducing information monopoly, simplifying processes and empowering citizens to put pressure on public officials to deliver performance

In several sectors of Panchayat Raj Institutions' management, such as accounts, agriculture development, finances, land records, procurement, and so on, ICT plays a significant role. In India, affordable ICTs are critical not just for the ability to transact electronically or to improve the delivery of government and business services to isolated rural and disadvantaged communities, but also for the core goal of empowering people through literacy, education, knowledge, employable skills, poverty reduction, and wealth creation. Various e-Government programmes and applications have been developed for the development of rural areas as a result of the expanding importance of ICT. India has done a remarkable start in terms of using ICT for improving government business. Several states in have been attempting e-governance solutions to improve information management and governance. States have set up Information Technology and Communication (IT&C) Departments to guide and coordinate the implementation of e-governance programmes and projects. These Departments also provide guidance for procurement of hardware and software by government agencies. IT&C Departments have made commendable progress in the development of e-governance applications. These projects have become role models and have been emulated by other states in the country.



- Strong domain knowledge is critical for the success and sustainability of applications; 80% of projects fail due to poor knowledge content and design in e-applications following from lack of adequate domain support from government departments & agencies at the development stage;
- Lack of ownership and coordination in the government lead to many well crafted e-solutions to languish into disuse; the institutional framework for e-governance needs to be robust and well-defined;

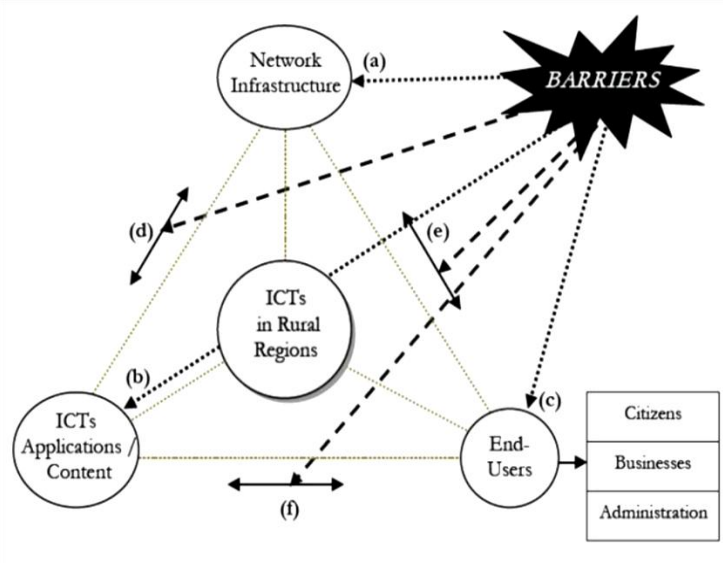
- Everything in government is linked with every other thing; developing and implementing ICT-enabled processes in narrowly defined departmental silos tend to have limited impact on improving governance and limited interest from public sector managers in the medium or long-term;
- Data standards, metadata standards and service delivery definitions are very important for inter-operability; most e-governance applications are not based on defined codes and standards as a result of which they don't lead to the network or linkage economies. A common IT infrastructure and architecture standard is key to ensuring e-development in a coherent and integrated way. Advanced planning of common IT infrastructure standards can result in shortened development time and system compatibility.
- Support infrastructure is critical for e-governance implementation; the reliability and reach of electric power, telecommunication links and broad band connectivity are critically important;
- Top-down approaches hardly sustain; involvement of all key stakeholders is crucial; localization of e-governance and ownership at the local level is a must for sustainability;
- It is very difficult on part of governments to recruit and retain quality professionals with ICT expertise in view of much better prospects in the private sector; thus public-private partnership models need to be explored in addition to providing pay and allowance to ICT professionals in government on par with the private sector;
- General ICT literacy with local language content and application are essential elements of the climate for effective e-governance and its acceptance;
- Development and implementation champions - ICT leaders are necessary in government to deal with resistance to implementation and change and forging public-private partnerships;
- Resistance to the use of ICT in the government sector is large; well-designed and consistent change management programmes can address the mindset block issues effectively;
- Involvement of the civil society including academia from development to implementation stages helps in enhancing acceptability of e-applications by employees and social groups; and
- Training, awareness building, and social mobilisation to create constituencies of ICT-propelled transformation in government and to facilitate the acceptance of new tools and methods by various sections are very important.

3.6 Reforms for E-Governance

- Using e-governance tools for good governance requires certain fundamental reforms. We need a new institutional framework – a framework of "networked" or "joined-up" government based on the foundation of simplified, reformed and connected horizontal processes and appropriate regulations. The institutional structure of government, which has so long been based on a hierarchical model, needs a thorough overhaul. Good governance requires a systems approach wherein various facets of government are linked to each other in an organic way.
- E-Governance requires a range of new rules, policies, laws and legislative changes to address e-activities including electronic signatures, electronic archiving, freedom of information, data

protection, computer crime, intellectual property rights and copyright issues. Dealing with e-governance means signing a contract or a digital agreement, which has to be protected and recognized by formalized laws. Digital laws are yet to be fully developed. Establishing protection and legal reforms will be needed to ensure, among other things, the privacy, security and legal recognition of electronic interactions and electronic signatures. Hence, the government needs to tackle the design and development of key public infrastructure – physical, administrative, legal etc. - which will guarantee secure transactions between organizations and individuals.

- A major challenge of any e-governance initiative is the lack of required ICT skills in government. This is a particular problem where the chronic lack of qualified staff, frequent turnover of contract IT personnel, and inadequate human resources training are endemic. The availability of appropriate skills is essential for successful e-governance implementations. e-Governance requires hybrid human capacities: technological, commercial and management which can be procured at market cost. Technical skills for installation, maintenance, designing and implementation of ICT infrastructure, as well as skills for using and managing online processes, functions and citizens, are necessary. Typical government salary structure should not be applied to key ICT professionals in government when the market provides far greater opportunities. To address human resource development issues, management initiatives are required focusing on staff training, seminars, workshops etc. in order to create the basic skills for handling e-governance. Public-private partnership models appear to be a partial solution.



3.7 NATIONAL E-GOVERNANCE PLAN (NEGP)

Change management issues must be addressed as new work practices, new ways of processing and performing tasks are introduced through ICT. Correctly designed e-government projects, supported by change management, not only save costs and improve service quality, they also revolutionize and reinvent government processes and functions. Employee

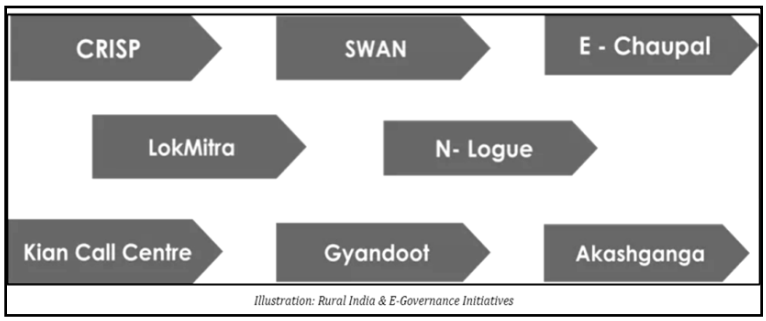
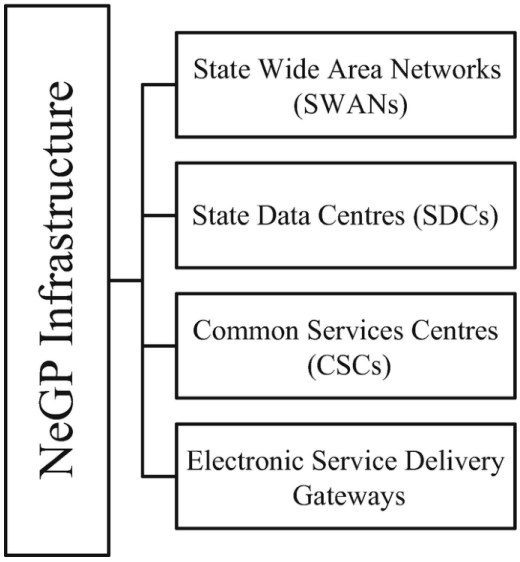


Illustration: Rural India & E-Governance Initiatives

resistance to change is still the biggest barrier to successful change. Employees fear changes in general and ICT applications, in particular as they believe that ICT would replace them and contribute to loss of jobs. Moreover, it is very difficult in a short time to turn off traditional methods of working and learn new ones. Addressing resistance successfully means ensuring the existence of incentives for employees to learn and change and the establishment of well-structured plans that embrace employee participation throughout all stages of a change process.

The recently formulated National e-Governance Action Plan of India attempts to address many of the key issues of e-Governance in India with a view to harnessing the power of ICT to improve governance for the common citizen. The National e-Governance Action Plan demands wide-ranging reforms in governance processes. Simple automation of processes does more harm than benefit. The syndrome of "garbage in – garbage out" will operate if complicated processes are automated without simplification and establishing their usefulness for the people. Thus, process reforms hold the key to successful e-Governance. The National e-Governance Plan (NeGP), takes a holistic view of e-Governance initiatives across the country, integrating them into a collective vision, a shared cause. Around this idea, a massive countrywide infrastructure reaching down to the remotest of villages is evolving, and large-scale digitization of records is taking place to enable easy, reliable access over the internet. The ultimate objective is to bring public services closer home to citizens, as articulated in the Vision Statement of NeGP. Harnessing the power of ICT for e-governance has the power of transforming government and making knowledge-based good governance a reality. While the challenges faced by governments are colossal, the new technologies provide tremendous opportunities for enhancing the power of governments to handle data, take better informed decisions, and provide transparent, cost-effective and accountable solutions and services to citizens and business.



Good governance requires process reforms and input-output-outcome-impact tracking. Automation of reformed processes and tracking systems can assist in the delivery of good governance to citizens in developing countries. As good governance is the single-most important factor for socio-economic development and poverty reduction, e-Governance can make a distinct impact on the development scenario, especially for the poor and weaker sections of society, including women. There is an urgent need to address the issues of using new technology for transformation of governance and leapfrogging development.

❖ AADHAAR-DIGITAL BIOMETRIC IDENTITY INFRASTRUCTURE

The Aadhaar System is built on a sound strategy and a strong technology backbone and has evolved into a vital digital identity infrastructure. Aadhaar, being a unique digital ID – provides a powerful

platform for authenticating a resident anytime and anywhere which is in line with the vision of the UIDAI. The purpose of Authentication is to enable residents to prove their identity and for service providers to confirm that the residents are 'who they say they are' in order to supply services and give access to benefits.

❖ DIGITAL LOCKER

DigiLocker is a key initiative under Digital India, the Indian Government's flagship program aimed at transforming India into a digitally empowered society and knowledge economy. DigiLocker ties into Digital India's vision areas of providing citizens a secure document access platform on a public cloud. Targeted at the idea of paperless governance, DigiLocker is a platform for issuance and verification of documents & certificates in a digital way, thus eliminating the use of physical documents.

DigiLocker has helped in bringing paradigm shift towards paperless governance i.e. it helped citizens and departments to shift from paper based processes to paperless process thereby helping to contribute to Hon'ble Prime Minister's vision of Digital India. These digital documents are legally valid documents under the Indian Information Technology Act 2000. Furthermore, under Rule 9 A of "The Information Technology (Preservation and Retention of Information by Intermediaries Providing Digital Locker Facilities) Rules, 2016" issued documents available via Digital Locker are to be treated at par with original physical documents.

❖ OPEN DATA - BRIEF OF NATIONAL DATA SHARING & ACCESSIBILITY POLICY (NDSAP)

The Union Government through Ministry of Science and Technology has formulated the National Data Sharing and Accessibility Policy (NDSAP), while Ministry of Electronics & Information Technology (MeitY) is the nodal Ministry to implement the policy. The Department of Science and Technology under Ministry of Science and Technology has formulated the NDSAP through close collaboration with other line Ministries and MeitY by creating "data.gov.in" through National Informatics Centre (NIC). The NDSAP had identified MeitY as the nodal Ministry for the implementation of the policy through NIC, while Department of Science and Technology continues to be the nodal department on policy matters. The policy was notified by the Department of Science and Technology

❖ GOVERNMENT PROCUREMENT - GOVERNMENT E-MARKETPLACE (GeM)

Government created one stop Government e-Marketplace (GeM) to facilitate on line procurement of common use Goods & Services required by various Government Departments / Organizations / PSUs. GeM will enhance transparency, efficiency and speed in public procurement. It will also provide the tools of e-bidding and reverse e-auction as well as demand aggregation to facilitate the government users to achieve the best value for the money.

❖ MOBILE GOVERNANCE - MOBILE E-GOVERNANCE SERVICE DELIVERY GATEWAY

The MSDG delivers Government services over mobile devices using mobile applications installed on the user's mobile handsets. MSDG provides different set of mobile based services to the backend departments and citizen. As MSDG is developed based on IIP/IIS (Interoperability Interface Protocol / Interoperability Interface Specifications) standards of government of India, it provides seamless integration with backend department through existing NSDG/SSDG e-Gov exchange infrastructure. Backend departments will be connected to MSDG for mobile based services.

❖ STATE DATA CENTRE

State Data Centre (SDC) has been identified as one of the important element of the core infrastructure for supporting e-Governance initiatives of National e-Governance Plan (NeGP). Under NeGP, it is proposed to create State Data Centres for the States to consolidate services, applications and infrastructure to provide efficient electronic delivery of G2G, G2C and G2B services. These services can be rendered by the States through common delivery platform seamlessly supported by core Connectivity Infrastructure such as State Wide Area Network (SWAN) and Common Service Centre (CSC) connectivity extended up to village level. State Data Centre would provide many functionalities and some of the key functionalities are Central Repository of the State, Secure Data Storage, Online Delivery of Services, Citizen Information/Services Portal, State Intranet Portal, Disaster Recovery, Remote Management and Service Integration etc. SDCs would also provide better operation & management control and minimize overall cost of Data Management, IT Resource Management, Deployment and other costs.

❖ MYGOV 2.0 : A PLATFORM FOR CITIZEN ENGAGEMENT IN GOVERNANCE

The citizen-centric platform empowers people to connect with the Government & contribute towards good governance. My-Gov as a Government of India's Citizen Engagement Platform collaborates along multiple Government bodies/ Ministries to engage with the citizens for policy formulation and seeking the opinion of people on issues/ topics of public interest and welfare.

❖ JEEVAN PRAMAAN

Jeevan Pramaan is a biometric enabled digital service for pensioners. Pensioners of Central Government, State Government or any other Government organization can take benefit of this facility. Jeevan Pramaan uses the Aadhaar platform for biometric authentication of the pensioner.

❖ OPEN FORGE PROJECT

Open Forge is Government of India's platform for open collaborative development of e-governance applications. Through this platform, the government wants to promote the use of open-source software and promote sharing and reuse of e-governance related source code. In 2015, the Department of Electronics & IT, Government of India rolled out the "Policy on Collaborative Application Development by Opening the Source Code of Government Applications", which provides a framework for archiving government custom developed source code in repositories and opening these repositories for promoting reuse, sharing, and remixing. By opening the source code, the Government wants to encourage collaborative development between Government departments / agencies and private organizations, citizens, and developers to spur the creation of innovative e-governance applications and services.

While providing numerous opportunities for better governance, globalization and ICT have also brought in many new challenges for governments. These pertain to creating networks and an environment for absorption and growth of information technology, bridging the digital divide, management of laws and regulations, knowledge management, and capacity building for information management. While new technologies have the potential of improving governance, they are by no

means sufficient for good governance. Governments need to understand, manage and lead change effectively. There is a need for building capability of the state and its apparatus to adapt to the new realities and exploit the opportunities for development and poverty reduction presented by globalization.

Through e-governance, government services are made available to citizens in a convenient, efficient, and transparent manner. The three main target groups that can be distinguished in governance concepts are government, citizens, and businesses/interest groups. The use of ICT in public administration combined with organisation changes and new skills in order to improve public services and democratic processes and strengthen support to public policies. The use by the government of Web-based Internet applications and other ICTs, combined with processes that implement these technologies to Enhance the access to and delivery of government information and services to the public, other agencies, and to government entities; or Bring about improvements in government operations that may include effectiveness, efficiencies, service quality, or transformation.

3.8 CONCLUSION

The e-Governance or electronic governance means utilization of ICT (Information and Communications Technology) to carry out the functions and achieve the results of the governance. Governance has become very complex and the increasing expectations from the Government are the reasons for opting for e-governance. Under the banner of e-governance, the use of ICTs helps the rural people to perform their public affairs, efficiently utilize public resources so that they can ensure the rights of the citizens of the nation. It is the use of Information and Communication Technology (ICT) by the government to provide and facilitate government services to its citizens 24 hours a day, seven days a week. The four main stages of e-governance are presence, interaction, transaction and transformation. It involves digitizing and automating various government activities, such as service delivery, communication, decision-making, and citizen engagement. E-Governance aims to improve the efficiency, transparency, accessibility, and accountability of government services and interactions with citizens

Bringing the people in the rural region in the mainstream of the digital technologies to access and adopt modern technologies is a major concern now. Rural Development implies both, the economic development of the people and greater social transformation using electronic governance (e-governance). The goal of e-governance is to ensure that people participate in the political process through electronic channels like email, websites, SMS connectivity, and others while facilitating and improving the quality of governance. The main disadvantage of e-governance is the loss of interpersonal communication. Interpersonal communication is an aspect of communication that many people consider vital. Technology has its disadvantages as well. Specifically, the setup cost is very high and the machines have to be regularly maintained. The major cause of failure of e-governance may be weak technology or digital infrastructure with unreliable internet connectivity, digital divide, financial/economic constraints, cultural-socio-behavioral constraints, unreliable political climate, handicapping policies or legal frameworks, donor-reliant programmes, lack of unified standards for public connectivity etc

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CHAPTER-04

RENEWABLE ENERGY RESOURCES : AFUTURE ASPECT OF ENERGY

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4.1 INTRODUCTION

Energy is the fundamental need of any society.The economic development is directly linked with the energy resources the demand for energy has increased with the economic development of the world it is a power which is needed in one form or the other to do work. In the older days, man used his muscular power. Later on, domesticated cattle power was used for doing the work. In 1750 Machine power was used in the development sequence of human civilization, for the improvement of traditional skills and for the development and improvement of new techniques. On account of industrialization, urbanization, agricultural technology transmission and transport, the demand of energy has increased tremendously. Increase in population is also the main cause of increase in energy demand. On one side the demand of energy has increased, while on the other side the energy sources are depleting fast. It is essential there to reduce dependence on such energy sources and the need of the hour is to explore and exploit.

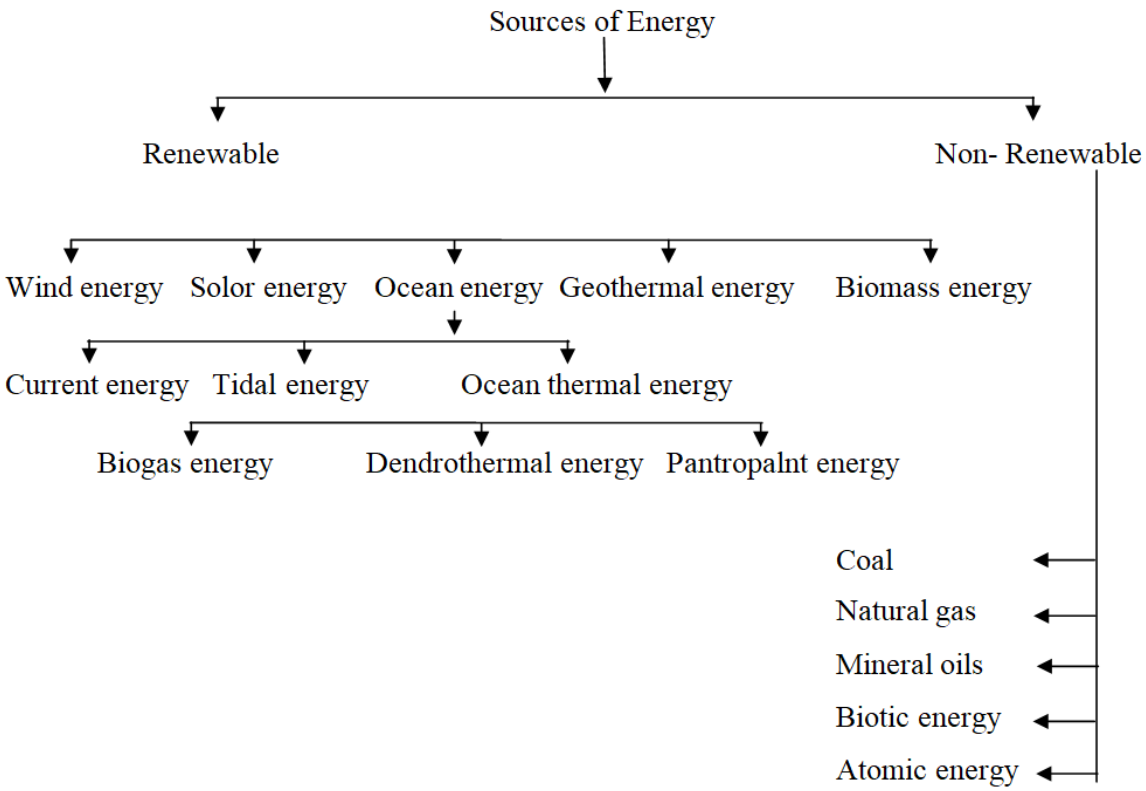
The renewable or alternative sources of energy which can save us from the energy crisis and the major source of energy in future include wind energy, solar energy, tidal energy, geothermal energy and Biomass energy. Over 80%of India's energy needs are met by three fuels: coal, oil and solid biomass. Coal has underpinned the expansion of electricity generation and industry, and remains the largest single fuel in the energy mix. Energy is primarily tanned from oil and four of these energy sources are free from causingsame impacts on environment enable development in search impacts and taking recreationally steps to minimize them in order to safeguard the environment.

It is also evident that environmental sources of energy getting depleted rapidly. At present energy is an important input for development. Energy is needed by all the living organisms and vegetation for biochemical reaction of their cells. It aims at human welfare covering household agriculture transport and Industrial complex like other natural resources. Non-renewable energy resources are available in Limited amounts and develop over a longer period as a result of unlimited use they is likely to be exhausted these include coal, Mineral oil, nuclear power, Petroleum and natural gas. In other words, we can say that

1) Any heat or material/substance which is used in any activities can be called as energy resources.
2) Such resources from which capacity to do work is obtained are called as energy resources.

4.1.1 TYPES OF SOURCES OF ENERGY

There are two major renewable energy sources -



❖ Renewable /Non-conventional/Exhaustible Energy Resources

Renewable energy is energy from sources that are naturally replenishing but flow-limited; renewable resources are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time. It is sustainable - something that can't run out, or is endless, like the sun. When you hear the term 'alternative energy' it's usually referring to renewable energy sources too. It means sources of energy that are alternative to the most commonly used non-sustainable sources. Renewable energy sources are energy sources that are collected from renewable resources that are naturally replenished on a human time scale, they can never be depleted. Some examples of renewable energy sources are solar energy, wind energy, hydropower, rain, tide waves, geothermal energy, and biomass. Although most renewable energy, comes from natural sources or process that are constantly replenished.

Every day we rely on energy to provide us with electricity, hot water, and fuel for our cars. Most of this energy comes from fossil fuels, such as coal, oil, and natural gas. These are non-renewable energy sources, which mean that if we use them all up, we can never get more during our lifetime. Fossil fuels also contribute greatly to global climate change by releasing carbon dioxide into the air when they are burned. Because fossil fuels can run out and are bad for the environment, it is important that we start switching to other energy sources, like renewable energy source. These energy sources are constantly being replenished, such as sunlight, wind, and water. This means that we can use them as much as we want, and we do not have to worry about them running out.

Additionally, renewable energy sources are usually much more environmentally friendly than fossil fuels. Overall, they release very few chemicals, like carbon dioxide, that can harm the environment.

Currently, less than 10% of all the energy we use comes from renewable sources. So, you might be wondering, 'if renewable energy sources do not harm the environment and will not run out, then why are we not using them everywhere and all the time?' It is because many of them are currently expensive to harness, are inefficient, or have other disadvantages. For example, using energy from the wind might be great in an area that is really windy all year-round, but it wouldn't work so well in an area with very little wind.

❖ Advantages of Renewable Energy

- Generating energy that produces no greenhouse gas emissions from fossil fuels and reduces some types of air pollution. It has numerous environmental benefits.
- Diversifying energy supply and reducing dependence on imported fuels.
- Creating economic development and jobs in manufacturing, installation, and more.
- Renewable energy won't run out.
- Renewable energy has lower maintenance requirement.
- Renewable energy save money.
- Renewable energy lower reliance on foreign energy sources
- Renewable energy leads to cleaner water and air.
- Renewable energy can cut down on waste.

❖ Disadvantages of Renewable Energy

- Renewable energy has high upfront costs.
- Renewable energy is intermittent.
- Renewable energyhas storage capabilities.
- Renewable energy sources have geographic limitations
- Renewable energyisn't always 100% carbon-free.

4.2 TYPES OF RENEWABLE ENERGY REOURCES

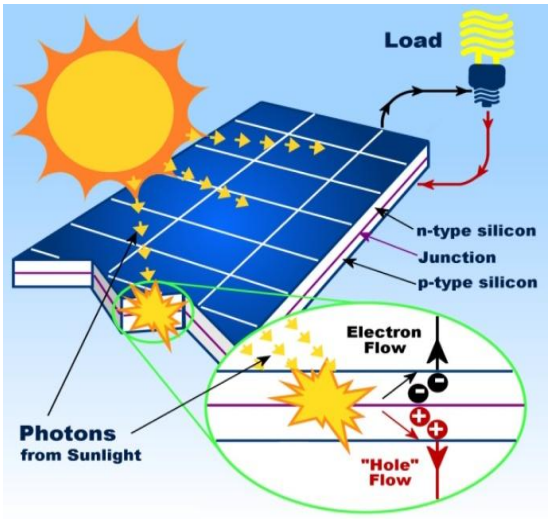
Energy generated by using wind, tides, solar, geothermal heat and Biomass including farm and animal waste as well as human excreta is known as non-conventional energy.All these sources are renewable or inexhaustible and do not cause environmental pollution.Moreover, they do not require heavy expenditure.

The most popular renewable energy sources currently are:

- Solar energy.
- Wind energy.
- Tidal energy.
- Geothermal energy
- Biomass

4.2.1 SOLAR ENERGY

Sun is the source of all energy on the Earth. It is most abundant inexhaustible and universal source of energy. All other sources of energy draw their strength from the sun.India is blessed with plenty of solar energy because most part of the country receive bright sunshine throughout the year accept a brief monsoon period. Most of the energy received from the sun is in the form of short-wave radiations of light. When this radiation strikes a solid or liquid, it gets absorbed and transformed into heat energy. Electric energy or electricity can be produced directly from solar energy by means of photovoltaic cells. The photovoltaic cell is an energy conversion device which is used to convert photons of Sunlight directly into electricity. The Solar thermal route uses radiation in the form of heat that in turn may be converted to mechanical, Electrical or chemical energy. Solar thermal devices like solar cookers, solar water/air heaters, solar dryers, solar wood seasoning kilns and silicon systems have been developed. a solar cooker consisting of an aluminumreflector (10 square feet in area) has been tried and introduced by DNES in extremely cold and remote areas of Laddakh. IITs have been successful in developing the technology to trap solar and wind energy on the Icy continent of Antarctica and remote area of Leh and Laddakh.



Source : www.mrsolar.com/what-is-a-solar-panel

❖ **Application :** There are many applications of solar energy namely solar water heating, solar distillation and Solar pumping, solar furnaces, solar electric power generation, solar greenhouse, solar cooking.

❖ **Advantages of Solar Energy**

Some very popular advantages of the solar energy is given here

- Solar equipmentdoes not create pollution.
- Most solar equipment does not require any serious attention for their working. for example, the food will be cooked simply by putting a solar cooker in sunlight. The taste of the cooked food remains quite natural and its nutritional value is also not affected.
- In most solar equipment the maintenance cost is negligible.
- No need of containers to store the fuel
- Occupies less space on floor as there is no need of storage vessels
- Noiseless operation

Limitations of Solar Energy : The limitations of solar energy is given here

a) Solar equipmentfails to work in nights or during cloudy days.

b) Solar equipmentis costly.

c) All sorts of food cannot be cooked in solar cooker.

d) Solar cooking takes more time so it is therefore not suitable for quick needs.

e) Computers powered by solar panels- Devices designed to charge laptops and mobiles through solar energy. Through these computers and mobile can be charged anywhere where sunlight is available.

f) Heat of water

g) Using technology based on solar energy which can be used to heat mobile for commercial and industrial use.

h) Through solar energy, vehicles are now being manufactured by means of solar energy by NASA HELIOS by a multinational company War machine Odysseus A solar car Quant And airplane Impulse have been manufactured, solar appliances, solar lanterns, lights and music players, etc. Various types of household appliances are being used, the use of long distances has increased and solar panels were used by India Mass orbiter mission (MOM) in the mission.

i) Solar power is being built to meet the increasing demand for energy The world's largest solar plant has been built in Tamil Nadu. Its capacity is 648 megabytes.

4.3 SOLAR POWER IN INDIA

India's dense population and high solar energy make solar energy an ideal energy source for India, but solar energy is constantly expensive and this but it requires huge investment and its form is stable, due to this it has to be organized. Lack of public awareness High cost of production and limitations of existing energy release and transmission network have been considered as the main impediments towards full exploitation of solar energy potential across the country 250 to 300 Indus in 1 year in most part of India and the solar radiation of 4 to 7 kWh is received per square meter per day. Despite having 30 to 50 MW per square kilometer area in the country, the exploitation of solar energy in the country is less as compared to the available capacity.

National Institute of Solar Energy has assessed the Country's solar potential of about 748 GW assuming 3% of the waste land area to be covered by Solar PV modules. Solar energy has taken a central place in India's National Action Plan on Climate Change with National Solar Mission as one of the key Missions. National Solar Mission (NSM) was launched on 11th January, 2010. NSM is a major initiative of the Government of India with active participation from States to promote ecological sustainable growth while addressing India's energy security challenges. It will also constitute a major contribution by India to the global effort to meet the challenges of climate change. The Mission's objective is to establish India as a global leader in solar energy by creating the policy conditions for solar technology diffusion across the country as quickly as possible. The Mission targets installing 100 GW grid-connected solar power plants by the year 2022. This is line with India's Intended Nationally Determined Contributions(INDCs) target to achieve about 40 percent cumulative electric power installed capacity from non-fossil fuel based energy resources and to reduce the emission intensity of its GDP by 33 to 35 percent from 2005 level by 2030.In order to achieve the above targeIn order to achieve the above target, Government of India have launched various schemes to encourage

generation of solar power in the country like Solar Park Scheme, VGF Schemes, CPSU Scheme, Defence Scheme, Canal bank & Canal top Scheme, Bundling Scheme, Grid Connected Solar Rooftop Scheme etc.

Various policy measures undertaken included declaration of trajectory for Renewable Purchase Obligation (RPO) including Solar, Waiver of Inter State Transmission System (ISTS) charges and losses for inter-state sale of solar and wind power for projects to be commissioned up to March 2022, Must run status, Guidelines for procurement of solar power though tariff based competitive bidding process, Standards for deployment of Solar Photovoltaic systems and devices, Provision of roof top solar and Guidelines for development of smart cities, Amendments in building bye-laws for mandatory provision of roof top solar for new construction or higher Floor Area Ratio, Infrastructure status for solar projects, Raising tax free solar Floor Area Ratio, Infrastructure status for solar projects, Raising tax free solar bonds, Providing long tenor loans from multi-lateral agencies, etc.

4.3.1 WIND ENERGY

Wind power is the conversion of wind energy into a useful form of energy, such as using wind turbines to make electrical power, windmills for mechanical power, wind pumps for water pumping or drainage or sails to propel ships. Wind energy is a renewable source of non-polluting energy. Turbines Wind energy may be converted into mechanical and electrical energy. Ed, it has tremendous potential and it can easily satisfy the energy demands of our country.

Large wind farms consist of hundreds of individual wind turbines which are connected to the electric power transmission network. Offshore wind is steadier and stronger than on landand offshore farms have less visual impact but construction and maintenance costs are considerably higher. Small onshore wind farms provide electricity to isolated locations. Utility companies buy surplus electricity produced by small domestic wind turbines. When the energy has been utilized for pumping water in rural areas and may also be useful in remote areas. About 20,000 MW electricity can be generated in India from wind.

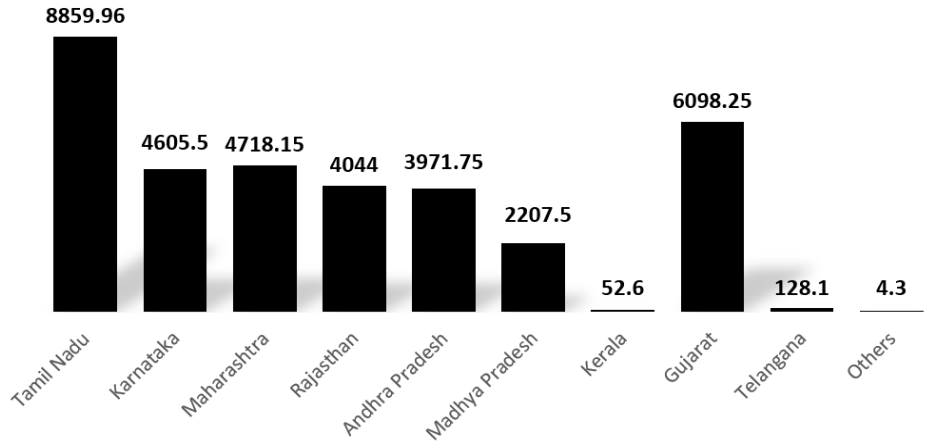


Figure 9.2 : Wind power installed capacity, Source: https://www.indianwindpower.com/wind-energy-in-india.php

According to DNES, the windfarms with a total capacity of 3.3 MW have already been setup in Mandvi, 1.1 Mw in Kutch; 550 KW in Okha (Gujarat), 550 KW in Deogarh (Maharashtra), 550 KW in Tuticorin (Tamilnadu) and 550 KW in Puri (Orissa). The type of the wind mills developed are 12 PU-500 sail type, Vertical Axis type etc. Areas with constantly high wind speed preferably about 20 km/hour well suited for harnessing wind energy.

Advantages of Wind Energy : The advantages of wind energy are described here

a) Abundance availability for no price.
b) Nonpolluting and eco-friendly.
c) Useful at remote places also for electricity generation.
d) Cheaper installation cost and almost negligible recurring expenditure.

Limitations of Wind Energy : The limitations of wind energy are given below

a) Unreliable, intermittent and erratic as the wind energy may not be available regularly and uniformly. Their use for a continuous supply Power Station is not feasible.
b) Less favorable in city locations, as the wind is available at higher location.
c) Due to fluctuating nature of wind blowing, the produced mechanical energy has to be stored in by some means example battery storage.

4.3.2 TIDAL ENERGY

Tidal energy is a renewable energy powered by the natural rise and fall of ocean tides and currents. Some of these technologies include turbines and paddles. just like the Wind Mills, Tidal Energy was used for the mechanical crushing of grains in grain mills. To crush grains. Here, the movement of the turbines powered by tidal energy was used. Tidal Energy is also used to store energy in hydroelectric dams, which act as large energy storage.Tidal energy is produced by the surge of ocean waters during the rise and fall of tides. Tidal energy is a renewable source of energy. During an incoming high tide, water flows over the turbines as the water rises. Then, the water flows back through the turbines as it becomes low tide. The turbines are connected to a generator which produces the electricity.

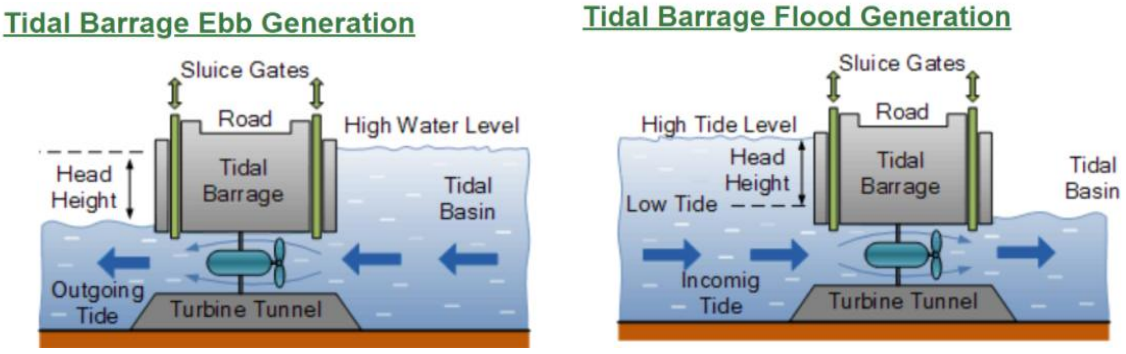


Figure 9.3, Source :https://www.mdpi.com/1996-1073/14/19/6123/htm

In other words, we can say that Tidal energy is a form of hydropower that converts the energy of tides in to useful forms of power. Tidal power has potential for future electricity generation. Tides are more predictable than wind energy and solar power. Among sources of renewable energy, tidal

power has traditionally suffered from relatively high cost and limited availability of sites withsufficientlyhigh tidal ranges or flow velocities, thus constricting its total availability of tidal power may be much higher than previously assumed, and that economic and environmental costs may be brought downto competitive levels.

Advantages of Tidal Power : The advantages of tidal energy are described here

- Cleanliness : Tidal energy is green. It does not pollute the atmosphere with greenhouse gases.
- Wave turbines are relatively quiet to operate and to not affect wildlife.
- Consistency
- Permanence
- Long-term Economy
- Energy Efficiency
- Intermittence
- Startup costs
- Biofouling

Disadvantages of Tidal Energy : The limitations of tidal energy are described here

- Initial construction cost is very high.
- Formation of silt behind the barrage.
- Effect on animals and plants living near tidal stations.
- Very few suitable sites for constructing barrages.
- Disturbs migration of living creatures in the ocean.

4.3.3 GEOTHERMAL ENERGY

The word Geothermal comes from the Greek words geo (earth) and thermal (heat). Geothermal energy is heat within the earth. Geothermal energy is a renewable energy source because heat is continuously produced inside the earth. People use geothermal heat for bathing, to heat buildings, and to generate electricity.We utilize the heat in the interior of the earth. Geothermal energy is thermal energy generated and stored in interior of the Earth.Thermal energy is the energy that determines the temperature of matter. Thegeothermal energy of the Earth's crust originates from the original formationof the planet 20% and from radioactive decay of minerals 80%.

There is an increase in temperature of the earth with increasing depth below the surface. All the heat stored in the earth's crust as thermal energy constitutes an inexhaustible source of energy termed as geothermal energy. Hot molten magma is present (25-40 km depth) in the Core of the earth. This molten magma is sometimes pushed up towards the surface resulting in volcanic action .when the ground water finds its way into such a rock having molten lava then it gets heated up and comes to the surface of the earth as a steam in the hot water (200 -300 *C) .This hot geothermal water or steam is used to operate turbines to generate electricity .Geothermal energy sources are also being exploited for non-power sectors like space heating, poultry farming, mushroom cultivation and chemical industries.Hot water from geothermal energy resources(well) at Laddakh is used to heat the

soil and environment of a Greenhouse supporting the growth of more than 40 varieties of plants even at the peak of winter.

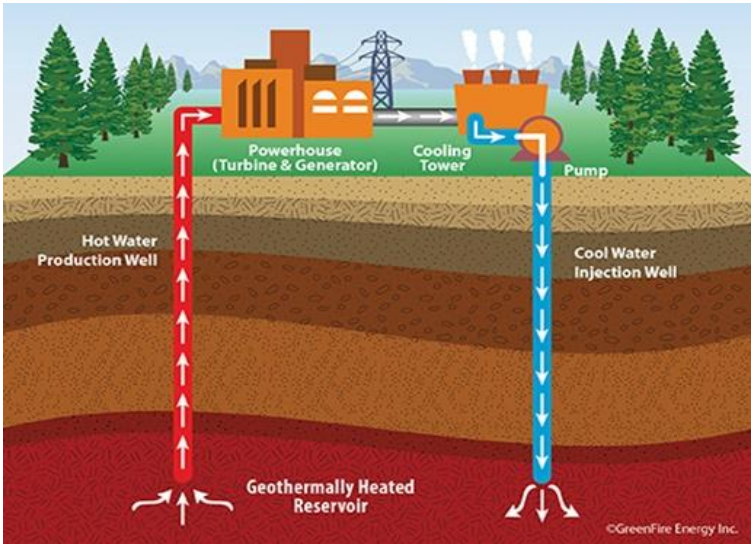


Figure 9.4 : Convolution Geothermal, Source : https://www.greenfireenergy.com/how-does-geothermal-energy-work/

❖ **Advantages of Geothermal Energy :** The advantages of thermal energy are described here-

a) It offers an inexhaustible and versatile source of energy
b) It causes negligible pollution
c) It is less expensive, since it is naturally available

❖ **Limitations of Thermal Energy :** The limitations of thermal energy are described here -

a) Generally, they are located at far- off distance from the place where use of energy is required.
b) Noise pollution results from drilling operation
c) Air Pollution results due to release of Co2, H2O, NH3
d) The overall efficiency for power production is quite low (15%) only

4.3.4 BIO-GAS

Biogas is produced by the anaerobic decomposition or fermentation of organic and biodegradable materials such as manure, sewage, Municipal waste, green waste, plant material and crops. Biogas comprises primarily Methane CH_4 and carbon dioxide CO_2 and may have small amounts of hydrogen sulphide (H_2S) moisture and siloxanes. It is a renewable energy sources like solar and wind energy. furthermore, biogas can be produced from regionally available raw materials and recycled waste and is environmentally friendly. Biogas is practically produced as landfill gas and LFG or digested gas.A biogas plant is an anaerobic digester that treats farm wastes or energy crops. These plants can be fad with energy crops such as maize or biodegradable wastes including sewage sludge and food waste. During the process and air tight tank transformsbiomass waste into Methane and producing renewable energy that can be used for heating electricity and many other operations.

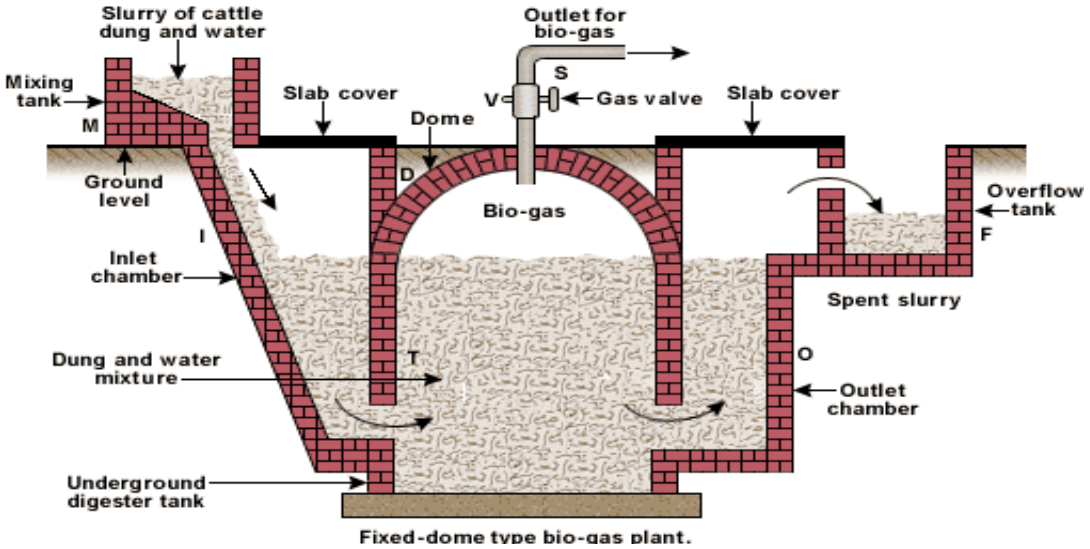


Figure 9.5 : Biogas Uint, Source : https://www.researchgate.net/figure/Fixed-Dome-Type-Biogas-Plant_fig2_275645496

❖ **Advantages of Biogas :** The advantages of biogas energy are described here

a) It is clean, non-polluting and cheap

b) Supply of gas is direct from the plant hence no storage problem

c) The sludge leftover is a rich fertilizer containing bacterial Biomass with most of the nutrients preserved as such

d) Air tight digestion/ degradation of the animal wastes is safe as it eliminates health hazards which normally pure in case of direct use of dung due to direct exposure to faucal pathogens and parasites

e) Heating biogas has 5000 to 5500 kcal/kg calorific value. It can be used for operating small engines for pumping water for lighting

In rural areas biogas can be used for providing power to agriculture pumps and to run machines like threshers, straw choppers etc.

❖ **Limitations of Biogas :** The limitations of biogas energy are described here

a) The process of digestion reduces the total solids content in the sludge and thus there is a volume loss of the organic waste compared to composting, however both can produce a fertilizer.

b) Biogas contains contaminant gases which can be corrosive to gas engines and boilers.

c) Digestate must meet high standards in order to be used on land without detrimental affects on agricultural uses especially food crops.

d) Produces a limited quantity of energy and is dependent upon location, its proximity to feedstock and energy users.

There is little or no control on the rate of gas production, although the gas can, to some extent be stored and used as required.

❖ **Comparison of Renewable Energy Sources :** The comperative table is given below -

Comparison of Renewable energy sources					
Wind Energy		**Solar Energy**		**Tidal Energy**	
Advantages	**Disadvantages**	**Advantages**	**Disadvantages**	**Advantages**	**Disadvantages**
Pollution free	Noise free	Unbeatable	Expensive	Pollution free	Destruction of wildlife habitat
Once installed, low power generation cost	Expensive windmills to be installed	Pollution free	Energy wastage due to diffusion of the source	Indestructible	Difficult to harness
Safe and clean	Interference in the broadcast signals of radio and television				Affects coastal biodiversity
Less maintenance required	Harmful for the birds				

Bio Gas		**Geothermal energy**		**Hydropower**	
Advantages	**Disadvantages**	**Advantages**	**Disadvantages**	**Advantages**	**Disadvantages**
Low cost	Cause of greenhouse effect	Clean, eco-friendly and available at all times	Expensive to carry electricity due to its location far away from the city	Pollution free	Displacement of the local community
Easy to use				Promotes irrigation and fishing	Flooding of the lower surface
Use of bio-waste and production of bio-gas				Affordable	Expensive to install
					Loss of Bio-diversity

❖ **Non-Renewable / Conventional / Non Exhaustible Energy Resources Conventional Energy resources :** Conventional and non-conventional sources the expansion of energy sources has been directly related with the pace of Industrial and agricultural development in almost every part of the world with expansion of industry and Agriculture sector the available energy sources within to fall in their supply besides there were associated environmental problems with the use of traditional sources conventional energy sources as most of the fuel wood as consumed for domestic purpose is mainly in rural areas very little of it was available to industrial sector pool already in use in industries became a highly prized so it was then supplemented by Mineral oil life while the use of hydroelectricity water energy became bear in the areas where running water and heated technology was really available World War one and yet another source of energy nuclear power was developed all resources of energy are known as conventional sources of energy among which pole is still active file that Central position. These natural resources are not reproducible and are obtained from the finite nonliving resources these natural resources cannot be regenerated once they are exhausted or consumed completely their formation required millions of years which cannotoccur with human time Scale.

Advantages of Non-Renewable Energy : The advantages of NRE are described here

a) Non-renewable energies are abundant and affordable. For example, oil and diesel are still good choices for powering vehicles.

b) According to the U.S. Energy Information Administration, non-renewable energy sources cannot be replenished in a short period. They include fossil fuels such as oil, natural gas, coal, and uranium used for nuclear energy.

c) Non-renewable energy is cost effective and easier to product and use. According to National Geographic, there are reservoirs of non-renewable energy sources throughout the world.

❖ **Disadvantagesof Non-Renewable Energy :** The disadvantages of NRE are given here

a) Once sources of non-renewable energies are gone, they can't be replaced or revitalized

b) The mining of non-renewable energy and the by-products they leave behind causes damage to the environment. There is little doubt that fossil fuels contribute to global warming. When fossil fuels are burned, nitrous oxides cause photochemicalpollution, Sulphur dioxide creates acid rain, and greenhouse gases are emitted.

c) It is the challenge of breaking humans of their habit of leaning on it. The Union of Concerned Scientists reports it's an uphill battle to sway consumers that the so-called "public goods" of renewable energy, such as reducing pollution for everyone.

d) As reducing pollution for everyone, may not be enough to convince them to pay more for cleaner energy.

e) As countries disagree through wars and differences, the prices of non-renewable energies such as oil has become a commodity where price fluctuation is always eminent. The burning of fossil fuels continues to rise producing high levels of carbon dioxide.

4.3.5 Coal as a Source of Energy : Coal is a combustible black or brownish-black sedimentary rock usually occurring in rocks start in layers or veins called coal beds or coal seams. The harder forms such as school anthracite coal, can be regarded as Metamorphic rock because of later exposure to elevated temperature and pressure.Coal is highly carbonaceous matter. It is composed primarily of carbon along with variable quantities of other elements, chiefly hydrogen, Sulphur, oxygen and Nitrogen. Coal besides a prime source of industrial energy is also a raw material. Coal including lignite even today accounts for 60% of the country's commercial power requirements. In develop the world there is a trend of shift from coal to oil or gas.

❖ **Advantages of Coal Energy :** The advantages of coal energy are described here

a) Coal reserves are very large
b) Mining and transportation are easy
c) Combustion rate is controllable
d) Even low-grade coal can be used satisfactorily

❖ **Limitations of Coal Energy :** The disadvantages of coal energy are described here

a) It causes air pollution by emitting CO, CO_2, SO_2
b) Extraction of coal affects human health.
c) Ash is produced on burning which causes environmental pollution.

4.3.6 PETROLEUM FUEL ENERGY

Petroleum is a natural underground fossil energy resource. It is formed due to decomposition of micro plankton deposited the beds of sea, Lakes and rivers over a span of millions of years. The decomposition takes place by the action of bacteria under lack of oxygen and also by catalytic cracking. Petroleum is extracted by digging and oil well under the ground. The crude oil fractional distillation gives many products like (1) gasoline (petrol) 2) Naphtha 3) Heavy oil (for diesel engine) 4) kerosene 5) Jetoil (for aviation transport) 6) fueloil (for Ship transport)

❖ **Advantages of Petroleum :** The advantages of petrolium energy are given here

- Liquid fuels are clean
- Liquid fuels can be transported easily.
- There combustion rate is high

❖ **Limitations of Petroleum :** The limitations of petrolium energy are described here

- Liquid fuels are volatile and ever for a rapidly.
- They are burning produce CO_2 and add greenhouse warming.
- Petroleum also contributes to acid rain and urban air pollution.
- Extraction of Petroleum produces contamination from spills.

4.3.7 NATURAL GAS

Natural gas is the third major source of fossil fuel after coal and petroleum it contributes about 24% of the world energy requirement it is fast emerging as an alternate fuel to oil(diesel) Natural gas can be used both as energy source and also and industrial raw material in petrochemical industries. It takes less time to build a gas-based power plant. The gas is also used for fertilizer plants through Pipe lines. The case from Bombay and Gujarat Gas field is Now taken to M.P., Rajasthan and U.P. Hazira, vijaipur, JagdishpurHBJ gas pipeline is 1730 km. long and carries an 18 million cubic meters of gas every day. It feeds six fertilizers and three power plants. There are already 12refineries in India. The liquefied petroleum gas (LPG) also called the cooking gas is now very common domestic fuel. Natural gas can be used in two forms;

❖ **LPG (liquefied Petroleum gas)**
❖ **CNG (compressed natural gas)**

Natural gas is a naturally occurring hydrocarbon gas mixture of methane CH_4 propane C_3H_8 and Butane C_4H_{10}. It includes even a lesser percentage of carbon dioxide nitrogen and hydrogen sulphide. Natural gas is an energy source often used for heating, cooking and electricity generation. It is also used as fuel for vehicles and as chemical feedstock in the manufacturer of plastics and other commercially important organic chemicals.

Natural gas is found in deep underground natural rock formations are associated with other hydrocarbon reserve reservoirs in coal beds and as methane clathrates.Petroleum is also and other resources found in proximity to and with natural gas. Most natural gas was created over a long period of time by two mechanisms; biogenic and thermogenic. Biogenic gas is created by

methanogenic organisms in marshes, landfills and Shallow sediments. Deeper in the earth at greater temperature and pressure thermogenic gas is created fromburied organic material.

- **Advantages of Natural Gas :** The advantages of natural gas are given here
  a) It is clean fuel.
  b) Less processing is required.
  c) Transportation is easy.
  d) It is eco-friendly and causes negligible pollution.
  e) Its contribution to smoke formation is less.

- **Limitations of Natural Gas :** The limitations of natural gas are given here
  a) Leakage of gas is of serious environmental concern.
  b) Thick-walled storage tanks are needed as these gases are Stored at high pressure.

4.3.8 MINERAL OIL

Sedimentary rocks containing plants animals remains about 10 to 20 crores year old are the source of mineral oil. Mineral oil is very unevenly distributed over space like any other mineral. There are six regions in the world which are rich in mineral oil. USA, Mexico, former USSR and the west Asian region (Iraq, Saudi Arabia, Kuwait, Iran, United Arab Emirates, Qatar and Bahrain) are the major oil producing countries of the world.In India till independence Assam was the only state where mineral oil was drilled.In IndiaOil was first found at Makum (North East Assam) but drilling of oil was started at the Digboi in Lakhimpur district. After independence Gujrat plains and the major reserved were found off the Bombay coast the richest oil field of the country known as Bombay High (115 km from the shore). The latest oil deposits have been found in off shore areas off the deltaic coast of Godavari, Krishna, Kaveri and Mahanadi.

A Mineral oil is any of various colorless ,odorless life mixtures of alkyne as in the sea 15 2340 range from a non-vegetable mineral source particularly distillate of Petroleum some examples include white oil liquid paraffin and liquid petroleum Baby Oil refers to a perfumed Mineral oil is a liquid product of the distillation of Petroleum to produce gasoline and other petroleum based products from crude oil of Mineral oil in this sentence is a transparent colorless oil composed mainly of alkyne as and cyclic paraffins related to petroleum jelly it has a density of around 0.8 G cm cube Mineral oil is a substance of relative Li low value and it is produced in a very large quantity Mineral oil is available in light and heavy grades and can often be found in drug stores.

- **Advantages of Mineral Oil Energy Resources :** The advantages of mineral oil energy are given here
  a) It is cheaper for long-term production
  b) It can be easily transported
  c) It can be used to generate electricity

- **Disadvantages of Mineral Oil Energy Resources :** The disadvantages of mineral oil energy are given here

a) It is not environment friendly as its generation leads to pollution
b) Being highly inflammable it may cause damage to the environment
c) Being pollution-free this is an environment-friendly source of energy

4.4 SCENARIO OFRENEWABLE ENERGY IN INDIA

The renewable energy scenario of India as well as extrapolates the future developments keeping in views the consumption, production and supply of power. India's energy sector is one of the most critical components of an infrastructure that affects India's economic growth and therefore is also one of the largest industries in India. India has the 5th largest electricity generating capacity and is the 6th largest energy consumer amounting for around 3.4 % of global energy consumption. India's energy demand has grown at 3.6 % pa over the past 30 years.

At present India has seen an annual growth rate of about 22% for renewable energy in the last decade. The production from non-conventional sources in India during 2013–2014 is about 53.22 billion units and the major contributors are wind and solar with 31.26 billion units and 3.35 billion units respectively (Barpatragohain, 2015). Alternate energy also payback to investment in the form of carbon credit for clean development mechanism. Wind and solar power do not produce. The consumption of the energy is directly proportional to the progress of manpower with ever growing population, improvement in the living standard of the humanity and industrialization of the developing countries. Very recently smart grid technology can attribute important role in energy scenario. Smart grid refers to electric power system that enhances grid reliability and efficiency by automatically responding to system disturbances.

Government endeavor and achievement-The government has taken several measures to spread awareness for solar and wind energy systems. These include publication of book, magazine, organizing workshop and seminar, etc. Global Wind Day has been celebrating since, 2007 to create awareness and achievements in wind energy sectors. Ministry of New and Renewable Energy (MNRE), 2009 is the first ministry of its kind, completely dedicated toward renewable energy.(MNRE is implementing Remote Village Electrification (RVE) Program)

❖ Public Sectors Initiatives

The public sector undertakings in India have been contributing substantially in economic and social development for the nation since inception. A MoU between Ministry of New & Renewable Energy and Ministry of Petroleum & Natural Gas (MoPNG) has been signed to improve energy security along with clean energy development through investments in large solar, wind and other renewable energy projects by developing two special purpose vehicles (SPV).

❖ Participation of Private Sector

To promote the growth of renewable energy sources, several strategies have been formulated and implemented jointly by governments, local institutions, NGOs and private sectors. Although, the manufacturer of solar and wind sectors is by and large dominated by large players, there is a significant presence of small and medium enterprises, particularly in manufacturing of rural energy devices like solar cookers and solar lamps.

4.5 CURRENT RENEWABLE ENERGY POLICIES

These energy policies are set by Government.

a) Provision of renewable purchase obligation (RPO) under the National traffic policies

b) Notification of the long-term growth trajectory of RPO for solar and non-solar energy for three years from 2016-2019.

c) Development of solar parks and ultra-mega solar power projects

d) Development of power transmission network through green energy corridorproject.

e) Making rooftop solar as part of housing loan provided by banks.

f) Waiver of Inter- state transmission charges at losses.

g) Repowering of wind power projects for optimal utilization of wind resources.

h) Offshore wind energy policies for development of offshore wind energy in the Indian exclusive economic zone.

i) Supporting research and development on various aspects of renewable energy including with industry participation.

j) Financial incentives for off-grid and decentralized renewable energy system and devices for meeting energy needs for cooking, lighting and productive purposes.

k) Permitting 100% foreign direct investment in sector through automatic route.

l) The Government of India has setup a target of installing 175 GW capacity through renewable by 2022.

4.6 CAUSES OF ENERGY CRISIS (PROBLEMS)

a) On account of excessive population growth, rapid expansion and development of towns and urbanization, there is always conflict between demand and supply. In comparison to demand of energy, the supply is very less

b) Increasing use of energy for domestic and commercial purposes due to increased population and industrialization is also a major cause of energy crisis

c) Even after observing the demand of energy neither any attention is given towards the alternative energy sources nor any development is done in this direction

d) Energy/power/electricity theft increases the cost

e) Transmission loss due to defective power distribution system

f) On account of rapid expansion of cities, towns and establishment of new industries, life style of general public has changed totally, so the demand of electricity,petrol, diesel etc.is increasing day by day

g) Due to environmental pollution, there is decline in average rainfall so the level of water reservoirs is reducing gradually day by day which is the main reason for less production of hydroelectric power

h) On account of rapid expansion of cities, towns and establishment of new industries. Life style of general public has changed totally, so the demand of electricity petrol, diesel etc. is increasing day by day

i) There is lack of awareness in society; the fire wood is unnecessarily burned during Holi festival. Similarly at the time of Diwali, other festival and marriages the power energy is wasted

9.7 SOLUTIONS OF ENERGY PROBLEMS

a) Expansion and development of industries and cities should be done by estimating the future power supply.
b) By using wind mills properly, the electricity can be produced.
c) By utilizing the atomic energy correctly and properly, the energy problem can be improved to some extent.
d) Solar energy can be used for room heating, warming of water, preparation of food and also in the form of light.
e) By utilizing the Geo-thermal energy, the energy problem of towns and cities can be solved.
f) Public schools be made aware to save energy.
g) Effective measures to be adopted for transmission loss and energy theft.
h) The Govt. should help the electric transmission or distribution corporation that are running in loss.
i) Develop renewable sources of energy such as – wind power, hydel-power, solar radiation, atomic/nuclear power, biogas & biomass etc.
j) Technical development and dependence on alternative source of energy is the only solution of energy crisis.
k) Non-renewable energy resources should be used only when no non-conventional source of energy is available.
l) Alternative and pollution free sources- Solar energy, Geo-thermal energy, atomic energy, Biogas, should be tapped.
m) The conservation of existing energy sources as well as exploration of alternate resources should be done immediately.

Renewable energy is a term for clean, sustainable energy that's derived from naturally regenerating sources. Using a combination of these natural sources and intelligent technology, we can generate enough heat and electricity for all our homes, businesses and production needs. The renewable energy sector (RES) often receives financial, institutional or educational support from the government. A significant challenge for the actors in the RES field is policy consistency. When investments are carried out, a prognosis for future policies must be made. If the future is uncertain, larger risk margins should be included in the investment appraisals. Sudden, unexpected policy changes are one type of uncertainty that makes it more difficult to attract capital.

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Recent Trends of Entrepreneurship and Industrialization for Rural Development

CHAPTER-05

ECONOMIC GROWTH AND DEVELOPMENT

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5.1 INTRODUCTION

Economics involves making wise decisions when resources are limited. The primary measure for evaluating successful resource allocation is economic growth. Individuals track their earnings and asset values, while companies oversee profitability and market share. Countries analyze various data, such as national income and productivity, to assess economic growth. Some economists argue that a comprehensive evaluation of a nation's economy should consider distribution, equity, and per-capita income, alongside growth and productivity. Additionally, they emphasize addressing societal needs like environmental justice and cultural preservation to sustain economic growth and promote overall human development.

This includes creating more opportunities in education, healthcare, employment, and environmental conservation. Economic growth is not just about increasing output quantitatively; it also involves qualitative changes in social attitudes and practices, in addition to the quantitative growth of output or national wealth.

5.1.1 ECONOMIC GROWTH

The term economic growth is defined as the process whereby the country's real national and per capita income increases over a long period of time. This definition of economic growth consists of the following features of economic growth:

- Economic Growth implies a process of increase in National Income and Per-Capita Income. The increase in Per-Capita income is the better measure of Economic Growth since it reflects increase in the improvement of living standards of masses.
- Economic Growth is measured by increase in real National Income and not just the increase in money income or the nominal national income. In other words the increase should be in terms of increase of output of goods and services, and not due to a mere increase in the market prices of existing goods.

- Increase in Real Income should be Over a Long Period: The increase of real national income and per-capita income should be sustained over a long period of time. The short-run seasonal or temporary increases in income should not be confused with economic growth.
- Increase in income should be based on Increase in Productive Capacity: Increase in Income can be sustained only when this increase results from some durable increase in productive capacity of the economy like modernization or use of new technology in production, strengthening of infrastructure like transport network, improved electricity generation etc.

5.1.2 ECONOMIC DEVELOPMENT

Economic development is described as a consistent increase in society's material well-being. Economic growth is just one aspect of economic development. In addition to national income growth, it also entails social, cultural, political, and economic developments that advance the material world. It includes adjustments to the availability of resources, the pace of capital formation, population size and composition, technology, skill, and efficiency levels, as well as institutional and organisational structures. The broader goals of guaranteeing more fair income distribution, increased employment, and poverty alleviation are all achieved by these improvements. In summary, economic development is a long chain of interconnected changes in fundamental supply variables and demand structure that leads to an increase in a country's net national product in the long term.

5.1.3 COMPARISON OF ECONOMIC GROWTH VS. ECONOMIC DEVELOPMENT

Parameter	Economic Growth	Economic Development
Concept	It is the positive change in the indicators of economy.	It is the quantitative and qualitative change in an economy.
Factors	Growth relates to a gradual increase in one of the components of Gross Domestic Product: consumption, government spending, investment, net Exports.	Development relates to growth of human capital, decrease in inequality figures, and structural changes that improve the quality of life of the population.
Impact	It refers to the increment in amount of goods and services produced by an economy.	It refers to the reduction and elimination of poverty, unemployment and inequality with the context of growing economy.
Focus	This focuses on production of goods and services.	This focuses on distribution of resources.
Measurement	Economic Growth is measured by quantitative factors such as increase in real GDP or per capita income.	The qualitative measures such as HDI (Human Development Index), gender-related index, Human poverty index (HPI), infant mortality, literacy rate etc. are used to measure economic development.
Relevance	It reflects the growth of national or per capita income	It reflects progress in the quality of life in a country.
Time Frame	It is for short term/short period. It is measured in certain time frame/period.	It is a continuous and long-term process. Economic development does not have specific time period to measure.

Interaction	Economic growth is an automatic process that may or may not require intervention from the government	Economic development requires intervention from the government as all the developmental policies are formed by the government
Expectations	It is not concerned with happiness of public life	It is concerned with happiness of public life.
Application	Economic growth is more relevant metric for assessing progress in developed countries.	More relevant to measure progress and quality of life in developing countries.

5.2 FACTORS AFFECTING ECONOMIC GROWTH

Economic growth is a highly complicated phenomenon that is influenced by numerous and diverse aspects such as political, social, and cultural factors. As a result, economic analysis can only provide a partial explanation of this process. "Economic development has much to do with human endowments, social attitudes, political situations, and historical accidents," Prof. Ragnar Nurkse has said in this regard. Capital is a necessary but not sufficient condition for progress". The availability of natural resources, as well as the advancement of scientific and technological knowledge, all have a significant impact on the process of economic growth. We'll go over some of these characteristics briefly one by one.

5.2.1 ECONOMIC FACTORS

The following are the important factors which determine the economic growth of an economy.

- NATURAL RESOURCES

Natural resources are the main factor influencing how an economy develops. Natural resources include things like land area and soil quality, abundant forests, a healthy river system, mineral and oil resources, a pleasant and arid environment, etc. The quantity of natural resources is crucial for economic progress. A nation with insufficient natural resources might not be able to grow quickly. In actuality, natural resources are a necessary but insufficient requirement for economic progress. India and Japan are the two diametrically opposed instances. Lewis noted that, "other things being equal," man may utilise rich resources more effectively than poor ones. Natural resources are misused, underutilised, or wasted in less developed nations. This is one of the causes of their lag in development. Natural resource development is unlikely if people have little interest in the goods or services that these resources can produce. This is brought on by a lack of technological advancement and economic sluggishness. According to Professor Lewis, "A country which is regarded to be low in resources may be considered very rich in resources some later period, not just because unknown resources are discovered, but equally because new methods are created using the known resources". Japan is one of those nations with a lack of natural resources, but it is nonetheless one of the world's most developed nations because it has found innovative ways to utilise its scarce resources.

- CAPITAL FORMATION

Among several economic factors, capital formation is another important factor for development of an economy. Capital may be defined as the stock of physical reproducible factors of production.

Capital accumulation and capital formation, both of these terms carry the same meaning which may be understood simply by the stock of capital. As we know, capital formation is cumulative and self-feeding and includes three interrelated stages a) the existence of real savings and rise in them; b) the existence of credit and financial institutions to mobilise savings and to divert them in desired channels; and c) to use these savings for investment in capital goods. Low propensity to save in underdeveloped countries is due to low per capita income of the people, which may not be raised merely by voluntary savings. Hence, the rate of per capita savings can be increased by emphasizing forced savings which will reduce consumption and thereby release savings for capital formation. Forced savings can be possible through the implementation of a proper fiscal policy. In this regard, taxation, deficit financing and public borrowing is better instruments in the hands of the State to collect savings and accumulate capital. Nurkse's suggestion to use unemployed or underemployed rural youths in construction works has importance for capital formation in backward economies.

In addition to it, the external resources like foreign loans and grants, and larger exports can also help these economies in capital formation. The capital formation possesses special significance, as it is key to economic growth, particularly in backward economies. It increases sectoral productivity in the economy on the one hand and enhances ultimately national output by raising effective demand, on the other. According to Kuznets' estimates, during modern economic growth the gross capital formation and net capital formation was gradually between 11.13 to 20% and 6 to 12.14% in developed countries. According to Lewis, the rate in underdeveloped countries was 5% or less which should be raised to the level of 12 to 15%.

TECHNOLOGICAL PROGRESS

The process of economic growth is most significantly impacted by technological advancements. The founder of political economy, Adam Smith, emphasised the critical role that technical advancement plays in economic growth. Ricardo envisioned the growth of capitalist economies as a competition between technological advancement and population expansion. Karl Marx also recognised the critical role that technological advancement has played in the growth of capitalism. There is no denying that the development of technology has a significant role in determining the rate of economic growth. In reality, without technological advancement, even capital accumulation is impossible. A nation might be expanding its industry, electricity sources and methods of communication and transportation. Modern engineering terms refer to it as capital widening. The utilisation of more effective production methods and advancements in technology result in a large rise in per capita income.

The development of new, more effective production techniques or the refinement of existing ones is a component of technological progress. Natural resources may occasionally become available as a result of technological advancement. Yet, technical advancement typically leads to an increase in production, as with the green revolution. In other words, as technology advances, we are better able to exploit natural resources and other resources to boost production in a more efficient and fruitful way. By the use of improved technology it is possible to have greater output from the use of given resources or a given output can be obtained by the use of a smaller quantity of resources. It is a

matter of common knowledge that technological progress adds greatly to our ability to make a fuller use of the natural resources, e.g., generation of hydro-electricity.

With the aid of power - driven farm equipment a marked increase has been brought about in agricultural yields per acre and per worker. Technical progress also increases the ability to make a more effective use of capital equipment. Technological progress has very close connection with capital formation. In fact, both go hand in hand. Technical advancement is impossible without capital creation since better and more efficient production methods demand significant investment, even though their capital costs per unit of output may decrease after they are well-established.

As a result, the advancement of technology is crucial to a nation's economic growth. Without adopting ever-newer production processes and without having technical advancement aid its march, no economically backward nation can hope to advance on the road to economic development. The significance of capital formation for economic expansion has already been discussed. But capital accumulation promotes economic growth because it facilitates technological improvements, which raise labour productivity and thus add to the national and percapita income.

1) Human Resources

The rate of economic growth is greatly influenced by the population's quality. A small, high-quality human population is preferable than a big one for a nation's development. Investment in human capital in the form of healthcare, education, and other social programmes is therefore highly desired for economic progress. **Peter Drucker** asserts that "people are the most crucial prerequisite for rapid industrial progress, those who are prepared to seize the chances and challenges presented by economic transformation. People, above all, who are dedicated to the economic development of their country, and to high standards of honesty, competency, knowledge and performance. What are needed beyond all else are leadership and example, and that, only the right kind of people can provide". **Prof. Drucker** stressing the significance of human capital says further: "Capital without people is sterile, but people can move mountains without capital. Development, therefore, requires rapid growth of human talents and opportunities to employ them".

Population Growth

- Population growth contributes to the labour supply. Yet, the population rise ought to be typical. Population growth that is out of control impedes economic development. Only in a country that is sparsely populated is population expansion beneficial. But, in an overpopulated nation like India, it is unnecessary. In fact, our country's economic growth is severely hampered by a high population growth rate of 2.5% annually.

Social Overheads

- The provision of social overheads such as schools, colleges, technical institutions, medical colleges, hospitals, and public health facilities is another key predictor of economic success. Such facilities promote the health, efficiency, and responsibility of the working population. Such people have the potential to propel their country's economy ahead.

Organisation

- The organisation process is crucial to growth. The emphasis on maximising the use of the means of production in production is placed on organisation. To maximize production, organisation is a necessary complement to labour and capital. The entrepreneur fulfils the role of an organiser in the contemporary economic system and assumes all risks and uncertainties. As a result, entrepreneurship plays a crucial role in the process of economic progress. For instance, entrepreneurship was a key factor in the success of the Industrial Revolution in England. The majority of impoverished nations around the world are poor not because of a severe lack of entrepreneurship but rather because of a lack of money, bad infrastructure, inexperienced labour, and a lack of natural resources.

Myrdal rightly comments, "the Asian countries lack entrepreneurship not because they are deficient in capital or raw materials but because they are deficient in persons with right attitude for entrepreneurship". Behind Japan's rapid economic growth there is only one reason that it has entrepreneurship in abundance. As a result, it is crucial to foster an environment in LDCs that encourages entrepreneurship by placing a focus on education, fresh research, and scientific and technological advancements. In addition, the government should prioritise importing the tools, supplies, and equipment needed to open up new markets, as well as allowing tax breaks, grants, and loans for new businesses and sectors, especially in less developed regions of the economy.

- **Transformation of Traditional Agricultural Society**

The transformation of traditional agricultural society into a modern industrial society, i.e., structural changes lead to enhancement of employment opportunities, higher labour productivity and the stock of capital, exploitation of the newly developed resources and improved technology. Mostly, LDCs have a very large primary sector and very small secondary and tertiary sectors. In such economies the structural changes involve the transfer of population from the primary sector to the secondary and then to tertiary sectors. Agriculture being the main occupation of the 70-80 percent population in the LDCs passes through several structural changes. The number of dependents on agriculture sector progressively reduces with the expansion of industrial or non-agricultural sector. Similarly, the proportion of contribution of agriculture in the real national income also reduces gradually. But net output in agriculture sector progressively increases in absolute terms, as it is accompanied by a strong productivity movement, relating to the implementation of several programmes like land reforms, expansion of banks, improved agricultural techniques and other farm implements, availability of better marketing facilities, means of power and irrigation, and so on.

In LDCs the agriculture and industry become complementary to eachother. The progressively increasing productivity in agriculture enhances the per capita real income of the people, engaged in agriculture sector. This, in turn, increases the demand for consumer goods and agricultural inputs in rural areas, which in turn encourages the growth of the industrial sector. Also, it advances the agriculture sector by supplying better farming methods along with equipment, fertiliser, and other inputs. In other words, the potential for increasing agricultural productivity and incomes is greatly influenced by the economic system's structural changes, which have an impact on the growth of the

commercial demand for the goods produced, the expansion of alternative employment opportunities, and the quantity of purchased inputs that are made available to the agricultural sector.

5.2.2 NON-ECONOMIC FACTORS

In the process of economic growth, both economic and noneconomic factors are significant. In this regard, socioeconomic, economic, cultural, psychological, and political factors are equally important to the LDCs' economic development as are economic ones. Development is neither just dependent on financial resources, nor is it solely an economic phenomenon, as Cairn cross correctly notes. It includes all facets of social behaviour, as well as the establishment of law and order, scrupulousness in commercial operations, including dealings with tax officials, family relationships, literacy, acquaintance with mechanical devices, and other things. Here, we go through a few of the key noneconomic variables that affect how fast an economy is growing.

- **Political Factors**

Political stability and strong administration are essential and helpful in modern economic growth. It is because of political stability and strong administration that the countries like the UK the USA, Germany, France and Japan have reached the level of highest economic growth in the world. But in most of the poor countries there is political instability and weak administration which have largely influenced their economic development programmes. It is, therefore, essential for their faster economic development to have a strong, efficient and incorrupt administration. In conclusion, we can say that a clean, just and strong administration can put an economy on the way to rapid economic development. Lewis rightly comments that “no country has made progress without positive stimulus from intelligent governments”.

- **Social and Psychological Factors**

Modern economic growth process has been largely influenced by social and psychological factors. Social factors include social attitudes, social values and social institutions which change with the expansion of education and transformation of culture from one society to the other. The Industrial Revolution of England and other Western European countries in the 18th century was largely influenced by the spirit of adventure and the expansion of education which led to new discoveries and inventions and consequently to the rise of the new entrepreneurs. Social attitudes, values and institutions changed. Joint family system was replaced by the new single family system which further led to the rapid economic development in these countries. But the society in LDCs has been badly enveloped and guided by traditional customs, outdated ideology, values, and obsolete attitudes which have not been conducive to their economic development.

Thus, there is need to change or modify these social and psychological factors for the rapid economic development in these countries. But it is not an easy task, and moreover, any rapid change may bring discontentment and resistance in the society, with the result that it may adversely affect the economic growth in the economies. Only the selective social and psychological changes can lead to economic growth in LDCs. According to the UN Report on Economic Development of Underdeveloped Countries, it is hence impossible to speed up economic growth in these economies without painful

adjustments It, thus, advises to adopt an evolutionary change in social and cultural factors rather than revolutionary ones. Myrdal in his book Asian Drama also advocates the adoption of "modernisation values" or "modernisation ideals" for the rapid economic development of underdeveloped countries.

Education

It is now fairly recognised that education is the main vehicle of development. Greater progress has been achieved in those countries, where education is wide spread. J.K. Garlbraith in his book "Economic Development" has rightly stressed the role of education as an engine of economic growth.

Urbanisation

Another noneconomic factor promoting development is the process of urbanisation. In poor agrarian economies, the structural change must begin with the change in the size of population in rural and urban sectors.

Religious Factors

Religion has a significant impact on economic development. That might lead to an odd form of self-satisfaction. For instance, the Hindu religion promotes a belief in fate and discourages hard effort. They are taught to be content with their position and to despise risk and business. Hence, spirit is given a higher status than matter in our religion. In short, both economic and non-economic elements work together to create economic growth. Yet, the mere existence of one, many, or even all of these characteristics may not guarantee that the economy would be able to produce the forces necessary for rapid economic expansion.

5.3 CONCLUSION

The growth and development in literacy rate, life expectancy and infant mortality rate, purchasing power, and per capita incomes can determine the levels of development and also provide future recommendations where the country is lacking and what improvement is needed. In addition, we learn from the preceding statement that only economic factors are not responsible for poverty or economic backwardness of a country, non-economic factors are equally responsible for the underdevelopment of an economy.

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CHAPTER-06

CULTIVATING PROSPERITY : AGRICULTURE SECTOR AND LIVELIHOOD IN RURAL INDIA

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6.1 INTRODUCTION

At day break, the expansive rural landscapes of India are bathed in the initial rays of sunlight, signalling the commencement of a new day. Agriculture, profoundly embedded in the nation's historical tapestry, has long provided the vital sustenance of its people for millennia. Within the vast expanses that characterise rural India, the agricultural industry serves as both a demonstration of strength and a reflection of the difficulties and possibilities of a multifaceted socio-economic fabric.The origins of Indian agriculture are closely connected to the ancient narratives of civilizations that thrived alongside the powerful rivers. Throughout Indian history, generations have engaged in precise agricultural techniques, cultivating and harvesting the land, from the Indus Valley to the agrarian civilizations that have moulded the destiny of the country. The Green Revolution, which occurred in the 20th century, had a significant impact on conventional farming landscapes and laid the foundation for current issues.Presently, the agricultural industry in rural India encounters a complex environment characterised by numerous obstacles. The agricultural sector's potential is overshadowed by outdated farming practices, reliance on unpredictable monsoons, land fragmentation, and the persistent challenges faced by small and marginal farmers. In this chapter, it is important to acknowledge the historical context that contributes to the issues encountered by the modern agricultural community as we explore the complex dynamics of the agriculture sector and rural life. Recently, there has been a discernible change in the storyline. Technological developments have emerged as guiding lights, revealing a way towards sustainable and efficient farming practices.

The government's measures to offer financial assistance to farmers and promote technology innovations demonstrate a dedication to rejuvenating the agricultural industry. Comprehending the intricate balance between tradition and innovation is crucial in order to establish a sustainable future, as it significantly influences the agricultural landscape. In light of these intricate circumstances, this chapter undertakes a thorough investigation of the agriculture industry and the means of subsistence in rural India. We will explore the historical influences on farming communities, analyse the current obstacles they face, and investigate the potential of technology advancements to

bring about significant change. While exploring the realms of unpredictability, we will discover tales of perseverance, the successes of environmentally-friendly methods, and the ambitions of rural India in its pursuit of economic well-being.In the upcoming chapters, we will analyse many aspects of the agriculture sector, including the technological advancements that are transforming farming practices and the complex issues related to water management. The objective is to provide a comprehensive overview of the obstacles and achievements in the agricultural sector of rural India by analysing government policies, case studies, and success stories.This chapter essentially acts as an exploration of the central region of India, where the land bears witness to the strength and determination of its inhabitants, the crops hold the potential for a sustainable future, and the people grow not only crops but also the very core of their livelihoods.

6.2 HISTORICAL PERSPECTIVES

In order to have a comprehensive understanding of the complex interconnections between the agriculture sector and rural lifestyles in India, it is necessary to delve into the historical origins of agrarian traditions. The historical viewpoints provide insight into the development of agricultural methods, land utilisation, and the mutually beneficial connection between humans and the land.

ANCIENT AGRICULTURAL PRACTICES

The initial communities on the Indian subcontinent, such as those in the Indus Valley, were distinguished by advanced agricultural techniques. The careful and detailed organisation of urban areas, sophisticated methods of watering crops, and the presence of diverse cultivated plants demonstrate the fundamental importance of agriculture in supporting these ancient societies. The early farmers cultivated a variety of crops, including wheat, barley, cotton, and sesame, establishing a strong agricultural tradition.

VEDIC PERIOD AND AGRICULTURAL RITUALS

The Vedic period witnessed the rise of religious scriptures known as the Vedas, which encompassed hymns and ceremonies pertaining to agriculture. Agriculture served not only as a method of survival, but also as a revered obligation, with ceremonial practices devoted to the land, livestock, and the environmental factors that impacted crop development. The profound bond between individuals and the land established the basis for the lasting veneration linked to agriculture in Indian culture.

MEDIEVAL AGRARIAN SYSTEMS

During the mediaeval period, a range of agrarian systems emerged, such as the feudal system and the village-based self-sufficient economy. The land revenue schemes, such as the Mansabdari system implemented during the Mughal Empire, had a significant impact on the dynamics between rulers and agricultural people. The agricultural scenery underwent ongoing changes, shaped by both local customs and external factors.

COLONIAL IMPACT ON AGRICULTURE

The introduction of colonial control in India resulted in substantial transformations in the agricultural terrain. The British introduced lucrative agricultural products, modified land ownership arrangements

under the Zamindari system, and imposed revenue schemes that frequently took advantage of the farmers. The consequences of these shifts would reverberate over the decades, exerting influence on the agrarian conflicts and movements that defined the pre-independence era.

- GREEN REVOLUTION AND TECHNOLOGICAL SHIFTS

In the mid-20th century, the Green Revolution brought about significant changes by introducing high-yielding crop types, new irrigation methods, and chemical fertilisers. Although it resulted in heightened productivity, it also gave rise to ecological issues, changes in land utilisation, and socio-economic inequalities. The Green Revolution facilitated the simultaneous existence of conventional practices and contemporary technologies in Indian agriculture. Gaining insight into these historical viewpoints offers a perspective that allows us to analyse the current challenges and opportunities encountered by the agriculture industry. The narrative of rural India's agrarian journey is shaped by the enduring nature of ancient farming practices, the cultural importance attributed to the land, and the influence of colonial and post-independence policy. In the upcoming chapters, we will explore the current difficulties and advancements in light of the past, aiming to find a harmonious equilibrium that guarantees long-lasting development and success in the future.

6.2.1 CONTEMPORARY CHALLENGES

At dawn, as the sun ascends above the extensive rural landscapes of India, the agriculture sector confronts numerous modern difficulties that endanger the livelihoods of millions. These difficulties, which are deeply ingrained in the socio-economic structure, require a sophisticated comprehension in order to establish permanent solutions.

- OUTDATED FARMING TECHNIQUES

An eminent obstacle encountered by the agricultural industry in rural India is the enduring presence of antiquated farming methods. A significant number of farmers persist in utilising conventional techniques that may prove to be inadequate or unsustainable in the long term. The sector's capacity to enhance productivity is hindered by a deficiency of awareness, knowledge, and access to contemporary agricultural practices.

- DEPENDENCE ON MONSOONS

A significant proportion of Indian agriculture relies on rainfall, relying on the monsoon for sufficient water supplies. The fluctuating rainfall patterns caused by climate change have heightened the susceptibility of crops to both droughts and floods. The reliance on monsoons presents a perpetual risk to crop production and the general sustainability of the agricultural industry.

- LAND FRAGMENTATION

Land fragmentation is defined as the situation in which a single farm or ownership consists of numerous spatially separated plots. Fragmented land holdings have arisen as a consequence of the intergenerational distribution of agricultural land among family members. Small and marginal farmers frequently operate on pieces of land that are too little to take advantage of economies of scale. This fragmentation not only restricts the potential for mechanisation, but also intensifies the socio-economic difficulties experienced by individual farming households.

DEBT AND FINANCIAL DISTRESS

The agricultural industry is familiar with the presence of debt and financial hardship. Small and marginal farmers frequently become ensnared in a cycle of indebtedness, primarily as a result of circumstances such as crop failure, limited finance availability, and fluctuating market prices. To tackle this issue, a comprehensive solution encompassing financial literacy, improved credit accessibility, and risk mitigation methods is necessary.

MARKET FLUCTUATIONS AND PRICE VOLATILITY

Rural Indian farmers bear the full force of market changes and price volatility. Without direct market access, they are frequently subject to the control of intermediaries. Abrupt declines in commodity prices can result in monetary losses, affecting the revenue and viability of agricultural households. Implementing market-oriented changes and establishing procedures to guarantee equitable pricing are essential in tackling this issue.

LACK OF INFRASTRUCTURE AND TECHNOLOGY ACCESS

Farmers have logistical difficulties due to insufficient infrastructure, such as inadequate road connectivity and storage facilities. In isolated rural locations, access to contemporary agricultural technologies and information is limited due to the digital divide. Closing this divide is crucial to ensure that farmers can embrace efficient methodologies and establish stronger connections with markets.

ENVIRONMENTAL SUSTAINABILITY

The escalating environmental repercussions of agriculture, characterised by the excessive utilisation of chemical fertilisers, pesticides, and unsustainable water management, are becoming an increasingly worrisome issue. Ensuring a harmonious equilibrium between the imperative for heightened productivity and the adoption of sustainable and environmentally conscious methods is crucial for the enduring well-being of both the natural environment and the agricultural industry. Comprehending and tackling these current difficulties is crucial for the long-term growth of the agricultural industry in rural India. In the following sections of this chapter, we will examine how technology, regulatory reforms, and community-driven initiatives can serve as catalysts for good change, guiding the agriculture sector towards resilience and prosperity.

6.3 TECHNOLOGICAL INTERVENTION: A RAY OF HOPE

Technological involvement in rural India is seen as a promising answer to long-standing difficulties in the agriculture industry, providing transformative solutions in an ever-changing environment. Through the progress made in information technology, data analytics, and precision farming, technology is revolutionising conventional agricultural methods and equipping farmers with resources to improve productivity, sustainability, and resilience.

PRECISION AGRICULTURE

Precision agriculture is a method of farming that makes use of technology to maximise agricultural output while simultaneously reducing waste. Farmers have the ability to precisely monitor and

manage their fields by utilising technologies such as sensors, global positioning system (GPS) technology, and Internet of Things (IoT) devices. It is possible to make informed decisions, which ultimately leads to more efficient utilisation of resources, when real-time data on soil moisture, meteorological conditions, and crop health are available.

- SMART FARMING EQUIPMENT

Conventional agricultural methods are undergoing a sea change as a result of the introduction of intelligent farming equipment. These advancements, which include automated tractors and drones equipped with imaging equipment, make chores such as planting, harvesting, and pest control more efficient. The deployment of intelligent machinery not only lessens the amount of work that farmers have to do, but it also improves the overall efficiency of farm operations.

- DIGITAL PLATFORMS AND MARKET ACCESS

Farmers are provided with real-time information on commodity prices, demand trends, and market dynamics through the use of digital platforms, which play a significant role in connecting farmers with markets. It is possible for farmers to circumvent the traditional intermediaries by using online platforms, which allows them to obtain direct access to a larger client base. Increasing market openness and giving farmers more authority to make decisions are two benefits that come from the shift towards digital agriculture.

- AGRI-TECH STARTUPS AND INNOVATION HUBS

There is a thriving ecosystem of technological solutions that are specifically adapted to meet the requirements of Indian agriculture, as seen by the proliferation of Agri-tech firms and innovation hubs. These start-ups are concentrating their efforts on issues like as crop management, traceability from farm to fork, and financial inclusion for farmers alike. Collaborations between the business sector, the government, and academic institutions are fuelling a surge of innovation that has the potential to reshape rural areas in a significant way.

6.4 GOVERNMENT INITIATIVES

In a result of the government's recognition of the crucial role that technology plays in agriculture, a number of programmes have been established to encourage the wider adoption of technology. The Pradhan MantriKisanSammanNidhi (PM-KISAN) initiative offers direct financial assistance to farmers, whilst the Soil Health Card initiative makes use of technology to evaluate and enhance the fertility of the soil. In order to empower farmers economically and technologically, these projects are being undertaken.

- BLOCKCHAIN TECHNOLOGY FOR SUPPLY CHAIN TRANSPARENCY

More and more research is being done to investigate the potential of blockchain technology to bring transparency and traceability to the agricultural supply chain. Blockchain technology assures that the origin, quality, and travel of agricultural products can be validated by recording every transaction that occurs from the farm to the market on a distributed ledger. Not only does this improve consumers' faith in the company, but it also guarantees that farmers will receive fair remuneration.

- CAPACITY BUILDING AND TRAINING PROGRAMS

In order to ensure the successful deployment of technology solutions, it is essential to bridge the digital divide in rural areas. The acquisition of necessary digital skills by farmers through the implementation of capacity building and training programmes enables them to make efficient use of technology. One of the most important aspects of achieving sustainable technological transformation is providing farmers with the information they need to carry out these advances and reap their benefits. As we negotiate the technological landscape that is altering the agriculture sector in rural India, it is becoming increasingly apparent that the incorporation of these advances holds the possibility of a future that is both more robust and prosperous. Technology becomes a catalyst for positive change when it is implemented as part of a collaborative effort that includes support from the government, innovation from the private sector, and participation from the community.

This helps to steer the agricultural sector towards higher efficiency, sustainability, and economic well-being within the sector. In the following parts, we will go deeper into the impact that these technological interventions have had on the ground, and we will investigate case studies that show the successful implementation of these interventions.

6.5 WATER WOES : IRRIGATION CHALLENGES IN RURAL INDIA

It is one of the most significant problems that rural India has in terms of agriculture, and that is the absence of adequate irrigation facilities. The majority of farmers are dependent on rain-fed agriculture, which means that unpredictable rainfall patterns represent a considerable risk to crop harvests. For the purpose of mitigating this difficulty, it is necessary that sustainable water management methods and the implementation of efficient irrigation systems be implemented.

6.5.1 CROP DIVERSIFICATION : A PATH TO RESILIENCE

The practice of cultivating a varied range of crops is emerging as a strategic strategy to build resilience, promote sustainable agriculture, and minimise risks associated with monoculture in the agricultural landscapes of rural India. This is done in order to offset the risks associated with monoculture. Agricultural diversification refers to the practice of cultivating a wide range of crops within a particular geographical area. This practice provides economic, ecological, and social advantages that contribute to the general well-being of the farming community.

- MONOCULTURE CHALLENGES

As a result of the needs of the market, the practice of monoculture, which involves the cultivation of a single crop across enormous areas of land, has become the predominant method. There are inherent dangers associated with monoculture, despite the fact that it can result in high yields of a particular crop. Monoculture systems are more susceptible to the effects of pests, illnesses, and fluctuations in the market, which can possibly result in considerable financial losses for farmers.

- ECONOMIC BENEFITS OF CROP DIVERSIFICATION

The reduction of dependency on a single crop and the provision of a steadier income for farmers are two of the economic benefits that can be enjoyed through crop diversification. It is possible for

farmers to access a variety of markets by cultivating a wide range of crops, which guarantees a diverse range of incomes. Additionally, the cultivation of crops that have different development cycles can provide a constant income stream throughout the year, thereby lowering the financial risks that are connected with swings in the seasons.

ECOLOGICAL SUSTAINABILITY

When monoculture is used, it frequently requires the heavy application of fertilisers, pesticides, and herbicides, which contributes to the degradation of soil and the contamination of the environment. Crop diversity helps to reduce reliance on chemical inputs, which in turn contributes to the promotion of ecological sustainability. Different crops have varying nutritional requirements, and the cultivation of a wide variety of crops can improve the health of the soil, lower the number of pests and illnesses, and increase the amount of biodiversity located on farms.

RISK MITIGATION

Risk mitigation strategies help companies identify risks well before they arrive. This gives companies valuable time to plan for the emergence of any threats. Diversification is a risk mitigation approach that can be utilised to protect against the effects of climate change and unpredictable weather patterns from occurring. There is a wide range of tolerance levels among various crops when it comes to harsh weather events, and a farming system that is varied is more resistant to the many climatic uncertainties. Farmers that engage in crop diversification are in a better position to successfully adapt and recover in the face of adverse weather conditions such as drought, flood, or other weather-related issues. Risk mitigation focuses on minimizing the harm of a particular risk. This may involve taking measures to reduce the likelihood of the risk occurring, or it may involve developing contingency plans to minimize the harm if the risk does occur

PROMOTION OF TRADITIONAL AND INDIGENOUS CROPS

The resurrection and promotion of traditional and indigenous crops that are well-adapted to the agroclimatic conditions of the local area is a common component of crop diversification. The rediscovery and cultivation of these crops not only helps to maintain cultural legacy, but it also makes a contribution to food security by increasing the variety of food crops that are available, fostering dietary diversity, and enhancing nutritional outcomes.

GOVERNMENT SUPPORT AND INCENTIVES

Farmers are being encouraged to diversify their cropping patterns through the implementation of government initiatives and financial incentives. This is in recognition of the significance of crop diversification which is being recognised. In order to aid the shift towards farming practices that are more diverse and sustainable, financial support, technical assistance, and awareness campaigns are implemented.

MARKET OPPORTUNITIES AND VALUE ADDITION

Market Opportunities and Value Addition: Farmers who diversify their crop production have access to new market opportunities. The diversification of a business into high-value crops, organic produce,

or specialty markets can result in increased potential profits. Further enhancement of the economic feasibility of crop diversification can be achieved by the addition of value through the processing and sale of a wide variety of agricultural goods.

- COMMUNITY-BASED APPROACHES

In order to successfully implement agricultural diversification, community-based initiatives are frequently utilised. These approaches involve farmers working together to share their knowledge, resources, and experiences. Farmer groups, cooperatives, and agricultural extension agencies all play an important part in the process of developing a supportive network and spreading information about successful diversification strategies.

6.6 LIVELIHOOD BEYOND FARMING

In rural India, the idea of livelihood goes beyond only conventional agriculture and includes a range of activities that contribute to the overall development of rural communities. In order to address the many requirements of the population, there are ongoing initiatives to expand the range of livelihood possibilities, offer skill development programmes, and encourage the growth of agro-based industries. These efforts aim to create a socio-economic environment that is both inclusive and sustainable.

- DIVERSIFICATION OF LIVELIHOODS

Rural India is undergoing a transition from its traditional dependence on agriculture to embracing a wider range of livelihood options. This involves investigating alternate sources of income, such as animal husbandry, fisheries, horticulture, and non-farm enterprises. Diversification not only reduces the risks associated with reliance on a single industry but also enhances overall economic resilience.

- ANIMAL HUSBANDRY AND LIVESTOCK REARING

Animal husbandry is a large-scale business where animals that provide us food are reared, bred, sheltered and cared for in a farm or in regions which are specially built for them. Livestock raising, encompassing dairy farming, poultry, and animal husbandry, has become a promising means of sustaining rural lives. In addition to generating extra revenue, these activities contribute to ensuring enough nutrition, improve soil fertility through the use of organic manure, and generate employment possibilities in associated value chains.

- FISHERIES AND AQUACULTURE

Given the enormous water resources available in numerous rural regions, fishing and aquaculture offer highly profitable prospects for sustaining livelihoods. Fish farming not only provides a protein source for local communities but also helps generate income. Adopting sustainable methods in fishing facilitates the preservation of the environment while simultaneously upholding the livelihoods of individuals involved in the industry.

- HORTICULTURE AND FLORICULTURE

Agricultural practices involving the growth of fruits, vegetables, and flowers have become increasingly important in rural livelihood initiatives. Horticulture not only yields lucrative crops for

farmers but also sustains agro-processing enterprises. In addition, floriculture plays a significant role in meeting the increasing demand for flowers in both domestic and foreign markets.

- NON-FARM ENTREPRENEURSHIP

Rural livelihood diversification is significantly influenced by non-farm activities, such as small-scale enterprises, handicrafts, and artisanal work. The formation of rural firms is facilitated by government efforts and microfinance, which promote entrepreneurship and generate job prospects beyond the conventional agriculture sector.

- SKILL DEVELOPMENT AND TRAINING PROGRAMS

Government and non-government organisations are developing training programmes in rural areas to acknowledge the significance of skill development. These projects have the objective of providing persons with the necessary skills for a wide range of livelihoods, including agro-processing and handicrafts. This will improve the ability of rural youth to find employment and develop their entrepreneurial capabilities.

- PROMOTION OF AGRO-BASED INDUSTRIES

Agro-based industries, which include food processing, agri-business, and adding value to agricultural produce, play a vital role in connecting farming with industrialization. Establishing food processing units, cold storage facilities, and cooperative ventures enhances the worth of unprocessed agricultural products, diminishes losses after harvesting, and generates job prospects.

- ECO-TOURISM AND RURAL HOSPITALITY

Rural India's distinctive cultural and natural resources are being increasingly utilised to promote eco-tourism and rural hospitality. Efforts aimed at fostering sustainable tourism not only yield financial benefits for local communities, but also play a crucial role in safeguarding cultural heritage and preserving the environment.

- EMPOWERING WOMEN IN LIVELIHOODS

Efforts are being made to empower women in rural economies by providing them with skill development and entrepreneurship opportunities, acknowledging their crucial role. Efforts that prioritise women's involvement in agro-based industries, handicrafts, and small-scale companies play a significant role in promoting gender equality and fostering community development.

6.7 GOVERNMENT POLICIES : NAVIGATING THE PATH AHEAD

Rural India is a dynamic landscape, and the policies of the government play a crucial role in influencing the trajectory of the agriculture sector and the livelihoods of the people who live there. When it comes to tackling difficulties, developing sustainable practices, and ensuring inclusive development, policy interventions are absolutely necessary. In order to successfully navigate the path that lies ahead, it is necessary to conduct a thorough analysis of the policies that are now in place, as well as potential reforms and collaborative efforts among the many stakeholders.

FARM ACTS AND AGRICULTURAL REFORMS

The government's introduction of the Farm Acts seeks to deregulate the agricultural sector, granting farmers increased autonomy in the sale of their agricultural products. Although the primary goal of these reforms is to establish a market that is more transparent and characterised by healthy competition, they have triggered discussions on topics such as minimum support prices (MSP) and the involvement of intermediaries. To successfully navigate the future, it is crucial to strike a delicate equilibrium between promoting market liberalisation and safeguarding the welfare of small and marginalised farmers.

INCOME SUPPORT SCHEMES

Government-initiated income support programmes, such as the Pradhan MantriKisanSammanNidhi (PM-KISAN), offer direct monetary aid to farmers. These projects enhance the economic prosperity of farmers by meeting their immediate financial requirements. To navigate the path ahead, it is necessary to evaluate the efficiency of these initiatives, broaden their scope, and guarantee prompt distribution of funds.

CROP INSURANCE PROGRAMS

Crop insurance programmes, such as the Pradhan MantriFasalBimaYojana (PMFBY), have the objective of safeguarding farmers against potential losses resulting from unforeseeable occurrences like droughts, floods, or insect infestations. It is essential to assess the efficacy of these insurance programmes, tackle concerns regarding the cost of premiums, and raise awareness among farmers in order to strengthen the resilience of the agriculture sector.

SOIL HEALTH CARD SCHEME

The Soil Health Card Scheme aims to encourage sustainable agricultural practices by equipping farmers with comprehensive information regarding the condition of their soil. In order to successfully navigate the future course, it is imperative to achieve extensive acceptance of soil testing, effective distribution of information, and assistance to farmers in adopting soil health recommendations.

NATIONAL MISSION FOR SUSTAINABLE AGRICULTURE (NMSA)

The National Mission for Sustainable Agriculture prioritises the implementation of farming techniques that are both adaptable to climate change and environmentally beneficial. To successfully navigate the future, it is necessary to synchronise NMSA with technological progress, advocate for efficient water usage, and promote the adoption of agro-ecological methods for sustainable agriculture.

PRADHAN MANTRIKRISHISINCHAYEEYOJANA (PMKSY)

The primary objective of PMKSY is to enhance water utilisation efficiency by means of water resource development, effective water allocation, and precision irrigation. To successfully navigate the way ahead, it is necessary to consistently improve irrigation infrastructure, encourage the use of water-saving technology, and ensure fair distribution of water resources.

- SKILL DEVELOPMENT INITIATIVES

Initiatives aimed at developing skills, like the Pradhan MantriKaushalVikasYojana (PMKVY), play a crucial role in empowering rural youth by equipping them with the necessary skills for various livelihood opportunities. To successfully navigate the future, it is necessary to broaden the reach of these initiatives, adapt them to the changing demands of the labour market, and encourage entrepreneurship among rural workers.

- INTEGRATED FARMING SYSTEMS

Integrated Farming Systems (IFS) advocate for a comprehensive approach to agriculture by incorporating crops, livestock, and other agricultural operations. In order to successfully navigate the future course, it is imperative to advocate for the promotion of Integrated Farming Systems (IFS) as a sustainable and economically feasible model. This entails offering assistance to farmers in adopting integrated practices and sharing exemplary methods with a wider audience.

- WOMEN-CENTRIC POLICIES

The MahilaKisanSashaktikaranPariyojana (MKSP) and other government policies targeting women in agriculture have the objective of enhancing the empowerment of female farmers. To successfully navigate the route ahead, it is crucial to enhance these programmes, tackle difficulties that specifically affect genders, and encourage the active involvement of women in decision-making processes concerning agricultural and rural development.

- MARKET REFORMS AND AGRI-INFRASTRUCTURE

The implementation of market reforms, such as the formation of Agricultural Produce Market Committees (APMC) and the introduction of e-NAM (National Agriculture Market), aims to construct a clear and effective agricultural market. To navigate the future successfully, it is necessary to tackle obstacles in the market's infrastructure, encourage equitable trading practices, and utilise technology to achieve smooth market integration. Rural India needs a comprehensive approach to develop and implement policies as it moves forward. To achieve a resilient, sustainable, and prosperous future for the agriculture sector and livelihoods in rural India, it is essential to consider the needs and concerns of different stakeholders, promote inclusivity for marginalised communities, and adjust policies to address emerging challenges. In the subsequent sections, we will thoroughly examine the influence of these policies and examine case studies that provide insight into their efficacy in various circumstances.

6.8 CONCLUSION

Within the expansive fabric of rural India, our final investigation reveals the complex interaction between historical inheritances, present-day difficulties, and the capacity for change inherent in legislation, technical advancements, and many means of making a living. As we explore the fields, marketplaces, and communities, we gain a sophisticated comprehension that goes beyond the usual stories about agriculture and livelihoods. This provides us with a view into the complex and diverse aspects of rural development. The historical viewpoints revealed the ancient origins of Indian

agriculture, charting its development through several civilizations, invasions, and revolutions. The chapters elucidated the contemporary obstacles seen by the agriculture industry, encompassing antiquated farming methodologies, water scarcity issues, and the economic hardships experienced by small and marginalised farmers. The story thereafter shifted its focus to optimism, exploring the influence of technology as a catalyst for transformation, tackling issues related to irrigation, advocating for the cultivation of a variety of crops, and envisioning alternative livelihoods beyond conventional agriculture. Technological interventions have emerged as a promising solution, revolutionising rural areas through the implementation of precision farming, advanced equipment, and digital platforms. The issue of water scarcity was tackled by implementing sustainable water management techniques, while diversifying crops offered advantages in terms of economy, ecology, and society. People's means of making a living broadened to include activities like as raising animals, fishing, cultivating gardens, and engaging in non-agricultural business ventures. The government implemented regulations to navigate the intricate path ahead, aiming to strike a balance between market liberalisation, bolstering farmers' income, and fostering sustainable practices.

At the end, we find ourselves facing various opportunities and difficulties, acknowledging that the path to rural prosperity is a continuous endeavour that necessitates cooperation, flexibility, and persistent endeavours. The effectiveness of policies, technical advancements, and the expansion of income sources depends on their influence at the local level, specifically on the farms, households, and communities that are the foundation of rural India.As we conclude this chapter, the future ahead presents itself with both potential and obligation. Continued vigilance is necessary to oversee the execution and consequences of policies, guaranteeing their delivery to the intended recipients and their positive influence on the welfare of the agricultural community. Technological progress should prioritise inclusivity, by narrowing the gap in digital access and equipping farmers with the necessary knowledge and instruments to achieve success.

The demand for sustainable methods resonates across every furrow of the field and ripple of the water source. Ensuring a harmonious coexistence between economic expansion and environmental conservation is crucial for the long-term sustainability of agriculture in light of climate change and limited resources. The case studies exemplify the stories of success and creativity, demonstrating that the seeds of change have already been planted. Through assimilating knowledge from previous encounters, expanding effective frameworks, and modifying techniques to fit specific circumstances, the future trajectory becomes more evident. Ultimately, rural India finds itself at a crucial point that necessitates united efforts, forward-thinking policies, and a dedication to promoting comprehensive and sustainable progress. The chapters revealed the various difficulties and possibilities, but the genuine story is shaped by the diligent labourers, inventive thinkers, and hopeful individuals who aspire for a better tomorrow. As the sun sets over the rural landscapes, a sense of hope emerges. This hope extends beyond the words written in this chapter and finds its place in the fields, where the potential for prosperity is fostered through the collaborative endeavours of communities, policymakers and forward-thinking individuals. The future may provide difficulties, but it is also characterised by the ability to recover quickly, the introduction of new ideas, and the determined attitude of rural India.

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Recent Trends of Entrepreneurship and Industrialization for Rural Development

CHAPTER-07

EMPOWERING RURAL INDIA THROUGH CONTEMPORARY ENTREPRENEURSHIP AND INDUSTRIALIZATION IN THE HANDICRAFT SECTOR

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ABSTRACT

This chapter delves into the transformative potential of contemporary entrepreneurship and industrialization within India's handicraft sector, aiming to elucidate their role in rural empowerment and sustainable development. Enriched by a vibrant heritage woven into centuries of tradition and artistry, Indian handicrafts hold profound cultural significance while embodying livelihoods and community identities. Through a comprehensive exploration, the chapter navigates the historical foundations of these crafts, charting their evolution amid modern challenges, including limited market access, technological discrepancies and financial constraints, which hinder rural artisans' growth. The role of entrepreneurship emerges as a catalyst, reshaping traditional crafts into sustainable ventures and fostering skill development, community engagement and economic upliftment. Concurrently, industrialization and technological integration amplify scalability and quality enhancement without compromising authenticity, revitalizing the sector. The chapter scrutinizes government interventions, identifying both impactful contributions and areas necessitating refinement to align more effectively with artisans' practical needs. Furthermore, it outlines challenges as opportunities, advocating adaptive strategies and agile frameworks to harness innovation, sustainability and market expansion. Looking ahead, the chapter emphasizes sustainable growth through education, training and capacity-building programs, envisioning a future where India's handicraft sector thrives as a symbol of rural empowerment and sustainable development, inspiring stakeholders, policymakers and consumers to action.

Key words: Handicraft Sector, Entrepreneurship, Industrialization, Rural Empowerment, Sustainable Development, Challenges, Opportunities etc.

7.1 INTRODUCTION

India boasts a vibrant heritage of handicrafts deeply interwoven into its cultural fabric, tracing its roots through centuries of tradition and artistry. These handicrafts, nurtured in rural communities, hold significant value beyond artistic expression. They embody livelihoods, heritage and community identity. In contemporary times, the convergence of entrepreneurship and industrialization has emerged as a potent force for transforming these age-old crafts into sustainable sources of income and empowerment. This chapter seeks to explore and analyze the pivotal role that contemporary entrepreneurship and industrialization play in empowering rural India, particularly in the handicraft sector. The handicraft sector in India stands as a testament to the country's rich cultural heritage and

the skilled craftsmanship embedded in its rural communities. For centuries, these artisanal practices have been the backbone of rural economies, reflecting diverse traditions, creativity and artistry passed down through generations.

This chapter explores the transformative potential of contemporary entrepreneurship and industrialization within India's handicraft sector, highlighting their capacity to empower rural communities, revitalize traditional crafts and foster sustainable development. By integrating modern business practices, market access and managerial skills, entrepreneurship can catalyze the growth of rural artisanal communities, while industrialization aids in scaling production, enhancing quality and meeting evolving market demands without compromising the authenticity intrinsic to these artisanal products. The subsequent sections delve deeper into historical foundations, contemporary challenges, the role of government policies and strategies for sustainable growth, envisioning a future where entrepreneurship and industrialization serve as linchpins for rural empowerment and socio-economic development in the handicraft sector.

7.1.1 INDUSTRIALIZATION AND TECHNOLOGICAL INTEGRATION

The industrialization of handicrafts in India marks a pivotal transition, amalgamating the essence of artisanal craftsmanship with the efficiency and scalability of industrial processes. This shift has been instrumental in preserving the authenticity of traditional crafts while fostering their widespread reach and commercial viability. Technological integration has played a crucial role in this transformation, revolutionizing the sector's dynamics. Digital marketing strategies, e-commerce platforms and modern production methodologies have redefined the landscape of traditional crafts. These technological interventions have not only enhanced the productivity and quality of artisanal products but have also broadened their market horizons. From embracing e-commerce platforms to employing advanced machinery for intricate craftsmanship, the integration of technology has enabled artisans to uphold their traditional practices while meeting contemporary market demands.

This section emphasizes the pivotal role of industrialization and technological integration in bolstering the handicraft sector's growth and ensuring its relevance in today's dynamic marketplace. Through illustrative examples, it elucidates the transformative impact of technology on preserving heritage crafts and propelling them towards sustainable futures.

7.1.2 GOVERNMENT INITIATIVES AND POLICIES

Government interventions in India's handicraft sector hold significant sway in shaping the industry's dynamics and supporting rural artisans. A comprehensive evaluation of these initiatives reveals both their impactful contributions and areas necessitating refinement. This section meticulously examines the spectrum of government schemes, policies and initiatives directed towards fortifying the rural handicraft landscape. It scrutinizes their efficacy, implementation mechanisms and tangible outcomes, gauging their alignment with the practical needs and aspirations of the artisans.

By critically analyzing the strengths and limitations of these interventions, it aims to underscore the pivotal role of policy reforms in fostering sustainable growth, promoting innovation and addressing the nuanced challenges faced by artisans. Through this assessment, it endeavors to outline a

roadmap for refining governmental approaches and ensuring their efficacy in driving holistic development within the handicraft sector.

7.3 CHALLENGES AND OPPORTUNITIES

The handicraft sector, despite its richness and heritage, encounters a myriad of challenges that necessitate a comprehensive analysis to enable sustainable growth. This section critically examines the multifaceted hurdles thwarting the sector's advancement, ranging from market saturation to the evolving landscape of consumer preferences. By delving into these challenges, it aims to provide a nuanced understanding of the complexities hindering the sector's progress.

Moreover, this segment meticulously identifies latent opportunities within the realm of innovation, sustainability and market expansion. By illuminating these prospects, it aspires to pave the way for adaptive strategies and agile frameworks that can harness these opportunities for the sector's benefit. The discussion is poised to shed light on the essential balance required between addressing challenges and capitalizing on opportunities to foster a vibrant and resilient handicraft ecosystem.

7.4 FUTURE DIRECTIONS AND SUSTAINABILITY

Absolutely, the handicraft sector's trajectory hinges upon its ability to embrace sustainability while navigating the dynamic landscape. This segment delves into imperative strategies tailored for long-term sustenance. Education, training and capacity-building programs are identified as pivotal tools for empowering artisans, cultivating their entrepreneurial acumen and fostering self-sufficiency.

The discussion lays out a comprehensive roadmap delineating the crucial elements for sustainable growth, placing emphasis on skill enrichment, diversifying market outreach and integrating technology seamlessly into traditional craftsmanship. Furthermore, this segment endeavors to forecast forthcoming trends and potential developments within the industry, providing insights into the sector's future direction and possibilities.

7.5 CONCLUSION

The chapter's exploration of the interplay between contemporary entrepreneurship, industrialization and India's handicraft sector underscores the sector's pivotal role in rural empowerment and economic sustenance. Throughout history, Indian handicrafts have stood as a testament to cultural heritage, serving as a cornerstone of rural economies and livelihoods. The contemporary landscape unveils a dichotomy – rich cultural heritage juxtaposed with multifaceted challenges. Challenges include limited market access, technological obsolescence, financial constraints and exploitative market dynamics that hinder artisans' growth and sustainability. Despite these hurdles, the resilience of artisans and grassroots initiatives stands as a beacon of hope, hinting at possibilities for revival.
Entrepreneurship emerges as a transformative force, reshaping traditional crafts into viable ventures while fostering skill development, community engagement and economic upliftment. Concurrently, industrialization and technological integration offer scalability and quality enhancement without compromising authenticity. Government interventions, though impactful, necessitate refinement to better address artisans' practical needs and aspirations. The chapter delineates challenges as

opportunities, advocating adaptive strategies and agile frameworks to harness innovation, sustainability and market expansion. Looking forward, sustainable growth hinges upon education, training and capacity-building programs, empowering artisans and nurturing their entrepreneurial spirit. The sector's future trajectory depends on striking a delicate balance between tradition and innovation, leveraging technology and entrepreneurship while preserving cultural roots. This chapter serves as a call to action for stakeholders, policymakers and consumers, envisioning a future where India's handicraft sector thrives as a symbol of rural empowerment and sustainable development.

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Recent Trends of Entrepreneurship and Industrialization for Rural Development

CHAPTER-08

DAIRY AND LIVESTOCK MANAGEMENT IN RURAL INDIA

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8.1 INTRODUCTION

In rural India, milk and animal care are very important to the farming economy and help millions of people make a living. This abstract gives a quick look at the most important parts of managing dairy and cattle, including their economic importance, the problems they face, and the chances for long-term growth.A lot of people in rural India depend on the dairy industry as their main source of income. Small and marginal farms often do dairy farming as an extra way to make money, which is very important for the growth of the rural economy. Livestock, like cattle, goats, and chickens, also play a big part because they provide rural families with a variety of ways to make money and food.Even though it's important, dairy and cattle management has problems, like not enough veterinary services, not enough infrastructure, and unstable prices. These problems make it harder for the sector to grow and keep rural areas from getting the social and economic benefits they deserve. In order to solve these problems, we urgently need policy changes that focus on making medical facilities better, encouraging environmentally friendly practices, and strengthening market connections.In conclusion, the overall success of rural India depends on the long-term growth of dairy and livestock management. Unlocking the full potential of this sector will require a multifaceted approach that includes policy support, new technology, and community involvement. This will lead to better livelihoods, food security, and total rural prosperity.

There is a rich and complicated tapestry of tradition that is unfolding in the timeless landscapes of rural India. This is a place where the close interaction that exists between humans and animals has been weaving the fabric of agrarian life for millennia. Dairy and livestock management emerge as key components, providing sustenance, tradition, and a means of life to a large number of villages. This is set against the backdrop of rich fields and the rhythmic symphony of nature. There are a variety of animals that traverse these landscapes, including cattle, buffalo, goats, and poultry, which exemplify the richness and resiliency of the nation's agricultural heritage. 'Gau Mata' is a beloved cow in Hindu mythology, and it represents not just a source of milk but also an embodiment of the divine. Animals that are used for ploughing become partners in the agricultural journey because of their rhythmic ploughing technique. However, as the winds of change blow across these landscapes, spurred by

technological advancements, fluctuations in climate, and the dynamics of the market, conventional methods are confronted with problems that have never been seen before. Over the course of this chapter, we will start on a quest to uncover the complexities of dairy and cattle management in rural India. We will also investigate the delicate balance that exists between modernization and tradition. As we delve into the twin narrative of resilience and transition that defines the present and future of dairy farming in the wide canvas of rural India, we do so through the prism of history, cultural significance, and economic relevance. Each of these three factors plays a significant role in our investigation.

8.2 TRADITIONAL PRACTICES

In the heartlands of rural India, farming is based on old ways of taking care of animals that are deeply rooted in culture and family customs. Small herds of cattle, buffalo, goats, and chickens are kept by families, who often live in close-knit communities. These animals play many important parts in the agricultural ecosystem. In Hindu society, the cow, which is revered as "Gau Mata," has a holy place because it gives milk and has spiritual meaning. The toughness and flexibility of buffaloes make them popular in places where being able to handle changes in the weather is important. Everyday life in this traditional setting is planned around what the animals need. There is a timeless rhythm to the beautiful scenes of cows grazing in open fields and families milking their cows under the shade of old trees. Draught animals, usually oxen, plough the fields, making them an essential part of the hard work that goes into farming. People and their animals have a complicated relationship that goes beyond just doing business. The animals are seen as part of the family and are treated as such. Of course, there are problems with these customs, even though they are beautiful. Concerns have been raised about the low output of traditional methods, which are often blamed on bad feeding methods, a lack of medical care, and the popularity of native breeds that produce less milk. Traditional dairy farming methods can't be scaled up because they don't have modern structures like efficient systems for collecting and transporting milk, storage facilities, and processing units. Traditional ways of doing things are at a crossroads because climate trends are changing and markets are changing. This makes us rethink how long these ways will last. This chapter goes into great detail about these old ways of doing things, showing how strong they are and how hard it is to find the right balance between protecting cultural heritage and making big changes that will help rural towns thrive.

8.3 CHALLENGES IN TRADITIONAL DAIRY FARMING

Traditional dairy farming in rural India faces many problems that make it hard to keep going and work well, even though it is important to culture and has deep roots in tradition.

- **LOW PRODUCTIVITY**

One of the most significant issues is the low productivity that is inherently associated with the use of traditional methods. When compared to their modern equivalents, indigenous breeds typically produce less milk, despite the fact that they do have important cultural significance. Additional factors that contribute to this difficulty include suboptimal feeding practices and restricted access to nutritional supplements, both of which have an effect on the overall output of dairy farming companies.

- **LACK OF INFRASTRUCTURE**

Traditional dairy farming is frequently carried out in regions that do not have the necessary infrastructure to facilitate the collection, transportation, and processing of milk in an effective manner. Consequently, not only does this make it more difficult to transport milk to markets on time, but it also lowers the quality of the milk. The lack of cold storage facilities makes these difficulties even more difficult to deal with, particularly in areas where there is a substantial amount of temperature variation.

- **DIFFICULTY IN OBTAINING CREDIT FACILITIES**

Small-scale dairy producers, who primarily adhere to traditional farming methods, have a tough time gaining access to credit facilities. The lack of financial support that they receive makes it difficult for them to make investments in enhanced breeds, advanced veterinary care, and contemporary technology that have the potential to increase output. As a consequence of this, a great number of farmers find themselves caught in a continuous cycle of subsistence, unable to break free and adopt strategies that are more effective.

- **EXPOSURE TO CLIMATE CHANGE**

The conventional dairy farming industry is vulnerable to the effects of climate change. There are issues in maintaining the health and well-being of the cattle as a result of the variability in weather patterns, which affects the availability of fodder and water. The rising incidence of diseases, which is frequently made worse by the changing conditions of the climate, offers additional dangers to the conventional farming practices that have been used for generations.

- **THE DYNAMICS OF THE MARKET**

Traditional dairy farmers frequently face enormous challenges when attempting to navigate the complexity of modern marketplaces. A number of substantial problems are presented, including fluctuating demand, price instability, and the requirement to comply to quality standards. Traditional farmers are at a disadvantage when it comes to negotiating prices for their produce since they lack information about the market and have restricted bargaining power than other farmers.

8.4 GOVERNMENT INITIATIVES

In light of the fact that dairy and livestock management play a crucial part in the rural economy, the government of India has launched a number of strategic initiatives with the intention of enhancing the sector and providing traditional farmers with more power. In comparison to previous initiatives, the **National Dairy Plan (NDP)** stands out as a comprehensive programme that was initiated in 2012 with the intention of raising milk output and improving the livelihoods of dairy farmers. The National Democratic Party is committed to advancing scientific breeding, enhancing milk processing capacities, and improving animal nutrition at the same time. Through the use of artificial insemination services, the strategy intends to solve the problem of poor productivity that is linked with traditional farming practices. This will be accomplished by introducing breeds that are both disease-resistant and high-yielding.

Not only does this result in an increase in the quantity and quality of milk produced, but it also make a contribution to the overall health and happiness of the livestock at large. The government has also

introduced the **Pradhan Mantri Matsya Sampada Yojana (PMMSY)**, which is a programme that incorporates fisheries and animal husbandry. This programme is in addition to the **National Democratic Party (NDP)**. This holistic approach acknowledges the interconnection of different agricultural practices and seeks to increase the income of farmers who are engaged in these sectors of agriculture. Through the promotion of environmentally responsible methods and the provision of assistance for the development of infrastructure, the PMMSY addresses the issues that are encountered by traditional livestock farmers. In addition, programmes headed by the government place particular emphasis on the establishment and development of rural dairy cooperatives.

The facilitation of collective action, resource pooling, and market access on the part of these cooperatives is an essential component in the process of empowering farmers. Through the establishment of a unified front, small-scale dairy farmers are able to negotiate better prices for their produce, gain access to financial facilities, and reap the benefits of common resources such as veterinary services and modern infrastructure. These programmes not only play a significant role in tackling the issues that conventional dairy farming is currently facing, but they also contribute to the general socio-economic development of rural communities.

Through the implementation of certain regulations and the provision of financial assistance, the government intends to establish an environment that is conducive to the transition of farmers from conventional farming methods to methods that are more environmentally friendly and lucrative. The impact of these programmes is investigated in this chapter, with a focus on identifying success stories and potential areas for improvement in the role that the government plays in defining the future of dairy and livestock management in rural India.

▪ MODERNIZING DAIRY FARMING

The modernization of dairy farming has emerged as a primary priority for several stakeholders in rural India as a response to the changing environment of agriculture and the requirement for higher productivity. The transformation incorporates a number of different aspects with the goal of improving several aspects, including efficiency, sustainability, and the general well-being of farmers and animals collectively.

▪ IMPROVED BREEDING PRACTICES

The adoption of breeds that are genetically superior and have high yields is one of the most important aspects of the modernization of dairy farming. There is a preference for some breeds of cows, such as Holstein Friesian and Jersey cows, due to their elevated milk production and their ability to adapt to contemporary farming techniques. The concern of low productivity that is associated with traditional indigenous breeds is being addressed by the widespread promotion of artificial insemination services. This is being done to ensure a controlled and enhanced genetic pool.

▪ MANAGEMENT OF NUTRITION

In today's dairy farming industry, there is a great emphasis placed on ensuring that livestock receive the best possible nutrition. Implementation of feed practices that are scientifically developed and balanced is being done in order to fulfil the nutritional requirements of the animals, which will

ultimately improve their health and production. In order to achieve the highest possible milk production, this includes the utilisation of extra feed, mineral supplements, and cutting-edge feeding methods.

- **TECHNOLOGICAL INTERVENTIONS**

The use of technology is causing a revolution in the dairy farming industry in rural India. The dissemination of knowledge regarding best practices, market trends, and veterinary care is being accomplished through the use of digital platforms and mobile applications. Smart farming technology, such as automated milking systems, biometric identification, and precision farming equipment, are progressively making their way into rural dairy setups. These technologies are helping to streamline operations and improve overall efficiency.

- **MODELS OF COOPERATIVES**

The modernization of dairy farming frequently entails the establishment of dairy cooperatives and the strengthening of those cooperatives. Farmer empowerment is achieved through the promotion of collective action, resource pooling, and market access through the use of cooperative arrangements. Farmers are able to negotiate better pricing, gain access to credit facilities, and invest in common resources such as new equipment and infrastructure when they collaborate with one another.

8.5 CHALLENGES IN ADOPTION OF MODERN PRACTICES

The acceptance of contemporary procedures faces a number of hurdles, particularly among small-scale and traditional farmers, despite the fact that the modernization of dairy farming in rural India holds the potential of greater production and economic growth through the implementation of modern practices.

- **AWARENESS AND EDUCATION**

A significant barrier to the adoption of modern dairy farming practices is the lack of awareness and education among farmers. Many traditional farmers, deeply rooted in age-old practices, may be unaware of the benefits and intricacies of modern techniques. Extension services, farmer training programs, and awareness campaigns are crucial to disseminate knowledge and encourage the adoption of advanced practices.

- **AVAILABILITY OF RESOURCES**

Small-scale farmers frequently have challenges in gaining access to the critical resources that are necessary for modern dairy farming activities. It is a significant obstacle to have access to loans in order to make investments in enhanced breeds, high-quality feed, and technological advancements. Initiatives from the government and partnerships with the corporate sector are required in order to guarantee that farmers who are prepared to transition to more contemporary and environmentally friendly farming methods have access to the necessary financial resources.

- **INFRASTRUCTURE DEVELOPMENT**

The availability of supportive infrastructure is a critical factor in determining whether or not modern dairy farming practices are successfully brought into use. A significant number of rural areas do not

possess the facilities that are required for the efficient collection, transportation, and processing of milk. Therefore, it is very necessary to make investments in cold storage, processing units, and transportation networks in order to establish an environment that is conducive to the shift to modern methods.

- **TECHNOLOGICAL LITERACY**

In order to successfully implement technology in contemporary dairy farming, farmers need to possess a particular level of technological literacy. It is crucial to provide farmers with training programmes that concentrate on the use of digital platforms, mobile applications, and smart farming technology in order to provide them with the skills necessary to navigate the current agricultural landscape.

- **RESISTANCE TO CHANGE**

The cultural fabric of rural communities is heavily rooted in the conventional farming practices that have been used for generations. It is possible that a considerable obstacle will be presented by resistance to change on the part of both farmers and local populations. In order to overcome this opposition, it is necessary to not only educate people about the advantages of contemporary farming practices, but also to recognise and respect the cultural relevance of old farming methods.

- **THE COST OF TRANSITION**

The process of transitioning to contemporary dairy farming operations typically involves initial fees for the acquisition of improved breeds, investments in technology, and upgrades to infrastructure. It is possible that these expenses will be exorbitant for small-scale farmers; therefore, it is vital to have financial support mechanisms, subsidies, or incentives in place in order to allow a transition that is more seamless.

- **ACCESS TO THE MARKET AND QUALITY STANDARDS**

The implementation of modern farming practices frequently necessitates the enforcement of high-quality standards. There is a possibility that small-scale farmers will encounter difficulties in maintaining these requirements and gaining access to markets that require such quality assurances. It is vital to provide farmers with support in the form of quality certification and market linkages in order to guarantee that they will be able to exploit the economic benefits of modernization.

8.6 SUSTAINABLE LIVESTOCK MANAGEMENT

Within the context of rural India, the concept of sustainable livestock management is gaining importance as a response to the growing realisation of the environmental and socio-economic impact that livestock production has. At the same time that it places an emphasis on environmental stewardship, social responsibility, and economic viability, this strategy aims to strike a balance between the needs of the present and the ability of future generations to meet their own needs.

- **Agroecological Principles :** Sustainable livestock management incorporates agroecological concepts, which promotes a holistic approach that takes into consideration the links that exist between animals, crops, and the environment. To maximise agricultural output while minimising

the use of external inputs like synthetic fertilisers and pesticides, agroecology places an emphasis on the utilisation of natural processes and biodiversity as a means of increasing agricultural productivity.

- **Recycling of Waste :** The recycling of waste that is produced by livestock is an essential component of environmentally responsible livestock management. Animal dung, when properly managed, has the potential to be an invaluable resource for organic fertiliser, making a positive contribution to the health of the soil and reducing the degree to which chemical fertilisers are utilised. The implementation of this closed-loop system is in line with sustainable agriculture methods, which helps to encourage an approach that is more circular and resource-efficient.
- **Organic Farming Methods :** A significant number of farmers who are committed to the management of their livestock in a sustainable manner choose to use organic farming methods. To do this, it is necessary to steer clear of synthetic inputs and genetically engineered organisms, while also fostering crop rotation and biodiversity. The goals are to increase the fertility of the soil, reduce the negative influence on the environment, and produce products that are of high quality and do not contain any chemicals.
- **Climate Resilience :** The issues that are brought by climate change are addressed by sustainable livestock management, which is the fourth component of climate resilience. Creating farming systems that are resilient to the effects of climate change requires the use of practices such as rotational grazing, agroforestry, and water conservation. The long-term viability of farming methods can be ensured through the use of sustainable livestock management practices, which involve the adaptation to shifting climate patterns and the mitigation of environmental stresses.
- **Participation in the Community :** A fundamental principle of sustainable livestock management is the concept of social responsibility. The incorporation of local communities into decision-making processes, the promotion of fair labour standards, and the consideration of the cultural and social aspects of farming are all vital components. Community-based initiatives that contribute to the overall sustainability of livestock management are those that develop a sense of ownership and collective responsibility within the livestock population.
- **Concern for Animals :** Sustainable livestock management lays a significant emphasis on considering the well-being of animals. The provision of animals with sufficient space, appropriate feed, and access to clean water is not only necessary from an ethical standpoint, but it is also mandatory for the purpose of preserving the health of the livestock and maximising their productivity. It is consistent with the overarching objectives of sustainable farming to incorporate the treatment of animals in a humane and ethical manner.

8.7 SCHEMES-PROGRAMMES FOR LIVESTOCK & DAIRY

The role of employment in poverty-reduction programmes in developing countries has received considerable attention worldwide, in development strategies and policies. Many new employment opportunities in many developing countries are created in the informal sector whose rate of growth may be higher than that of the formal sector. Some important programmes are given here

8.7.1 RASHTRIYA GOKUL MISSION (RGM)

The RashtriyaGokul Mission (RGM) has been in effect since December 2014 with the objective of promoting the growth and preservation of native bovine breeds. The initiative plays a crucial role in improving milk output and productivity of cattle to satisfy the increasing demand for milk, while also making dairy farming more profitable for rural farmers in the country. The plan is further extended as part of the RashtriyaPashudhanVikasYojna umbrella scheme, spanning from 2021 to 2026, with a budget allocation of Rs.2400 crore. The implementation of the RGM will lead to increased production and advantages of the plan, extending to all cattle and buffaloes in India, particularly benefiting small and marginal farmers. This plan will specifically help women, as they are responsible for more than 70% of the labour involved in cattle farming.

OBJECTIVES OF THE SCHEME

- **a)** To optimise the efficiency of cattle and achieve a sustainable increase in milk output through the utilisation of advanced technologies.
- **b)** To promote the utilisation of bulls with superior genetic qualities for breeding reasons.
- **c)** To improve the coverage of Artificial Insemination by strengthening the breeding network and providing doorstep delivery of Artificial Insemination services to farmers.
- **d)** To facilitate the scientific and comprehensive promotion of indigenous cattle and buffalo rearing and conservation.

8.7.2 NATIONAL LIVESTOCK MISSION

The project primarily emphasises the growth of business and the enhancement of breeding in poultry, sheep, goats, and piggery, which includes the creation of feed and fodder. The scheme is executed through the incorporation of the subsequent three Sub-Missions:

- **a)** The Sub-Mission on Breed Development of Livestock & Poultry focuses on improving the genetic traits and characteristics of livestock and poultry breeds.
- **b)** The Sub-Mission on Feed and Fodder development aims to enhance the quality and availability of feed and fodder for livestock and poultry.
- **c)** Taskforce on Expansion and Advancement

8.6.3 LIVESTOCK HEALTH AND DISEASE CONTROL

The Livestock Health & Disease Control initiative seeks to improve the animal health industry by implementing preventative vaccination programmes for various diseases in livestock and poultry, enhancing capacity building, conducting disease surveillance, and developing veterinary infrastructure.The implementation of the scheme is expected to result in the prevention and control of diseases, leading to their eventual eradication. It will also increase access to veterinary services, improve animal productivity, and enhance trade in livestock and poultry products. Additionally, it will contribute to the improvement of the socio-economic status of livestock and poultry farmers. The financing for the CADCP and the non-recurring components of ESVHD is entirely provided by the central government. For the remaining components, as well as for ASCAD, the funding is shared between the central government and the state government in a ratio of 60:40. However, for hilly and

northeastern states, the ratio is 90:10, and for union territories, the funding is provided entirely by the central government.

Objective : The objectives of the scheme are -

a) The objective is to execute a Critical Animal Disease Control Programme with the aim of eradicating Peste des Petits Ruminants (PPR) by 2030. This will be achieved by vaccinating all sheep and goats. Additionally, the programme aims to control Classical Swine Fever (CSF) by vaccination the entire pig population. Another goal is to offer veterinary services directly to farmers by means of Mobile Veterinary Units (MVUs).

b) The objective of the Assistance for Control of Animal Disease (ASCAD) programme is to aid States/UTs in preventing and controlling livestock and poultry illnesses that are widespread in different regions, according to the specific priorities of each State/UT.

8.7.4 NATIONAL PROGRAMME FOR DAIRY DEVELOPMENT (NPDD)

The objective of the NPDD project is to improve the quality of milk and milk products and to increase the proportion of milk that is procured through organised channels. The scheme consists of two components :

Component 'A' : The objective is to improve and expand the infrastructure for advanced milk testing equipment and primary chilling facilities for State Cooperative Dairy Federations, District Cooperative Milk Producers' Union, and privately-owned dairies operated by Self-Help Groups. Dairy Farmer Companies, and Farmer Producer Organisations. The project will be implemented nationwide for duration of five years, starting from 2021-22 and ending in 2025-26.

Component 'B' : Dairying through cooperatives offers financial aid from the Japan International Cooperation Agency (JICA) in accordance with the project agreement that has previously been executed with them. This is an externally funded project that is planned to be carried out from 2021-22 to 2025-26 as a pilot initiative in Uttar Pradesh and Bihar. The main goal is to establish essential dairy infrastructure in order to facilitate market connections for agricultural products in rural areas and to enhance the capacity of institutions involved at various levels, from villages to the state.

8.7.5 ANIMAL HUSBANDRY STATISTICS (AHS)

The Animal Husbandry Statistics (AHS) Division of the Department of Animal Husbandry & Dairying (DAHD) is tasked with generating Animal Husbandry Statistics as part of the development projects categorised under the Centrally Sponsored Scheme "Livestock Census and Integrated Sample Survey." This approach comprises two components: (i) Livestock Census (LC) and (ii) Integrated Sample Survey (ISS). The initiative is being implemented by the Department of Animal Husbandry and Dairying in partnership with State Animal Husbandry Departments.

Division's Mandate : Here are the given mandate

a) Doing a Livestock Census (LC) every five years.

b) Doing an Integrated Sample study (ISS) every year as a sample study.

c) To publish a "All India Livestock Report" that lists the number of animals of the main species at the national and state/UT levels, broken down by use, sex, and age.

d) Putting out a breed-by-breed report based on the most recent animal Census, which will include detailed maps of the total and separated breed-by-breed animal populations.

e) There will be a yearly report called Basic Animal Husbandry Statistics that will include estimates of how much milk; meat, eggs, and wool are produced.

8.7.6 NATIONAL ANIMAL DISEASE CONTROL PROGRAMME (NADCP)

The National Animal Disease Control Programme (NADCP) is a prominent initiative introduced by the Honourable Prime Minister in September 2019. Its objective is to control the spread of Foot & Mouth Disease and Brucellosis by vaccinating the entire population of cattle, buffalo, sheep, goats, and pigs for FMD. Additionally, all female bovine calves aged 4-8 months will be vaccinated for brucellosis. The total budget allocated for this programme is Rs. 13,343.00 crore for duration of five years (2019-20 to 2023-24). The primary objective of the National Animal Disease Control Programme for Foot-and-Mouth Disease (FMD) and Brucellosis (NADCP) is to achieve control over FMD through vaccination by the year 2025, followed by complete eradication of the disease by 2030. This will lead to a rise in domestic output and ultimately result in an increase in the export of milk and livestock products.

The implementation of an intensive Brucellosis Control programme in animals is intended to effectively manage the disease in both animals and humans. The National Animal Disease Control Programme for Foot-and-Mouth Disease (FMD) and Brucellosis, known as NADCP, is a scheme operated by the Central Government. Under this scheme, the Central Government will provide 100% of the cash to the States and Union Territories (UTs).

MAJOR ACTIVITIES UNDER NADCP FOR FMD AND BRUCELLOSIS

a) Administering mass vaccination against Foot-and-Mouth Disease (FMD) to all vulnerable bovines, small ruminants (sheep and goats), and pigs every six months.

b) Initial immunisation of young bovine calves (aged 4-5 months)

c) Administering deworming medication one month before vaccination

d) Nationwide, regional, local, and community-wide campaigns to promote awareness and generate public attention, including training government officials on how to implement the programme effectively.

e) Identifying specific animals for the programme by tagging their ears, registering them, and entering the data into the animal health module of the Information Network for Animal Productivity and Health (INAPH).

f) Recording immunisation information via Animal Health cards

g) Conducting serosurveillance/seromonitoring to monitor the antibody levels in the animal population.

h) Acquiring cold cabinets (such as ice liners and refrigerators) and FMD vaccine for storage.

i) Investigating and isolating the virus, as well as determining its type, in the event of an outbreak.

j) Keeping records and regulating the movement of animals through temporary quarantine/checkpoints.

k) Testing samples before and after vaccination to assess effectiveness.

l) Collecting data and regularly monitoring the program's impact.

m) Providing adequate compensation to vaccinators, with a minimum of Rs.3/- per vaccination dose and Rs.2/- per animal for ear-tagging and data entry.

8.7.7 DAIRY PROCESSING & INFRASTRUCTURE DEVELOPMENT FUND (DIDF)

The Union Budget 2017-18 established the Rs 8,004 crore Dairy Processing & Infrastructure Development Fund with National Bank for Agriculture and Rural Development. In its meeting on 12.09.2017, the CCEA authorised the proposal to provide subsidised loans @6.5% to capital-stressed milk cooperatives to replace their decades-old chilling and processing units and build value-added product factories. The project components of DIDF will cost Rs 10,881 crore, with Rs 8,004 crore from NABARD to NDDB/NCDC, Rs 2,001 crore from end borrowers, Rs 12 crore from NDDB/NCDC, and Rs 864 crore from DAHD for interest subvention. The project installs processing and chilling infrastructure and electronic milk adulteration testing equipment at village level to improve milk procurement. Eligible End Borrowers (EEBs) include State Dairy Federations, District Milk Unions, Milk Producers Companies, Multi State Cooperatives, and NDDB subsidiaries. The scheme would amend its funding duration from 2017-18 to 2019-20 to 2018-19 to 2022-23 and extend its payback period to 2030-31 with a spillover to the first quarter of FY 2031-32.

Objectives of the DIDF scheme : To modernize the milk processing plants and machinery and to create additional infrastructure for processing more milk.

8.7.8 ANIMAL HUSBANDRY INFRASTRUCTURE DEVELOPMENT FUND (AHIDF)

The Prime Minister of India has announced the establishment of a Rs. 15000 crore Animal Husbandry Infrastructure Development Fund (AHIDF) as part of the AtmaNirbhar Bharat Abhiyan stimulus package. The Animal Husbandry Infrastructure Development (AHIDF) has received approval to provide incentives for investments made by individual entrepreneurs, private companies, MSME, Farmers Producers Organisations (FPOs), and Section 8 companies. These investments are intended to establish infrastructure for

a) Dairy processing and value addition,
b) Meat processing and value addition, and
c) An Animal Feed Plant

To enhance the capacity for milk and meat processing and expand product variety, thus facilitating unorganised rural milk and meat producers' entry into the organised milk and meat market.

- To provide the producer with higher price realisation.
- The objective is to provide high-quality milk and beef products to the local consumer.

- To address the need for protein-rich, high-quality food for the expanding population of the country and combat malnutrition in one of the world's most malnourished child populations.
- Foster entrepreneurial activities and facilitate job creation.
- The objective is to enhance the export of milk and meat products and boost their overall contribution to the export industry.
- The objective is to provide high-quality concentrated animal feed to cattle, buffalo, sheep, goat, pig, and poultry, ensuring a balanced diet at cheap costs.

8.7.9 SUPPORTING DAIRY COOPERATIVES & FARMER PRODUCER ORGANIZATIONS

The approval of a programme called "Supporting Dairy Cooperatives and Farmer Producer Organisations engaged in dairy activities" allows for the provision of a loan for operating capital to State Cooperatives and Federations. A sum of Rs. 303 crores have been disbursed to the National Dairy Development Board till December 2021 for the execution of the programme.

Objectives : The objective is to support the State Dairy Cooperative Federations by offering them a soft working capital loan to help them overcome financial difficulties caused by extremely unfavourable market conditions or natural disasters.

- To ensure consistent and reliable market opportunities for dairy farmers.
- The objective is to ensure that State Cooperative Dairy Federations can consistently and promptly pay the dues owed to farmers.
- The objective is to empower the cooperatives to purchase milk from farmers at a profitable price, even during periods of high milk production.

Due to the economic challenges caused by the Covid-19 lockout, the dairy cooperatives and Producer Owned Institutions have had financial difficulties. As a result, it has been determined that the "Interest Subvention on working capital loans" component would be included in the scheme for the year 2020-21, with a budget of Rs. 100 crores. Meanwhile, the provision for working capital loans under the scheme has been temporarily halted during the fiscal year 2020-21. The Standing Finance Committee (SFC) led by Secretary (AHD), has raised the allocation for "interest subvention on working capital loan" to Rs. 203 Crore, in response to the high demand. The allocation for the "working capital loan component" was maintained in abeyance for the fiscal year 2021-22 as well, with the purpose of offering interest subvention on working capital loans.

The Department is implementing the interest subvention component in collaboration with NDDB. The initiative offers a 2% annual interest subsidy on working capital loans obtained by qualifying Participating Agencies (PAs) from banks and financial institutions. In order to ensure prompt and timely repayment, an additional interest subvention of 2% per annum will be required at the conclusion of the loan repayment period. The eligible products for obtaining working capital loans include Skimmed Milk Powder (SMP), Whole Milk Powder (WMP), White Butter, and Ghee. The Union Cabinet has approved the implementation of the Supporting Dairy Cooperatives and Farmer Producer Organisations engaged in dairy activities (SDCFPO) as a component of the Umbrella Scheme "Infrastructure Development Fund" from 2021-22 to 2025-26, with a budget of Rs 500 Cr.

8.7.10 CONCLUSION

Within the expansive landscape of rural India, the process of managing dairy and livestock emerges as a dynamic and intricate pattern, composed of elements of tradition, difficulties, and the capacity for transformation. Examining ancient methods uncovers the complex interplay between humans and their cattle, characterised by deep cultural origins and mutually beneficial connections. Nevertheless, as the forces of transformation affect the rural farming areas, the difficulties encountered by conventional dairy farming become evident, necessitating the requirement for adjustment and ingenuity. The National Dairy Plan and Pradhan Mantri Matsya Sampada Yojana are government efforts that provide crucial support to traditional farmers, with the goal of empowering them with the necessary resources for a contemporary and sustainable future. The focused endeavour to enhance dairy cooperatives serves as a symbol of optimism, promoting solidarity among farmers and establishing opportunities for collective advancement. The modernization of dairy farming is becoming a powerful force for change, as it brings in better breeding methods, technology advancements, and cooperative models that have the potential to completely reshape the sector. However, despite the potential for advancement, there are significant obstacles to the widespread acceptance and implementation of this idea. These barriers include a lack of awareness and education, as well as resistance stemming from long-standing cultural practices. Attaining modernity necessitates more than just significant advancements in technology; it also demands a sophisticated comprehension of the socio-economic structure of rural communities. Amidst this ever-evolving environment, the notion of sustainable livestock management arises as a guiding principle. The utilisation of agroecological concepts, waste recycling, and organic agricultural practices exemplify a symbiotic relationship between agriculture and the environment.

The focus on climate resilience, community engagement, and animal welfare demonstrates a comprehensive approach that goes beyond only economic factors to embrace the overall well-being of the entire ecosystem.As we wrap off this investigation, the fabric of rural India persists in changing, influenced by the interaction between tradition, modernization, and sustainability. The obstacles encountered by conventional procedures are not hindrances but rather invitations for innovation and perseverance. The convergence of government programmes, technological breakthroughs, and sustainability principles creates a future where dairy and animal management not only provide a livelihood but also contribute to rural prosperity, environmental stewardship, and social peace. The upcoming chapters will further reveal the ongoing narrative of rural India's dairy and livestock management, showcasing the themes of adaptability, resilience, and the potential for a sustainable future.

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CHAPTER-09

IMPORTANCE, OPPORTUNITIES AND CHALLENGES OF RURAL MARKETING IN INDIA

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9.1 INTRODUCTION

The government's drive to support rural India has led to a sharp rise in rural income, which has raised the purchasing power of the rural populace and, in turn, expanded the rural markets and economy. The scale of the rural markets presents company houses with enormous market potential. when both an opportunity and a potential for danger are present. Therefore, it is imperative that we comprehend the notion of rural marketing, together with its significance, prospects, obstacles, and developing patterns in India. The process of determining the region-specific needs for products and services in rural markets and making those products and services available to rural consumers in a way that will meet their needs, improve their quality of life, and help the organization reach its goals is known as rural marketing. *"Inflow and outflow between Urban and Rural Markets occurs during the two-way process of marketing known as Rural Marketing."* Movement of products and services for consumption within rural areas is also included.

India's development strategy heavily relies on rural marketing, especially in the areas of modernization, self-reliance, and structural diversification. India is a rural country. Over the past 40 years, Indian markets rural markets in particular have advanced significantly and played a significant role in social and economic changes. In the years after independence, rural India and rural marketing initiatives have seen a dramatic transformation. The globalization age has brought about positive changes to the scale, scope and methods of rural marketing. The government at the federal and state levels has actively supported rural markets during the last 20 years in particular. Big business titans and international corporations are swarming rural India to sell their goods and take advantage of the enormous potential. All those involved in the rural marketing chain, however, nevertheless face a significant challenge and opportunity. With the aid of agrisciences, biotechnology, automation, cooperative movement, and the active participation of the federal and state governments, there has not been a commensurate increase in agri-production to fulfill local requirements and surplus for export too in India as a result of recent advancements. In India, rural marketing involves a complex interplay of business, technological, economic, historical, and cultural elements.

The Indian economy is dominated by the rural sector in this highly industrialized era. Because of this, the majority of Indian marketers seek to connect with rural customers and markets. One of the biggest and most significant markets in the world is rural India, and it is evolving quickly. India's rural market is not an isolated phenomenon; social and behavioural factors prevalent in the nation have a significant impact on it. Demand, product planning, distribution, and the entire marketing process are all included in the rural market, which is the target audience for all marketing initiatives meant to satisfy rural consumers. Because of the tremendous advancements in communication and transportation over the past ten years, marketing in rural areas is also much simpler now than it was for the pioneers. Consumers and the rural market can be contacted by marketers in a variety of methods.

9.2 RURAL MARKETING IN INDIA

The Indian economy's rural marketing philosophy has always had a significant impact on people's lives. With the exception of a few major cities, all of India's districts and manufacturing townships are connected to rural markets. The socioeconomic and behavioral characteristics prevalent in the country severely disfavor the rural market in India, which is not a separate entity in and of itself. Approximately 627 million people live in rural India, making up precisely 74.3% of the country's overall population. Given that the majority of the country's customers live in rural areas, India's rural marketplaces generate more national revenues than any other. The majority of the money in the Indian economy comes from the rural market. In the Indian economy, there are two main categories in which confidential rural marketing falls. These are the marketplaces for (a) consumer goods, which include both high-quality and low-quality products, and (b) farming inputs, which include products like seeds, fertilizer, and pesticides. The Indian rural marketing strategy is often designed to dispel doubts in the minds of those who believe that rural marketing is solely focused on agricultural marketing. However, rural marketing controls the way businesses carry out their operations that bring in the influx of freight from urban areas to the nation's rural areas as well as the marketing of various items impacted by the movement of non-agricultural labor from rural to urban areas.

9.3 IMPORTANCE OF RURAL MARKETING

There is greater opportunity for consumer durables and services in rural markets. The majority of the rural population is employed in agriculture, which generates close to 50% of the country's overall revenue. Enhancing the agriculture sector through rural marketing can strengthen the nation's economy as a whole. The urban market's saturation and competition are making the rural market more significant. Therefore, the goal of the marketers is to expand their product categories into the rural market. The purchasing power of rural households in India has significantly increased in recent years due to the growth of rural markets. The Green Revolution in India has led to a significant increase in the consumption of manufactured goods from both urban and industrial sectors in rural areasIn this sense, rural marketing, a new marketing tactic, has emerged. Delivering manufactured or processed inputs or services to rural farmers or customers is known as rural marketing. Due of their perceived value for money, small packets are purchased in rural India. When a buyer purchases a brand mostly out of habit rather than genuine choice, this is known as brand stickiness. Brands hardly

ever compete for market share all they need to do is be present where it matters. Deep distribution helps even pricey brands like Close-Up, Marie biscuits, and Clinic shampoo succeed. However, many other companies like Ghadi, a well-known detergent brand in Kanpur do well even with little to no promotional support. With a large base of demand, the Indian rural market presents excellent marketing potential. Nearly half of India's national revenue is earned in rural areas, where two thirds of its consumers reside.

9.4 FEATURES OF RURAL MARKETING

To target the rural market and create effective strategies for maximizing its market potential, businesses need to be aware of the following characteristics of the rural market. Here is a summary of some essential elements related to rural marketing. Let us acquire them:

- **Large, Diverse and Scattered Market :** India has a sizable and widely distributed rural market. It's interesting to note that 70% of Indians live in rural areas, where they number 75 crore. In addition, the population of rural areas is growing more quickly than that of metropolitan areas. Furthermore, the rural population has enormous marketing potential because it is dispersed over 6.30 lakh villages.
- **Major Income of Rural People :** Rural prosperity and agriculture are closely related. Rural residents' primary source of income is agriculture. Rural residents' income is directly impacted by crop failure. But as other industries have started to take center stage, the rural economy's reliance on agriculture has steadily decreased in recent years.
- **Standard of Living :** The rural populace is employed in small-scale farming and related industries. Moreover, rural consumers are particularly careful while making purchases because of this unpredictability factor in their income. It is as a result of their misgivings about their potential earnings. In addition, low literacy rates, low per capita income, and social backwardness contribute to the bulk of the rural population's poverty. Furthermore, certain obstacles exist that hinder the progress of society. It consists of ingrained superstitions, customs, religious prohibitions, and cultural norms. Sadly, due to their restricted capacity to save for future requirements, rural inhabitants, even those with respectable salaries, spend less to raise their level of living.
- **Traditional Perspective :** Villages take a while to grow and hold onto their traditional ways of thinking. Most rural dwellers eventually come to terms with change, even though it is an ongoing cycle. Nonetheless, the majority of them typically oppose change. But due to literacy, especially among young people, this is gradually changing. At last, they are starting to change the villagers' viewpoint.
- **Infrastructure Development :** Inadequate infrastructure is the one factor dividing the urban and rural markets the most. Infrastructure like communication networks, concrete roads, financial services, and warehouses is lacking in rural areas. Furthermore, in rural locations, physical distribution and advertising become very challenging. Basically, it's because there isn't enough infrastructure, which expands the use of rural marketing.

- **Market Growth :** The rural market has expanded significantly over time. Over time, there has also been a surge in demand for traditional commodities like bicycles, farming equipment, and fast-moving consumer goods (FMCG). This was the result of fresh prospects and employment chances. Programs for rural development also made revenue sources more accessible. Bicycles, agricultural products, and many other items have seen an increase in demand over time. The market is growing as a result of all these factors. Rural areas now have more potential as a result.
- **Socio-Economic Background :** Rural residents come from a variety of socioeconomic backgrounds. The rural market is impacted by geographical dispersion and uneven land fertility, in general. In addition, the villagers represent a wide range of social, cultural, and religious origins. Sociocultural aspects impact customers' willingness to accept innovations and new products across a range of domains. Variations in consumer behaviour due to factors such as geography, occupation, demography, and behaviour affect lifestyle and create completely distinct requirements in different locations. To effectively and financially service the rural market, this calls for segmenting it.
- **Literacy Rate :** It is common knowledge that the literacy rate in rural areas is lower than in urban areas. It also makes it more difficult to communicate for marketing objectives. Additionally, print media has lost some of its relevance and effectiveness in rural areas due to low literacy rates and limited access.
- **Higher Purchasing Capacity :** Although there is a larger reliance on electronic media, such as radio, television, and movies, rural literacy has improved in the past. In addition, a growing number of rural residents are moving to cities in order to pursue higher education. Furthermore, the government has also started a number of rural education initiatives. Increased awareness leads to farmers knowing more about the world around them. In the end, they're pursuing a better standard of living while also learning about new technologies.

9.5 CHALLENGES IN RURAL MARKETING

Rural marketing involves more exhaustive personal selling efforts compared to urban marketing. Firms should abstain from designing goods for the urban markets and subsequently pushing them in the rural areas. To effectively tap the rural market, a brand must associate it with the same things the rural folks do. The factors may be

- **Backwardness :** The two biggest obstacles to marketers catering to the rural population are low purchasing power and rigidity, or the inability to adapt one's mindset.
- **Low Literacy Rate :** The low percentage of literacy (36%) in rural areas is linked to issues with communication, ineffective media, and difficulties building consumer trust in rural areas regarding products, requirements education, and product differentiation from competitors' comparable offerings.
- **Low Per Capita Income:** Per capita income is lower in rural areas compared to those in urban areas.

- **Seasonal Demand :** Because agriculture is mostly dependent on the monsoon, demand and purchasing power are neither consistent or steady.
- **Poor Transportation Facilities :** Poor transportation infrastructure and the lack of well-built roads in 70% of the nation's communities make it difficult for farmers to access markets.
- **Warehousing :** The need for many agricultural commodities is constant, but their production is seasonal. Only in towns are stocks maintained since rural areas lack suitable facilities for storage
- **Packaging :** The cost of the packing shouldn't be excessive since that will raise the price of the goods overall. Marketers ought to package their products with less expensive materials and in less quantity. The lack of local language on the package label significantly hinders rural consumers' ability to comprehend the features of the product.
- **Distribution System :** The presence of too many tiers in the distribution system increases the cost of distribution.
- **Lack of Communication :** Numerous obstacles impede marketing communication in rural areas, including low literacy rates, the traditional mindset of rural residents, cultural differences, and economic regress. There are eighteen recognized languages in India. Many folks do not understand Hindi or English. These issues prevent rural consumers from being exposed to new items, in contrast to their metropolitan counterparts. The marketers should focus on using the local language to promote the rural market.
- **Traditional Life :** In rural places, norms and traditions still dominate daily life, and individuals find it difficult to adopt new behaviours. For instance, not even the wealthy and well-educated farmers wear jeans or designer shoes.
- **Buying Decisions :** Rural shoppers buy cautiously and make deliberate, thoughtful decisions. They prefer to give something a trial run before making a purchase if they are personally satisfied.
- **Availability of Appropriate Media for Promotions :** Print, radio, television, and film media all face numerous challenges in remote communities. In order to communicate with the rural populace, television is essential. But the bulk of people living in rural areas are unable to profit from different media because power and television sets are not readily available to them.
- **Sales Management :** The rural salesman must be able to guide the rural customers in the choice of the products, should properly motivate rural consumers, be a patient listener and have to spend a lot of time on consumer visits to gain a favorable response from them. The distribution channels in villages are lengthy causing higher consumer prices. In many cases, dealers with required qualities are not available.
- **Inadequate Banking and Credit Facilities :** For the purpose of facilitating credit transactions generally and obtaining credit assistance from the bank, the rural outlets need banking help. Without sufficient credit facilities, retailers are unable to maintain optimal stock levels. They are

unable to grant credit to customers as a result of this issue. Low marketing activity is the result of all these issues in rural areas.

- **Branding :** Due to rural consumers' limited purchasing power, illiteracy, and ignorance, local brands are becoming increasingly important in rural areas even though national brands are becoming more well-known. Rural consumers have been found to be more dissatisfied with the sale of subpar copy brands, especially when it comes to soaps, creams, clothing, and other items that are priced at half or slightly less than national brands but are otherwise of comparable quality. In rural marketplaces, local brands are growing in popularity despite their inferior quality.
- **Career in Rural Marketing :** While rural marketing offers a challenging career, a rural sales person should require certain qualifications and specialized talent.
- **Cultural Factors :** Culture is a system of shared values, beliefs, and perceptions that affects how people behave. A perception among rural residents that practical problem-solving skills are more valuable than formal education and that salespeople should be respected for their expertise. Salespeople must have the necessary training in order to fit in with the demands of the market and take on their roles with ease.

9.6 OPPORTUNITIES FOR VARIOUS INDUSTRIES IN INDIA OF RURAL MARKETING

The Indian rural market has changed dramatically in the last few years. The rural market has gained impetus due to government interventions. Numerous industries in India have significant potential in the rural market; some of these sectors' scenarios have been addressed here

- **Auto Industry :** One of the biggest auto industries in the world is located in India. The industry contributes 7.1% of the GDP (Gross Domestic Product) of the nation. Because of a young population and a growing middle class, the Two Wheelers category leads the Indian automobile market, holding an 80% market share. Furthermore, the increasing curiosity of the businesses to investigate the rural markets contributed to the sector's expansion. Businesses have enormous potential in rural areas. Infrastructure improvements have improved connectivity between rural and urban areas. The market for two-wheelers is growing daily, according to the data. Businesses in this sector must concentrate on their marketing.
- **Consumer Durables :** The Indian consumer category, which is divided mostly into urban and rural areas, is drawing interest from international marketers. The sector includes a sizable middle class, a sizable affluent class, and a little economically disadvantaged segment. By 2025, spending is expected to have more than doubled. India achieved a ten-year high and was ranked first out of 63 countries in the global consumer confidence index for the quarter ending in December 2016. The country's score was 136 points. International businesses consider India to be one of the important markets from where future expansion is anticipated. Rising disposable incomes and a more favourable population composition will be the main factors driving India's consumer market growth. Expanding internet sales' usability and electrifying more rural locations would both contribute to demand increase.

- **Banking Industry :** Because of the government's ongoing efforts to advance banking technology and encourage expansion in underbanked and non-metropolitan areas, access to the banking system has also increased over time. In addition, India's banking industry has sustained stability in the face of worldwide turmoil, winning back the trust of the public over time. The Pradhan Mantri Jan DhanYojana (PMJDY) has seen a surge in deposits as well.

  As of November 9, 2016, there has been 255.1 million account openings and 6,971.68 million US dollars deposited. The Reserve Bank of India (RBI) claims that the banking industry in India is adequately capitalized and subject to strict regulations. Total 27 public sector banks, 26 private sector banks, 46 foreign banks, 56 regional rural banks, 1,574 urban cooperative banks, and 93,913 rural cooperative banks make up the financial system in India. The assets of the banking system are dominated by public-sector banks, with the private sector holding a relatively smaller portion.

  Additionally, banks are pushing their clients to use mobile devices for financial management. Increased infrastructure spending, expedited project execution and ongoing reforms are anticipated to give growth additional momentum. Given that the country's economy is expanding quickly and will need loans from banks, all of these indicators point to a strong future for the banking industry in India.

- **Education Industry :** India is a significant player in the international education sector. There are over 751 universities, 35,539 colleges, and more than 1.5 million schools in the nation, serving over 260 million students. India boasts one of the biggest systems of higher learning worldwide. Still, there is a great deal of room for improvement in the educational system.

- **FMCG Industry :** Half of all sales of fast-moving consumer goods (FMCG) in India are made up of household and personal care products, making the FMCG sector the fourth largest in the country's economy. The primary growth factors for the sector have been changing lifestyles, easier access, and more awareness. With a revenue share of over 40%, the urban segment is the greatest contributor to the total income generated by the FMCG industry in India. In 2016–17, the market size was estimated to be around US$ 29.4 billion. In contrast to urban India, the FMCG market in rural India has expanded more quickly in recent years.

  Fast-growing semi-urban and rural markets now comprise 50% of the market for FMCG items. The Indian government's proposal for the Union Budget 2017–18 aims to double the income of farmers in five years by increasing spending on rural areas. This, along with a reduction in income tax rates primarily for small taxpayers, affordable housing, and infrastructure development will also serve as growth drivers for the consumer market industry. Rising aspiration levels and rising earnings have led to an increase in rural consumption; branded goods are in more demand in rural India. India's rural FMCG market is predicted to expand at a compound annual growth rate (CAGR) of 14.6%, from US$ 29.4 billion in 2016 to US$ 220 billion by 2025.

- **Healthcare Industry :** When it comes to employment and revenue, the healthcare industry in India has grown to be one of the biggest. Hospitals, medical equipment, clinical trials,

outsourcing, telemedicine, medical travel, health insurance, and medical devices are all included in the category of healthcare. The Indian healthcare sector is growing at a quick pace due to its strengthening coverage, services and increased investment by public as well private actors. There are two main components to the Indian healthcare delivery system: the public and private sectors. The government's public healthcare system, or primary healthcare centers (PHCs) in rural regions, provides basic healthcare services. It consists of a small number of secondary and tertiary care institutions in major cities. Most secondary, tertiary, and quaternary care facilities are run by the private sector, mostly in metro areas and tier I and tier II cities.

With over 70% of the population living in rural areas, India is expected to become a major source of demand. Ayurveda, Yoga &Naturopathy, Unani, Siddha, and Homoeopathy (AYUSH) care is provided by a total of 3,598 hospitals and 25,723 dispensaries nationwide, guaranteeing the public's access to alternative medicine and treatment. Grant-in-aid was given by the Indian government in 2017 to States and Union Territories in order to establish AYUSH educational institutes. In conclusion, both urban and rural India provides a wealth of potential for healthcare infrastructure investment.

- **IT Industry :** The IT BPM industry is growing at a slower rate than India's global sourcing market. While the global sourcing market grew by 1.7 times to reach US$ 173–178 billion, the global IT &ITeS market (excluding hardware) reached US$ 1.2 trillion in 2016–17. With a share of 55%, India continued to be the most popular destination for sourcing globally in 2016–17. More than 1,000 global delivery centers have been established by Indian IT and ITeS enterprises in more than 200 cities worldwide. By 2020, the Indian internet market is expected to have doubled in size to reach US$ 250 billion, or 7.5% of GDP.

  In 2020, 730 million Indians are likely to be online thanks to the country's rapid digital technology adoption, a forecast by the National Association of Software and Services Companies (NASSCOM) states. The Indian market for public cloud services is expected to expand by 35.9% to reach US$ 1.3 billion, as per IT firm Gartner. The primary factors propelling the ongoing expansion of the data center co-location and hosting market in India are the rising internet penetration rate, which includes rural areas, and the swift development of e-commerce.

- **Manufacturing Industry :** One of the industries in India that is experiencing rapid expansion is manufacturing. The government initiated the "Made in India" initiative with the goal of establishing India as a worldwide manufacturing hub and promoting the Indian economy. By the end of 2020, India is predicted to rank fifth in the world in terms of manufacturing. India is a desirable location for international manufacturing ventures. Numerous luxury, car, and mobile phone firms, among others, have established or are planning to establish their manufacturing operations in the nation. India's manufacturing industry is predicted to develop to be worth US$1 trillion by 2025, and by 2020, it is anticipated to be among the world's top three growth economies and manufacturing destinations. With a GDP of US$ 2 trillion and a population of 1.2 billion, the introduction of the Goods and Services Tax (GST) will turn India into a single market, which will attract significant interest from investors.

9.7 CONCLUSION

Rural marketing involves the process of developing, pricing, promoting, distributing rural specific product and a service leading to exchange between rural and urban market which satisfies consumer demand and also achieves organizational objectives. The government's objective is to guarantee the comprehensive growth of the country by prioritizing the establishment of industrial corridors and smart cities. The corridors will support advanced manufacturing techniques while also helping to integrate, monitor and create an atmosphere that is favorable to industrial development. Examining the range of options available in the rural market India is working hard to establish the rural market as a center for commerce. India has a sizable rural population. People's socioeconomic circumstances have changed, and they are now more open to new technology and actively seek them out. The rural market has enormous potential in all sectors, including IT, education and healthcare. Unilever and P&G have made significant inroads into the rural market within the FMCG sector. Due to the size of the industry, it is the responsibility of the companies to create fresh marketing plans. Every opportunity must overcome some obstacles, and the Indian rural market is the next market to be explored if these obstacles are resolved. In conclusion, the future of rural marketing in India is a promising journey of growth and innovation. As we move forward in 2023, companies that adapt to the changing dynamics, leverage digital tools, and genuinely connect with rural consumers on a personal level will be the ones to thrive in this exciting landscape.

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CHAPTER-10

EXTENSION SERVICE DELIVERY INSTITUTES IN INDIA

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10.1 INTRODUCTION

Extension institutes towards successful implementation of Agricultural Extension activities. Through its various programs, schemes and activities, extension institutes help farmers to get information regarding scientific research and new knowledge in agricultural practices. It assists and encourages the State Governments in organizing, maintaining and operating professional Extension Services. Extension Division implements SMAE (Sub Mission on Agricultural Extension), a Submission of Krishonnati Yojana. The popular ATMA Scheme which supports the State Governments in their extension activities is also run by the Extension Division. The Institute also provides Information Support to farmers in their agricultural activities. For this, it coordinates with Prasar Bharati and All India Radio in the effective running of DD Kisan channel and Krishi Vani programs respectively. Kisan Call Centers have been established at 21 locations across the country covering all states and UTs where the farmers can call a toll-free number (1800-180-1551) and get information regarding their area of interest in agriculture. Extension Institutes also publishes four magazines two each in Hindi and English whereby information regarding various aspects of Extension activities and new developments is provided.

An Autonomous Institute – National Institute of Agricultural Extension Management (MANAGE) is also associated with Extension Division. MANAGE has a mandate of developing linkages between prominent State, Regional, National and International institutions concerned with Agricultural Extension Management. Extension Division has four Extension Education Institutes (EEIs) situated in Nilokheri (Haryana), Hyderabad (Telangana), Anand (Gujarat) and Jorhat (Assam) which cater to the training needs of field extension functionaries working under agriculture and allied departments of States/UTs of respective regions. The whole team of the Extension Institute is dedicated tothe successful implementation of Extension Activities through which agricultural productivity and farm income in the country can be increased.

10.2 DIRECTORATE OF EXTENSION, DAC & FW, MOA & FW, GOI

Directorate of Extension was set up in 1953 in the wake of the launching of the Community Development Program and National Extension Service throughout the country. It is the nodal agency in the Department of Agriculture, Cooperation, and Farmer's Welfare under the Ministry of Agriculture and Farmer's Welfare for agricultural extension policies, programs, schemes and services at the national level. The Directorate is extending support to associated organizations such as

National Institute of Agricultural Extension Management (MANAGE), Extension Education Institutes (EEI), State Agricultural Management and Extension Training Institutes (SAMETIs) and State Departments of Agriculture in organizing training programs, strengthening infrastructure for maintaining and operating professional extension services across the country. The major areas of concern are Extension management, Extension training, Agricultural information, Communication media, Extension reform (ATMA), etc. It is also involved in the transfer of technology and dissemination of knowledge and information to the farming community (DAC&FW, 2020).

10.3 AGRICULTURAL TECHNOLOGY MANAGEMENT AGENCY (ATMA)

ATMA is a society of key stakeholders involved in agricultural activities for sustainable agricultural development at the district level. As on October 2018, it is under implementation in 676 districts of 28 States and 3 Union Territories (UTs) in the country (Directorate of Extension, 2018). It is a focal point for integrating research and extension activities and decentralizing day-to-day management of the public Agricultural Technology System (ATS). As a society, it would be able to receive and expend project funds, entering into contracts and agreements and maintaining revolving accounts that can be used to collect fees and thereby recover operating costs.

Each ATMA has a governing board. Activities such as Farmer's Training, Demonstrations, Exposure Visit, Farmer Friends and Farm Schools are conducted under ATMA. The district collector is the chairman of the Governing Board of the ATMA.

The objectives (TNAU, 2020) of ATMA are

a. To strengthen research – extension – farmer linkages.
b. To provide an effective mechanism for coordination and management of activities of different agencies involved in technology adaption/validation and dissemination at the district level and below.
c. To increase the quality and type of technologies being disseminated.
d. To move towards shared ownership of the agricultural technology system by key shareholders.
e. To develop new partnerships with private institutions including NGOs.

10.4.1 SALIENT FEATURES OF ATMA

a. Creating a Farmer Advisory Committee to improve feedback.
b. Using NGOs to organize farmers.
c. Encouraging private sector involvement in technology transfer.
d. Validation and refining technologies through research units in the district.
e. Bottom-up planning procedure.
f. Increased use of Information Technology
g. In-service training to increase staff competence.
h. Developing new public-private partnerships.

10.4.2 Formation and Strengthening of Farmer's Interest Group

Under the ATMA, a Strategic Research and Extension Plan (SREP) is prepared, which can be defined as a participatory methodology to increase agricultural production, formulate research extension agenda based on producers' requirements, develop technology acceptable to users and prioritize resource allocation to research and extension at the district level.

10.5 NATIONAL INSTITUTE OF AGRICULTURAL EXTENSION MANAGEMENT (MANAGE)

Hyderabad MANAGE is an autonomous national institute under the Ministry of Agriculture & Farmers Welfare, Government of India. It is an Indian response to the challenges of agricultural extension in a rapidly growing and diverse agriculture sector. MANAGE offers its professional services in the following five streams viz., Extension Management Training, Consultancy, Extension Management Education, Action research and Information Services.

The mandates of MANAGE; (MANAGE, 2020)

a. Developing linkages between prominent states, regional, national and international institutions concerned with agricultural extension management.
b. Gaining insight into agricultural extension management systems and policies
c. Forging collaborative linkages with national and international institutions for sharing faculty resource
d. Developing and promoting the application of modern management tools for improving the effectiveness of agricultural extension organizations
e. Organizing need-based training for senior and middle-level agricultural extension functionaries
f. Conducting problem-oriented studies on agricultural extension management
g. Serving as an international documentation center for collecting, storing, processing, and disseminating information on subjects related to agricultural management

The "Centre for Extension in Agri-Allied Sectors" (EAAS) is one among the 9 centers of MANAGE, specifically focusing on extension management training, research and policy advisory in the agri-allied sector. The center conducts induction training programs for field-level Veterinary /Fishery/Sericulture and Horticulture Officers and refresher training programs for middle and senior-level officers along with action research, national workshops and conferences to support policy makers.

10.5.1 Extension Education Institutes (EEIs)

EEIs are regional-level training institutes directly working under the Ministry of Agriculture & Farmers Welfare, Government of India with 100 % financial assistance. There are four EEIs situated in Nilokheri (Haryana), Hyderabad (Telangana), Anand (Gujarat) and Jorhat (Assam) under the administrative control of state agricultural universities. These institutes cater to the training needs of field extension functionaries, trainers working under agriculture and allied departments of States/UTs, besides, research and extension work in their respective areas of operation.

The main objectives of EEIs are; (Hiralal, J. 2016)

a. To provide in-service training to staff of the State Training Institutes/Staff of Line Departments of state Agriculture Universities in Extension Teaching Methods and Communication Media

b. To organize Workshops on Communication and Extension Teaching Methods/Training Methodology for Master Trainers/ Sub Divisional Agricultural Officers/ Subject Matter Specialists working under broad-based Agricultural Extension

c. To conduct Workshops in specialized fields like Monitoring and Evaluation, Supervision, and Extension Management for Middle-Level Extension personnel working under Broad-based Agricultural Extension

d. To undertake a program of publication and production of basic teaching/ training material as relevant to extension personnel and e. To have a continuous program of field studies on Extension Education and allied subjects

However, as such, their activity profile reflects more focus on agriculture extension.

10.5.2 State Agricultural Management & Extension Training Institutes

SAMETI is a State-level training institution that is autonomous with greater flexibility in structure and functioning. These are mainly responsible for organizing need-based training programs for the project implementation functionaries of different line departments as well as the farming community. SAMETI has to function with the technical guidance of the National Institute of Agricultural Extension Management (MANAGE).

❖ Functions of SAMETIs (SAMETI, 2020)

a. To provide need-based consultancy services to the Agricultural Technology Management Agency (ATMA) in areas like project planning, appraisal, implementation, etc.

b. Develop and promote appropriate and specific management tools for improving the effectiveness of agricultural extension services through better management of human and material resources.

c. Organize need-based training programs for middle-level and grassroots-level agricultural extension functionaries.

d. It should have close linkage with institutions like KVKs, ZRS, State Agricultural Universities, NGOs, MANAGE to use appropriate faculty resources from these institutions for training and consultancy services to ATMA functionaries, farmers and other clients.

e. To conduct studies on problems related to Agriculture extension management, Communication and information technology, Agriculture product marketing, Human resource development using participatory approaches

However, as such, their activity profile reflects more focus on agriculture extension.

10.5.3 Indian Council of Agricultural Research (ICAR), New Delhi

Agricultural Extension Division of ICAR is mainly involved in technology assessment, demonstration and capacity development through a network of 11 Agricultural Technology Application Research Institutes (ATARIs) and 731KrishiVigyanKendras (KVKs).

The mandates of ATARIs are:

a. Coordination and monitoring of technology applications and frontline extension education programs.

b. Strengthening agricultural extension research and knowledge management.

10.5.4 Krishi Vigyan Kendras

KVK is an integral part of the National Agricultural Research System (NARS), which aims at assessment of location specific technology modules in agriculture and allied enterprises, through technology assessment, refinement and demonstrations. KVKs are linking the NARS with extension system and farmers. The institute is wholly financed by ICAR with its presence at each district level. KVKs functions under the administrative control of State Agricultural Universities, ICAR institutes, related Government Departments and Non-Government Organizations (NGOs) working in agriculture sector. The major mandate of KVK are;

A. On-farm testing to assess the location specificity of agricultural technologies under various farming systems.

B. Frontline demonstrations to establish the production potential of technologies on the farmers' fields.

C. Capacity development of farmers and extension personnel through need-based training to update their knowledge and skills on modern agricultural technologies.

D. To work as Knowledge and Resource Centre of agricultural technologies for supporting initiatives of public, private and voluntary sector in improving the agricultural economy of the district.

E. Provide farm advisories using ICT and other media means on varied subjects of interest to farmers.

In addition, KVKs produce quality technological products (seed, planting material, bio-agents, and livestock) and make them available to farmers, organize frontline extension activities, identify and document selected farm innovations and converge with ongoing schemes and programs within the mandate of KVK (ICAR, 2020a).

10.6 Private Extension Services

Private Extension Service is defined as the services rendered in the area of veterinary, agriculture and allied sectors by extension personnel working in private agencies or organizations for which farmers are expected to pay a fee and it can be viewed as supplementary or alternative to public extension services. Gowda et al. (1999) as cited in Joshi, P. (2017a). The emergence and encouragement of privatization in India opened the door for private investment and the provision of foreign direct investment, which paved way for entry of private players in poultry and dairy sectors.

The integration /contract farming in poultry sector have made inroads especially in southern states mainly because of the integration of all the three services viz. supply of inputs, extension advisory and technical service are provided by one agency. Due to assurance of market, at the end of the production period, the farmer is going to get a fixed amount as rearing charges. Though considered

exploitative, the integrated poultry farming is gaining more popularity as the farmers are free from investment, production and marketing risks (Rao et al., 2011).

The farmers are taking care of the disease risk as millions of birds are being reared in several locations and the chances of spread of diseases in all the locations is bare minimum when compared to rearing all the birds in one location by the integrator. This also facilitates the easy marketing of the product for the integrators in different locations (Rao, SVN. &Natchimuthu, K. 2016a). Similarly, the private dairies have been established over dairy cooperatives and operate with farming community through a contract agreement in which they provide variety of input services like breeding, feed, treatment, disease prevention and extension services to the farmers.

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