
ASSESSMENT OF CHALLENGES IN RURAL LOGISTICS AND ITS SOLUTIONS THROUGH BLOCKCHAIN



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Atal Bihari Vajpayee Institute of Good Governance and Policy Analysis
(A registered body of Government of Madhya Pradesh under
Public Service Management Department)



A

PROJECT REPORT ON

**ASSESSMENT OF CHALLENGES IN RURAL LOGISTICS AND ITS
SOLUTIONS THROUGH BLOCKCHAIN**

FOR

**THE DEPARTMENT OF PANCHAYAT RAJ & RURAL DEVELOPMENT,
GOVERNMENT OF MADHYA PRADESH**

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PREFACE

Likely the biggest challenge will be in achieving successful industry adoption through collaboration and even competition between diverse logistics stakeholders that have legacy processes and varying interests. When it does, this technology will facilitate greater efficiency and new business models including faster and leaner global trade logistics, superior transparency and traceability in the logistics, and increased automation of commercial processes in logistics. Exploring the very latest analysis, opinions and findings to identify key success factors for implementation, this trend report aims to answer: Challenges in Rural Logistics and its solutions through this Blockchain technology already being applied across industries. What opportunities could blockchain deliver to our logistics operations. In addition, we look forward to future collaboration with Department of Panchayat Raj & Rural Development – together we can unlock the value of blockchain in rural logistics.

ACKNOWLEDGEMENTS

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The study has indeed helped me to explore more knowledgeable avenues related to my topic and I am sure it will help me in my future.

FOREWORD

Rural Logistics plays an important role in agricultural production and logistics management, ultimately enhancing food safety and quality. Improvements in rural logistics help farmers to harvest and market crops more efficiently; and by facilitating communication, they serve to expand the markets for agricultural products. Developing rural logistics can result in effective and efficient distribution channels between urban and rural areas; improve the quality and value of agricultural products; and provide low-cost, high quality consumer goods to the state. While recognizing the rapidly changing rural scene currently, the rural logistics system is still weak, the organization structure inadequate, the distribution of goods impeded, and the quality of services poor. Rural logistics system is yet to meet the requirements for agricultural modernization. Promoting the development of rural logistics will facilitate structural adjustment and the industrialization of agriculture, providing important support for its modernization. It will also narrow the gap between urban and rural areas, thereby enhancing the goal for social harmony and stability. There is an urge to establish efficient logistics systems in rural areas to enable unimpeded distribution channels for agricultural inputs and products and manufactured consumer goods to and from rural areas, and promote the development of the agriculture sector. There also exists the need to improve the value chains for agricultural produce and the distribution of consumer goods by developing better logistics systems in rural areas. There is a need of necessary policies for promoting logistics development in rural areas: (i) enhance government support, (ii) strengthen rural logistics infrastructure, (iii) increase the informatization of rural logistics systems, and (iv) cultivate strong rural logistics enterprises. We hope this Report will be of interest to policy makers in the agriculture and logistics sectors, practitioners, and researchers, and to other developing states of India that face similar challenges regarding rural logistics.

ABBREVIATIONS

APMC	:	Agricultural Produce Market Committee
BT	:	Block chain Technology
CSC	:	Common Service Centre
CCC	:	Cash Conversion Cycle
DL	:	Driving License
DC	:	Dispatch Consolidation
EDI	:	Electronic Data Interchange
ERP	:	Enterprise resource planning
GPS	:	Global Positioning System
GOI	:	Government of India
GDP	:	Gross Domestic product
GST	:	Goods and Services Tax
ICT	:	Information and Communications Technology
MMLP	:	Multi-modal logistics park
OEMs	:	Original equipment manufacturers
OECD	:	Organization for Economic Co-operation and development
RMC	:	Ready Mix Concrete
RC	:	Registration Certificate
RONA	:	Return on net Assets
TQM	:	Total Quality Management
VAT	:	Value Added Tax

ABSTRACT

This Project researches the possibility of the development of sustainable rural logistics and supply chain management through decentralized data storage represented by blockchain technology. Although the benefits of blockchain technology have been most widely researched in the financial sector, major challenges in logistics, such as order delay, damage to goods, errors, and multiple data entry can also be minimized by introducing block chain technology. Current and rising trends of blockchain technology usage in logistics and supply chain management can be well integrated with the current applications of Rural Logistics in the state of Madhya Pradesh

Keywords: blockchain; rural logistics

EXECUTIVE SUMMARY

We see the need to create industry standards and protocols to enable blockchain platforms to operate together with established technologies. In the future, blockchain standards and intercompany collaboration will support the logistics strategies that enable customers to participate in global trade and finance.

Blockchain has multiple applications in the logistics industry, especially related to supply chains, insurance, payments, audits and customs brokerage. The technology has the potential to increase transparency and efficiency among shippers, carriers, brokers, consumers, vendors and other supply chain stakeholders. UPS (the Ultimate Procurement and Supply chain), which is investing in capacity and leading operations technologies to build the Smart Logistics Network of the future, views blockchain as a truly disruptive technology that could change many facets of global commerce.

Blockchain technology would help by improving transaction accuracy and by replacing existing paper-heavy and manual processes. This will benefit all parties involved in the transactions. Such an application would be highly secure and would generate valuable efficiencies for shippers.

Blockchain technology can be leveraged to facilitate execution and visibility of trusted transactions between customers, and government customs agencies. Blockchain, a digital database using blocks that are linked and secured by cryptography, can be used to keep a record of any information or assets. This includes physical assets, like transportation containers, or virtual assets, like digital currencies.

SCOPE OF THE STUDY

Rural logistics development is an important part of the modernization of the agriculture sector, that is essential for enhancing the living standards of rural residents. It is also a critical step toward urban–rural integration and improvements in the quality of rural life. It is a live Use case and a technology-based project that focuses on building up Blockchain-enabled Smart Rural Logistics in MP which is traditionally having poor & disintegrated management system for Transportation of Agri-based Goods leading to poor delivery of low-quality rural logistics of product lagging behind in time/cost/space/quality /technology domain and failing in better, smart & environment friendly Rural Logistics Performance.

Blockchain-enabled smart Rural Logistics will provide Mobility as a Service (MaaS) feature in Rural Logistics for Cost transparency between stakeholders, confidential information system, immutability & transparency of records, traceability, Auditability & verifiability of integrated smart rural logistics systems with proper smart contracts to reduce risks of frauds.

This Project will provide infrastructure requisites/ strategy & framework for building up emerging technology-based, Blockchain-enabled Smart Rural Logistics in MP with proper management of the aforementioned sub-domains of Rural Logistics using an integrated mobility system.

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CHAPTER 1: INTRODUCTION

Rural Logistics refers to the procurement, transportation and storage of materials throughout the manufacturing and selling process. Because of the complexity and the lack of transparency of traditional supply chains, it is of great interest for the stakeholders involved in the logistics process to introduce and develop blockchain technology to enhance the logistics processes in the supply chain, making them more sustainable. Blockchain is a distributed book (ledger) with many potential applications. It can be used for any data exchange, whether it is contracting, tracking of shipments and financial exchanges (payments). Each action is captured in the block and the data is distributed over many nodes (computers), making the system transparent. Every block connects to the one before and after, which makes the system safer. Blockchain can increase the efficiency and transparency of the supply chain and positively affect all logistic processes, from storage to delivery and payment. In addition to increased transparency and security achieved through blockchain, it is possible to speed up the physical flow of goods. Tracking goods through blockchain can improve the decision-making process with the end result being a more satisfying service for the end-user. Blockchain technology possesses the potential for the creation of new logistics services, as well as new business models. As a relatively new technology, blockchain is designed to achieve decentralization, real-time peer-to-peer operation, anonymity, transparency, irreversibility and integrity in a widely applicable manner. The verification of every transaction requires the acknowledgement of every node in the network, which will take substantially more time than the centralized system. It should be emphasized that no available literature sources have been found that comprehensively explains the exclusive application of blockchain technology principles in logistics. The goal of this project is to explore the possible use of blockchain technology in logistics processes, to identify the impact of blockchain technology on business transparency and why it is important to implement blockchain technology in every part of the logistics.

CHAPTER 2

RELATED LITERATURE REVIEW

(A) RURAL LOGISTICS

• RURAL LOGISTICS & SUPPLY CHAIN

Rural logistics encompasses more than just the outbound flow of agricultural products from rural areas. It includes the movement of agricultural inputs and consumer products into rural areas, as well as the movement of light industrial goods produced in villages. A supply chain consists of all parties involved, directly or indirectly, in fulfilling a customer request. The supply chain includes not only the manufacturer and suppliers, but also transporters, warehouses, retailers, and even customers themselves. Within each organization, such as a manufacturer, the supply chain includes all functions involved in receiving and filling a customer request. These functions include, but are not limited to, new product development, marketing, operations, distribution, finance, and customer service.

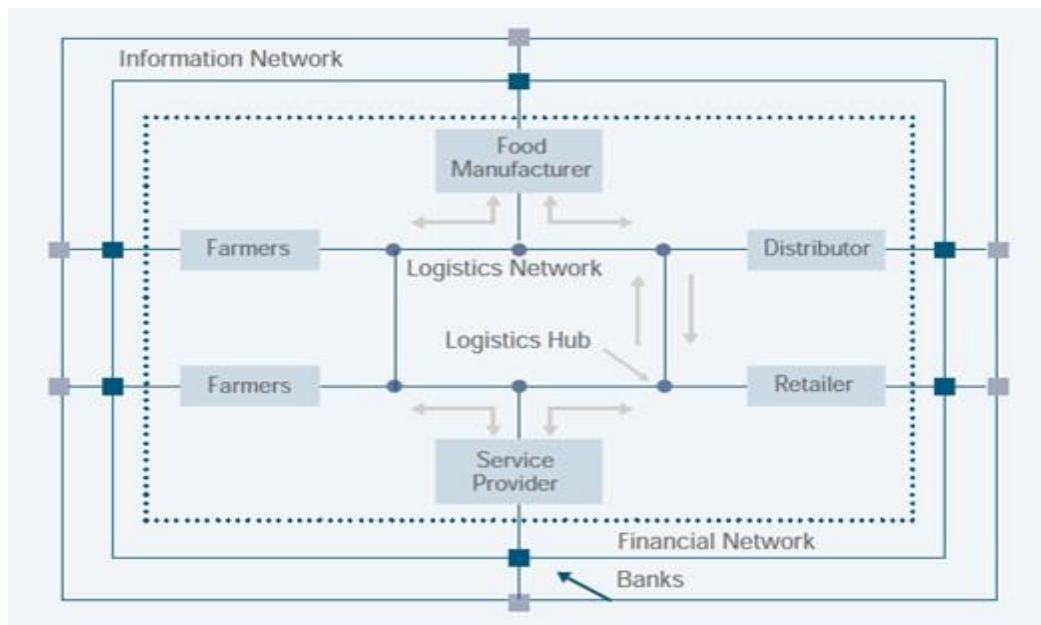


Fig 1: Rural Logistics Structure

• GOVERNMENT INITIATIVES

The government of India (GoI) has launched the “Make in India” initiative intending to support the manufacturing sector of the Indian economy and elevate its contribution to GDP from the current 17% up to 25%. Logistics efficiency can also benefit farmers through the reduction in loss and wastage of product during transportation to markets. Currently, India loses 40% of agricultural production to wastage in the supply chain. Reducing that wastage could both

provide an income boost to farmers and also lower overall prices. Beyond providing broad social benefits to farmers and low-income workers, efficiency in logistics can also enhance the quality of life for practitioners within the logistics industry. Finally, improved logistics can bring about important environmental benefits. Improving the efficiency of logistics can rein in the growing demand for trucking services, helping India to meet its international climate commitments while simultaneously reducing pollution in India's most populated cities.

- ***Development of Multi-Modal Logistics Parks in India***

Multi-Modal Logistics Park (MMLP) is a freight-handling facility and to be constructed in a minimum area of 100 acres providing access to different modes of transportation. MMLP also provides storage solutions like mechanized warehouses and cold storage with other services like customs clearance and quarantine zones. The Indian transport ministry is currently planning a network of 35 MMLPs around different Indian states. These parks will help reduce freight & warehouse costs, and vehicle congestion.

- ***GST Effects on Logistics***

One of the significant consequences of Goods and Services Tax (GST) on the Indian logistics sector is the integration of multiple layers of taxes into a single one. Due to GST's implementation, there is a substantial reduction in waiting time and paperwork. It has improved the utilization of vehicles, reduced the cost, and eliminated the need for various warehouse stations across Indian states. As per the IBEF study, the logistics sector is expected to reach \$500 billion by 2025.

- ***Parivahan Portal***

Earlier, different states have different policies regarding the processing of basic documents like Registration Certificate (RC) and Driving License (DL). The Government wanted to standardize processes across PAN-India to make sure that correct data can easily be shared between systems irrespective of their location. Hence, the ministry launched two software's – SARATHI for driving license processes and VAHAN for vehicle registrations. SARATHI offers services like Common Service Centre (CSC), E-Payment Gateway & State Service Delivery Gateway (SSDG) and VAHAN offer services like fitness, permit taxes and registration. All these services are offered in one mobile app called mParivahan which makes it easy to get information regarding RC, DL, etc. There is also an SMS alert service to constantly notify the user.

- ***Introduction of E-Way Bill***

Basically, an E-way bill is an electronic document, generated from the E-way site, that is required to be carried by a person carrying a truckload worth more than Rs. 50,000. The E-way bill is issued by registered suppliers transferring goods from one state to another. Its validity mainly depends upon the shipment distance. E-Way bill helps in the elimination of state boundary check posts and physical paperwork which facilitate vehicles' movement across the states and reduce their overall turnaround time. Over the last few years, it is proved to be one of the best initiatives taken by the Indian Government. Are you a consignor looking for hassle-free delivery of your load? Are you tired of calling different transporters to know the best price? Then fret not, acts as a digital bidding platform between consignors and transporters. The consignor needs to enter cargo details along with the ceiling price, and various transporters will bid for it from the other end. Transporters get to compete for the load, and consignors instantly get the best delivery price.

- **SCOPE OF RURAL LOGISTICS**

- ***Rapid Response:***

Rapid response is concerned with a firm's ability to satisfy customer's requirements promptly. Instead of stocking the goods and supplying on-demand, orders are executed on a shipment-to-shipment basis. Here IT helps to postpone the logistical operations to the latest possible time and then execute rapid delivery when needed by the customer.

- ***Minimum Variance:***

Variance is any unexpected event that disrupts the system. Logistical operations are disrupted by events like delays in order receipt, disruption in manufacturing, goods damaged at customer's location and delivery to an incorrect location etc. The traditional solution to deal with variance was to keep safety stock or use high-cost transportation. Such practices were expensive and risky and thus have been replaced by information technology to achieve positive logistics control.

- ***Minimum Inventory:***

The objective of minimum inventory involves asset commitment and inventory turnover. Asset commitment is the financial value of inventory developed throughout the logical system and inventory turnover is the rate of inventory usage over time. The objective is to reduce the inventory without sacrificing customer satisfaction.

- ***Movement Consolidation:***

One of the most significant logistical costs is transportation. Transportation cost depends on the type of product, size of shipment and distance. Movement consolidation means grouping small shipments to reduce transportation costs.

- ***Quality Improvement:***

Logistics is a prime part of developing and maintaining continuous TQM improvement. If the quality of the product fails, logistics will have to ship the product out of the customer's premises and repeat the logistical function again. This adds to cost and customer dissatisfaction.

- ***Life-Cycle Support:***

Life cycle support is also called cradle-to-cradle logistical support. It means going beyond reverse logistics and recycling to include the possibility of after-sale services, product recalls and product disposal. This means that firms must consider how to make a product and its package (cradle) and how to remake and reuse them (to cradle). E.g. Cold drink industries use their glass bottle again and again whereas the cans are reused in the making of paper dishes.

- ***Logistics Synchronization:***

Manufacturing systems, transportation networks, and supply chains are all logistics systems, which are required to operate efficiently without waste of resources or time. Synchronization is a widely used term in connection with logistics systems, and it promises to increase efficiency by coordinating supply and demand over time and space. Synchronization in logistics systems is intended to foster future developments of a concrete quantification and operationalization of synchronization in logistics systems. The measurable and quantifiable phenomenon of synchronization in logistics is mainly composed of a temporal and performance-related coupling of the state of individual logistics elements or complete systems.

- **FACTORS AND PERFORMANCES**

- **Factors**

- ***Consumer Demand:***

The main functions of logistics are material flow distribution from the producer to the final consumer. The efficiency of interaction of logistics systems is considered in an isolated form not taking into consideration the problems of improving the efficiency of the whole

society. This leads to the need to take into account the consumer's component in the logistics system. The development of a logistics approach based on consumer's profit-loss opens new opportunities to improve the service and the efficiency of the logistics system.

- ***Globalization:***

Globalization has had a tremendous effect on the level of integration of all countries into the international economy. It has generally provided huge opportunities for developing countries to achieve economic growth through international trade. This is even though trade logistics is key to competitiveness by allowing goods to be shipped from where they are produced in one country to destination markets throughout the world.

- ***Competition:***

Most research on logistics strategy has turned its focus towards operations themselves, in isolation, and has hence failed to link logistics with strategy. This shift in logistics strategy research makes possible a move from a transaction-based to a value-based view of logistics where the latter view incorporates logistics considered as a platform and a resource-based supporting the strategy of the firm. When being value-based, logistics is used not only to create profitability through e.g., efficient processes but also to support growth by being flexible enough to support different strategies and adding value to the physical product.

- ***Environment:***

Green logistics, also known as environmental logistics, refers to sustainable policies and measures focusing on lowering the impact logistics has on the environment. This includes the configuration of processes, structures, systems, and equipment used in the transportation, distribution, and warehousing of goods. Logistics transportation emits high greenhouse gas emission rates. Transport and road traffic, in particular, produce fine particles that pollute the outside air. These particles are not only dangerous and carcinogenic to humans, but they are also toxic to ecosystems.

- **Performances**

- ***Customer Service:***

Customer service in logistics is the activities, service actions are provided, acting as added value. The aim is to bring more value than the core service that customers need and bring the most satisfaction to customers. For businesses or business organizations today offer more services to customers besides their main products.

- ***Inventory Velocity:***

Inventory availability is the most important aspect of customer service. Without an adequate level of product in stock, companies cannot meet customer needs.

- ***Speed of Responsiveness:***

Responsive Logistics are expected to meet such baseline business activities as -Order fill accuracy, Scalable delivery, ongoing communication, Customer satisfaction. These are all goals of an efficient supply chain.

- ***Product Quality:***

The process of making and distributing products and services to customers is becoming the most effective and efficient way for companies to stay successful and is central to the practice of Logistics.

- ***Product Availability:***

Rural Logistics affects manufacturing companies in a variety of ways, including the availability of inputs needed for production processes, costs and profitability of manufactured items, company infrastructure and ways in which companies interact with their suppliers and customers.

- ***Load Times:***

A real-time load tracking platform gives you and your customer service team access to location information for all of your shipments, regardless of carrier. Instead of being built on outdated EDI technology, new offerings provide updates directly from the onboard GPS device your carriers use to track their trucks. Combine that with cell phone tracking for small fleets and owner-operators, weather and traffic information, and other predictive analytic, and you have a tool that enables you to manage exceptions proactively.

- ***Cash Conversion Times:***

The cash conversion cycle (CCC) is a metric that expresses the time (measured in days) it takes for a company to convert its investments in inventory and other resources into cash flows from sales. This metric takes into account how much time the company needs to sell its inventory, how much time it takes to collect receivables, and how much time it has to pay its bills.

- ***Logistics Cost:***

Expect to continually look for ways to reduce logistics costs while still operating your business efficiently. One of the simplest ways to keep logistics costs under control is to manage orders and deliveries effectively. It costs a lot more to receive a rush delivery because the materials need to be loaded onto a plane.

- **Net Asset Returns:**

Return on net assets (RONA) is a measure of financial performance calculated as net profit divided by the sum of fixed assets and net working capital. Net profit is also called net income. The RONA ratio shows how well a company and its management are deploying assets in economically valuable ways;

(B) RURAL LOGISTICS MANAGEMENT

- **OPERATIONS**

- **Network Design:**

Designing an optimal Rural Logistics network means the network must be able to meet the long-term strategic objectives of the company. Most business units or functional areas within a company are impacted by a network design project. Once the path forward is determined and the design approach has been completed correctly, the business will reap many significant benefits.

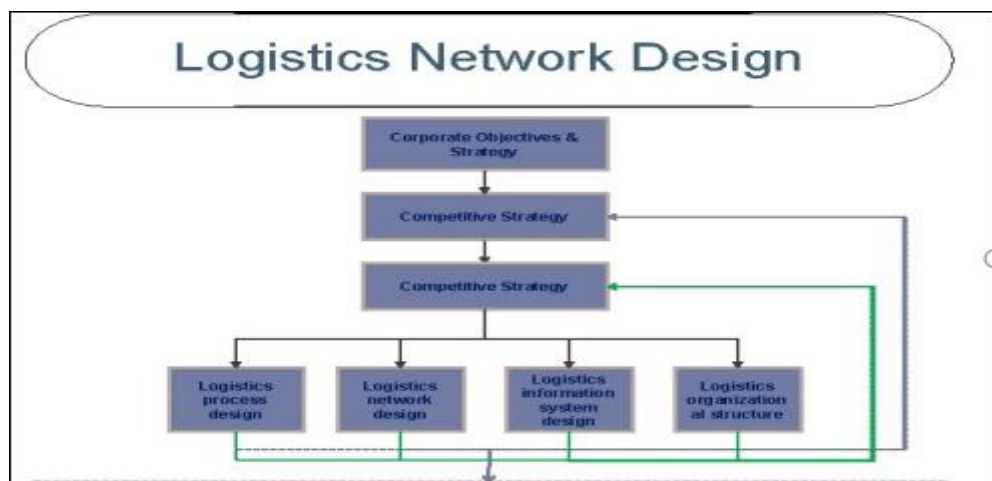


Fig.2: Logistics Network Design

- **Material-handling:**

Material handling is the movement, protection, storage and control of materials and products throughout manufacturing, warehousing, distribution, consumption and disposal. Inventory management and control. Customer delivery. After-sales support and service.

- **Flexibility Principle:** Encourages methods and equipment which are possible to utilize in all types of conditions.
- **Simplification Principle:** Encourage simplification of methods and processes by removing unnecessary movements.
- **Gravity Principle:** Encourages usage of gravity principle in the movement of goods.

- ***Order processing:***

This process includes many different variables and models but many of them are tied to location, such as your distribution centres, store network, and possible routes to serve those stores. Other assumptions, such as the number of transportation resources, assumed delivery time, and total route time is also tied to location even though they might not initially appear to be impacted by location. The exact routes and road networks play a major role in how you will ultimately design your routes and assign resources to different clusters of stores.

- ***Inventory Management:***

Inventory management is one of the most important business processes during the operation of a manufacturing or production company as it relates to purchases, sales and logistic activities. Inventories are essential for keeping the production wheels moving, keep the market going and the distribution system intact.. This results in tying up money or capital which could have been used more productively.

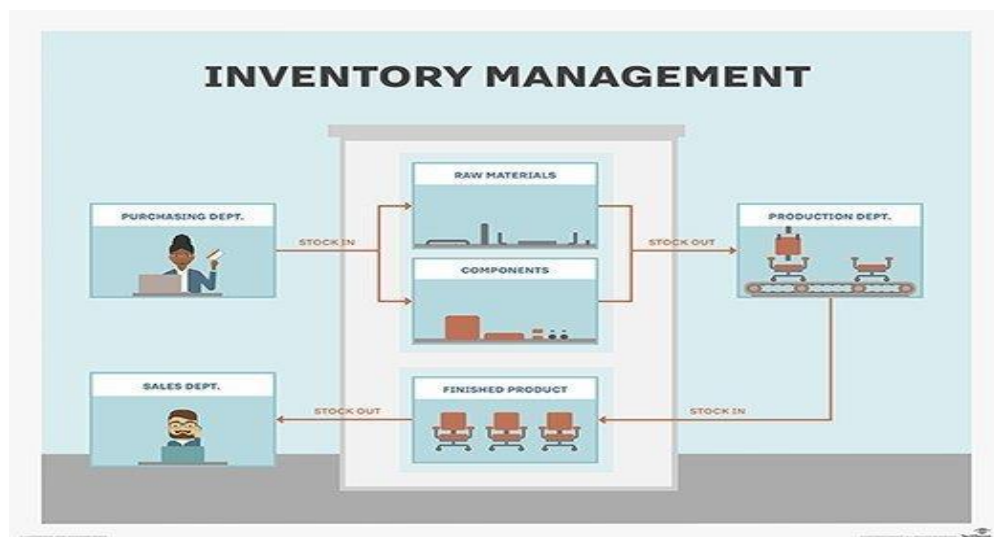


Fig. 3: Inventory Management

- ***Packaging:***

This means packaging also plays an integral role in supply chain management. It protects products from damage, allows for their efficient distribution, communicates to the consumers, and is one of the major product promoters in a competitive marketplace. Good logistics packaging keeps products safe, and ensure that your product arrives at their address in the perfect form and free from any damage. A distributor requires a lot of information about the product. And a transportation packaging is a suitable position to display the same.

- ***Warehousing:***

Warehousing is one of the main spheres of logistics. The very broad meaning of it is storage of finished goods or materials (raw and components) for manufacturing, agricultural or commercial purposes. In fact, warehousing contains numerous functions, like acceptance of products (loading, unloading), inspection, and “proper storage”. It is the whole system (warehouse management system) that includes warehouse infrastructure, tracking systems and communication “between product stations”. One of the most sustainable trends in storage solutions is the “Just in Time technique”. It means product delivery directly from supplier to producer without warehousing.

- ***Transportation:***

Transportation or shipment is necessary for an uninterrupted and seamless supply. The factors that have an impact on a shipment are economic uncertainty and instability, varying fuel prices, customers’ expectations, globalization, improvised technologies, changing transportation industry and labour laws.

- **CHARACTERISTICS**

- ***Local links and nodes:***

Improving rural connectivity is a concern not only of local-level government but also those agencies responsible for national, state and other transport network levels. Participants agreed that there was a need to view rural transport as part of an integrated transport network, rather than as a separate entity. For a start, there is no agreement on what is meant by “connectivity”, which makes it difficult to design policies.

- ***Local production centres, Small volumes, Initial process and packaging:***

The product packaging system (i.e., primary, secondary and tertiary packages and accessories) is highly relevant in the logistics and its importance is growing because of the necessity to minimize costs, reduce the environmental impact and also due to the development of web operations (i.e., electronic commerce). All products moved are contained in packages and for this reason, the analysis of the physical logistics flows and the role of packaging is a very important issue for the definition and design of manufacturing processes, improvement of layout and increase in companies' efficiency.

- ***Consolidation use of smart trucks on the spot market:***

Rural consolidation centres provide the logistical infrastructure for cooperation among less-than-truckload carriers with contiguous destinations. When delivery capacities are not restrictive, i.e., when waiting costs trigger truck dispatches, we show that stable allocations in the core always exist and can, in their entirety, be found by solving a compact linear program.

- **FUNCTIONAL IMPACT**

It Improves real-time visibility, transparency, security, immutability, irrevocability, neutrality, and reliability for all the supply chain actors. It increases data quality (ensuring immutable product-process links, smarter and more accessible data and market information)

- Improve real-time tracking for the agri-food products
- Management of defective products.
- Improve faster, responsiveness and efficient operations and scalability
- Automated certification of food safety and quality
 - ***Economic Impact***
 - Lower transaction costs; Markets can form more efficient prices
 - ***Environment Impact***
 - Reduction of wastes due to enhanced traceability.
 - ***Social Impact***
 - Improves customer satisfaction by ensuring food safety and quality; Disintermediation; Risk reduction of involved actors; Empowered users
 - ***Business Impact***
 - Process integrity; Enhance members' collaboration; Disintermediation & Decentralized operations

- **MEASURED SERVICES**

- ***Availability***

The availability rate is the % of products available at a given time T while the service rate is the ratio of orders delivered over time to the total number of orders.

- ***Service Reliability***

Although public transport passengers consider service reliability a key quality aspect, actual services are often not perceived as reliable. we present recommendations to improve concession requirements as well as to improve the design of networks and of timetables, both aiming at enhanced service reliability.

- **RURAL INFRASTRUCTURES**

Infrastructure assets such as rural roads, tracks, bridges, irrigation schemes, water supplies, schools, health centres and markets are needed in rural areas for the local population to fulfil their basic needs and live a social and economic productive life.

- ***Point-Point network***

A point-to-point network connects directly to a set of locations without any interruption of services (e.g., pick up or drop off) even if the route itself may not be direct. One of the biggest advantages of the point-to-point model is reduced travel time. Passengers could save time without having long layovers between connecting flights, and wouldn't have to deal with the consequences of a delayed flight.

- ***The Trader networks***

Trade logistics works when the internal processes, the flow of goods and information meet all the requirements of the merchandise management system and warehouse management through the selection of a concept that is suitable for the trading company.

- ***Hub-and-Spoke network***

Agro-Food Scenario using a hub-and-spoke network the use case chosen to describe and identify the interoperability mentioned problems is about a simple request of an orange "Valencia Late" box. After obtaining an answer at all these parameters the intermediate warehouse will take a decision, choosing the farmer that will correspond to the best choice accordingly to the farmer's answers.

- ***Distance***

A more complex representation that accounts for the existing structure of the transport network. A simple form involving only one mode is a routing exercise that considers the shortest path between two points. In a more complex form, it concerns the set of physical activities related to transportation, such as loading, unloading, and transshipment.

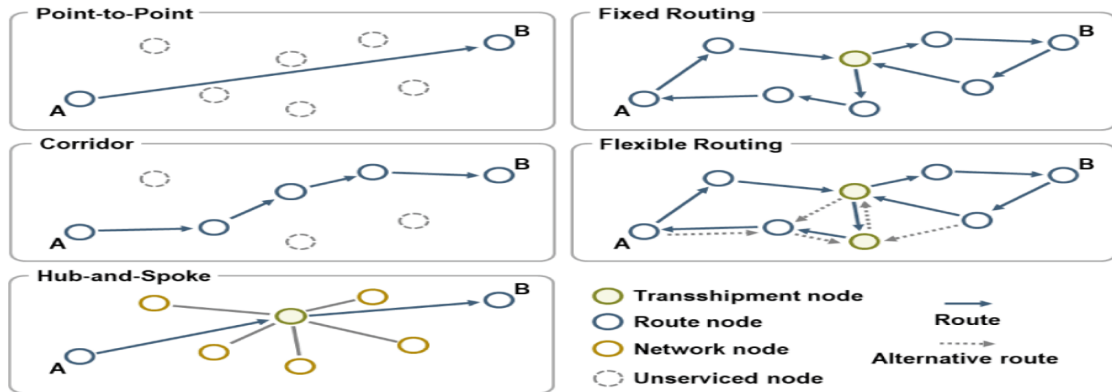


Fig. 4: Network Topology

- **CHALLENGES AND ISSUES**

- ***Customer Service***

Logistics customer service is a part of a firm's overall customer service offering, customer service elements that are specific to logistics operations including fulfilment, speed, quality, and cost. The fulfilment process includes the receipt of the order, managing the payment, picking and packing the goods, shipping the package, delivering the package, providing customer service for the end-user, and handling the possible return of the goods.

- ***Transportation cost control***

Transportation cost determines how much a firm will charge for the goods and services that it makes available in the supply chain. Pricing affects the behavior of the buyer of the good or service. For example, if a transportation company varies its charges based on the lead time provided by the customers, customers who value efficiency will likely order early and customers who value responsiveness will be willing to wait and order just before they need a product transported.

- ***Planning and Risk Management***

A logistics risk management plan is a strategy to speed response to as many circumstances as can be predetermined to minimize disruptions to the rural logistics if they were to occur. .

These may include changing market conditions, the competition gaining market share or operating at lower costs or evolving customer tastes.

- ***Lack of awareness & education***

Lack of visibility into your rural logistics can cause companies to lose track of their logistics network. If you don't have the technology that permits you to forecast demand, you could be left with not enough or too much inventory at different points in your logistics chain. It is a fact that education and access to better technology are two major factors contributing to fighting poverty and lifting communities out of a place of constant strife. If vast amounts of people around the globe simply do not have the knowledge needed to help themselves increase production and make a climb up the economic ladder, then the responsibility to help them lies with the people who are already above them.

- ***Supplier/Partner relationships***

A supplier relationship is important because a long-term relationship between your organization and its suppliers allows for the free flow of feedback and ideas. Over time, this will create a more streamlined, effective supply chain that will have a positive impact on costs and customer service.

- ***Slow Digital Transformation***

Digital transformation in logistics has allowed small companies as well to make a global reach. Over the few years ahead, this race will be mostly to work upon customer's experience in logistics and to make way to win over other companies. It is helping with logistics control, reducing operation cost, improving efficiency, with it, it is allowing the company to satisfy customer's same-day delivery needs too.

- ***Low-frequency visit of APMC (Agricultural Produce Market Committee)***

The frequency of farmers visits the APMC market is 1-2 times a month and is low as most of the produce is sold to village aggregators and it's uneconomical to transport a small lot of produce to the market which is at a distance. Most of the farmers sell their produce to traders outside of RMC yards. The next large category is comprised of farmers who sell their produce to village level aggregators except a few.

- ***Non-participation of the buyer at RMC markets (Ready Mixed Concrete)***

The markets under RMC are devoid of any transaction as there are no market channels in a function. Like sellers, the traders also face uncertainty in trading in RMC markets as there is a risk of inconsistent supply low marketable lots and poor quality of the produce. Buyers have no motivation to trade in the market as farmer producers do not visit these markets to sell the produce. The other reasons which were cited by the farmers were small surplus with farmers and uncertainty about getting a deal and price.

(C) DISRUPTIVE TECHNOLOGIES IN RURAL LOGISTICS

The summary of the technologies presented demonstrates that IoT, big data and AI do not operate in isolation but instead represent highly complementary technologies. The main applications of these particular technologies in transportation focus around demand forecasting and traffic optimization resulting in better traffic management, asset management, travel planning and operation of autonomous vehicles (AVs). The key challenge in the development of the identified disruptive technologies and their applications will be their successful integration into new business and governance models, maximizing their combined benefits to support the end goal.

- ***Blockchain***

The blockchain is a universally acclaimed innovation based on a distributed ledger technology, which originated from the efforts of anonymous developers to create a secure digital currency. Digital currencies that are based on a blockchain are defined as cryptocurrencies since they rely on cryptographic mathematical tools. Big companies such as IBM and Microsoft have started to consider offering blockchain services.

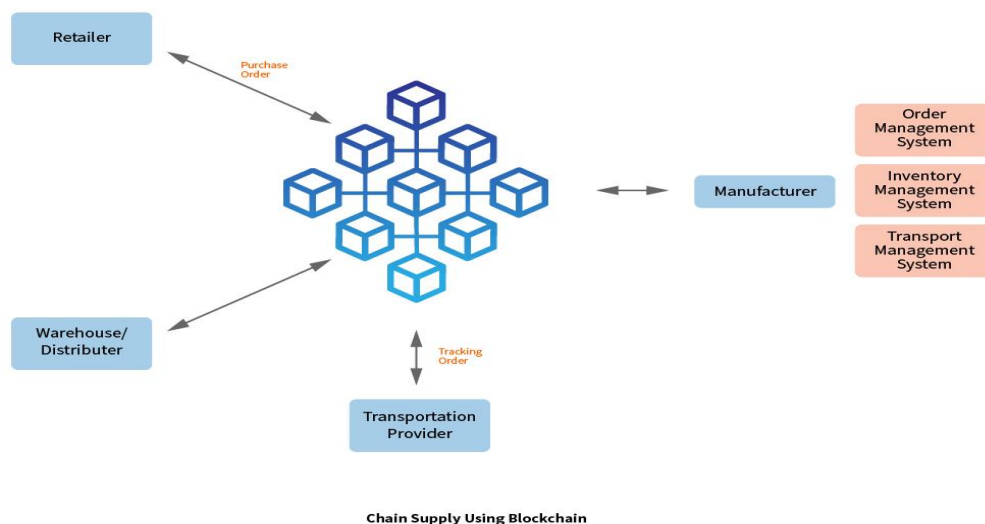


Fig. 5: Logistics using Blockchain

CHAPTER 3: RESEARCH METHODOLOGY

- **Problem Statement:**

Assessment of Digital Interventions in Rural Logistics and its solutions through Emerging Technologies

- **The objective of the Study:**

1. **Initiatives and Challenges in Rural Logistics**
2. **Its Solutions through Emerging Technology-BLOCKCHAIN**

- **Scope of the Study:**

It is a live Use case and a technology-based project that focuses on building up Blockchain-enabled Smart Rural Logistics in MP which is traditionally having poor & disintegrated management system for Transportation of Agri-based Goods leading to poor delivery of low-quality rural logistics of product lagging behind in time/cost/space/quality /technology domain and failing in better, smart & environment friendly Rural Logistics Performance.

Blockchain-enabled smart Rural Logistics will provide Mobility as a Service (MaaS) feature in Rural Logistics for Cost transparency between stakeholders, confidential information system, immutability & transparency of records, traceability, Auditability & verifiability of integrated smart rural logistics systems with proper smart contracts to reduce risks of frauds. Traditional Rural Logistics suffer from many drawbacks, lacking areas and disadvantages in its processes. Rural Logistics Management is required to carry out its functions through emerging technology Blockchain in the following areas of Rural Logistics that lacks in the management of the following in an integrated manner:

- ***Traffic, Vehicle & Transportation***
- ***Material & Market***

This Project will provide infrastructure requisites/ strategy & framework for building up emerging technology-based, Blockchain-enabled Smart Rural Logistics in MP with proper management of the aforementioned sub-domains of Rural Logistics using an integrated mobility system.

The survey has been fielded in seven (07) Districts of Madhya Pradesh viz. Bhopal, Hoshangabad, Sagar, Sehore, Dewas, Khandwa & Ujjain. The semi-structured questionnaire survey had been distributed to Sr. Government officials and senior technical Executives at Jila Panchayat, Janpad Panchayat, Mandi Board, Collectorate, Public Service Management, Digital Center, Common Service Center and Stakeholders like Warehouses, Transporters, Traders, Suppliers, Farmers, Shopkeepers, and Manufacturers. The respondent includes Sr. Government officials and senior technical Executives of Govt. Departments. The data has been tabulated, analyzed and presented.

Government must focus on Blockchain policy and its technological implementation about Rural Logistics in Madhya Pradesh to help reduce time, cost and risk in the areas of regulatory compliance, contract management, identity management and citizen services. Strategy and framework have been designed for stakeholders in the area of Rural Logistics. The decentralization process requires the involvement of different actors and those actors can play a very important role in providing the necessary data intended to gather from this study. Therefore, the target populations for the study are the respondents based on their participation and experience in the decentralization process. This target population is a sample representative of the whole of Madhya Pradesh and stakeholders involved in the current decentralization process has been drawn from the following Departments/Concerned Respondents:

- Jila Panchayat,
- Janpad Panchayat,
- Mandi Board,
- Collectorate,
- Public Service management,
- Digital Center, Common Service Center and
- Stakeholders like Warehouses, Transporters, Traders, Suppliers, Farmers, Shopkeepers, and Manufacturers

● **Research Design:**

It is a Mixed-Method based Research Methodology that follows an Inductive approach and includes Descriptive & Non-Experimental case study-based Research Design. This Research Design is a Cross-Sectional study used to observe the current IT ecosystem of the Government Departments at a given time. It adheres to both Pragmatism & Realism Philosophy.

- **Sampling Method & Techniques for Data Collection:**

Probability Sampling Method has been used that utilizes a combination of two Sampling techniques viz. Non-Uniform Systematic Cluster sampling and Stratified Random Sampling. The population of Madhya Pradesh has been targeted. 7 Clusters (Districts) have been chosen systematically based on the Rural Logistics activities pattern. Districts are Bhopal, Sehore, Sagar, Hoshangabad, Khandwa, Ujjain, Dewas. Stratas has been designed as per the need of the Rural Logistics. 60 Samples have been gathered for its data analysis and predictions. Sampling Frame includes Jila Panchayat, Janpad Panchayat, Mandi Board, Collectorate, Public Service Management, Digital Center, Common Service Center and Stakeholders like Warehouses, Transporters, Traders, Suppliers, Farmers, Shopkeepers, and Manufacturers.

- **Data Collection Techniques:**

Qualitative & quantitative methods of data collection have been followed based Face to Face interactions, In-depth interviews, Focused Group Discussions and Close-ended Questionnaire Survey Forms as tools for Primary Data Collection. The permission letters had been obtained from the government departments to facilitate data collection from its structures and partners/stakeholders. Secondary Data has been collected through Websites, International Research Publications, National & International Journals, Books, online pdfs etc.

- ***Quantitative Close-ended Questionnaire Survey:*** Four distinct sections –

- Baseline – Questions involving queries of age, gender and education level achieved.
 - Disruptive Technology – General questions regarding respondents' knowledge and awareness of Blockchain technology innovations and any concerns they may have concerning them.
 - Blockchain General – Introductory questions on Blockchain to establish if there is an awareness of Blockchain among respondents.
 - Blockchain Specific – Using specific examples of how Blockchain can be used

- **Data Analysis Techniques:**

- **Pivot Charts using Excel for Graphical Analysis of Data;**

CHAPTER 4: DATA ANALYSIS

(CHALLENGES IN RURAL LOGISTICS)

(DISTRICT WISE OPINIONS FOR RURAL LOGISTICS)

Traders, Farmers, Manufacturers, Jila Panchayat, Common Service Centers, Public Service Management Department, Mandi Board, Shopkeepers, Warehouses, Suppliers and Transporters of the Bhopal, Hoshangabad, Sagar, Khandwa, Ujjain, Dewas, Sehore districts of Madhya Pradesh have the common opinion on Challenges /Issues in Rural Logistics:

- They have fear of technology failure
- They have a lack of transparency due to incomplete data sharing.
- They seek legal issues in technology.
- They agree to have a collaborative commerce platform for payments through blockchain.
- They do not find mobility as a service in the blockchain.
- They do not have the technological framework for rural logistics
- They do not have a scope for capacity building.
- They do not use smartphone sensors for logistics.
- They do not have an optimized vehicle tracking system.
- They do not have the requisite technical skills in logistics.
- They do not have a GPS.
- They do not use disruptive technology like blockchain.
- They do not have a videography system for logistics.
- They do not have a better information system in logistics.
- They do not have a prediction mechanism of logistics patterns.
- They do not have an on-demand logistics service.
- They do not have social media data on the traffic situation.
- They do not have surveillance and controllers.
- They do not have Broadband/RFID/Digital Display Systems.
- They do not have a smart transaction processing system.
- They do not have data sharing for farmers/manufacturers/warehouse keepers/traders/retailers.
- They do not have a smart vehicle security system.
- They do not smart & intelligent logistics systems.
- They do not have blockchain vehicle network architecture
- They do not have joint proof of work & proof of stake consensus mechanism.
- They do not maintain the confidentiality of information in logistics (commercial in confidence).
- They do not have logistics event tracking in the blockchain.
- They do not have what/why/when/where/who (blockchain).
- They do not have cost transparency in farmer/manufacturer/warehouse keeper/trader&retailer.
- They do not have a real-time data collection system.
- They do not have sustainable development goals for smart logistics.
- They do not have sufficient information for traceability.
- They do not have a digital database to record tracks, monitor, transacts physical and digital assets.
- They do not have quality transactions and enhanced traceability.
- They do not maintain immutable and transparent records.
- They do not ensure authentic rural logistics services.
- They do not use advanced packaging techniques: crypto-anchors/QR codes/digital fingerprints.
- They do not use mobile apps to trace product origin and movements along each step of logistics.
- They do not have data on quality, safety, and product sustainability.
- They do not have distributed ledger technology implemented in logistics.
- They do not have time-efficient document and data processing systems.

CHAPTER 5:

DATA FINDINGS & OUTCOMES

(SOLUTIONS THROUGH EMERGING TECHNOLOGIES)

DATA FINDINGS:

STATISTICS ON FINDINGS OF DIGITAL INTERVENTIONS IN RURAL LOGISTICS

No.	DISTRICT	TOTAL QUESTIONS	BENCHMARKED OUTCOMES (Using any Disruptive Technology)	TOTAL EXPECTED STANDARD OUTCOMES (Without using any Disruptive Technology)	% of Total Expected Standard Outcomes (Without using any Disruptive Technology)	RECEIVED VALID OUTCOMES	% of Received Outcome (Out of Benchmarked Outcomes)	Difference to be covered to implement any Disruptive Technology like Blockchain	NOT RECEIVED OUTCOMES (out of Benchmarked Outcomes)	% Scope for Rural Logistics Services Enhancement using Disruptive Technology Blockchain	Ranking of Districts based on Performance of Rural Logistics
6	DEWAS	50	46	32	69.6%	9	19.6%	50.0%	37	80.43%	RANK 1
7	UJJAIN	50	46	32	69.6%	8	17.4%	52.2%	38	82.61%	RANK 2
5	SAGAR	100	92	64	69.6%	16	17.4%	52.2%	76	82.61%	RANK 2
4	KHANDWA	200	184	128	69.6%	31	16.8%	52.7%	153	83.15%	RANK 3
2	HOSHANGABAD	350	322	224	69.6%	50	15.5%	54.0%	272	84.47%	RANK 4
3	SEHORE	300	276	192	69.6%	42	15.2%	54.3%	234	84.78%	RANK 5
1	BHOPAL	450	414	288	69.6%	56	13.5%	56.0%	358	86.47%	RANK 6

Table 1: Statistics on Findings of Digital Interventions in Rural Logistics

Standard Current Statistics, without using any disruptive technology should have a minimum of valid 32 inputs out of 50.

Advanced & desirable statistics of rural logistics that embeds disruptive technology like Blockchain must have valid 46 inputs out of 50. i.e., the Standard value of inputs to be considered is: 46

No.	District	DESIRED OUTCOME	
	Stakeholder Category	Standard	Advanced
1	HAVE YOU HEARD OF BLOCKCHAIN TECHNOLOGY?	0	1
2	DO YOU FIND MOBILITY AS A SERVICE IN BLOCKCHAIN?	0	1
3	DO YOU HAVE REAL TIME TRAFFIC MANAGEMENT?	1	1
4	DO YOU HAVE TECHNOLOGICAL FRAME WORK FOR LOGISTICS?	1	1
5	DO YOU HAVE ANY SCOPE FOR CAPACITY BUILDING?	1	1
6	DO YOU USE SMART PHONE SENSORS FOR LOGISTICS?	1	1
7	DO YOU SEEK ANY SURVEILLANCE OPPORTUNITY?	1	1
8	DO YOU HAVE OPTIMIZED VEHICLE TRACKING SYSTEM?	1	1
9	DO YOU HAVE INCIDENT DETECTION / FORECASTING SYSTEM?	1	1
10	DO YOU SEEK ANY LEGAL ISSUES IN TECHNOLOGY?	0	0
11	DO YOU HAVE REQUISITE FOR TECHNICAL SKILLS IN LOGISTICS?	1	0
12	DO YOU MAINTAIN ANY SECURITY / PRIVACY ISSUE?	1	1
13	DO YOU HAVE ANY GPS SYSTEM?	1	1
14	DO YOU HAVE E-PAYMENT IN LOGISTICS?	1	1
15	DO YOU USE ANY DISRUPTIVE TECHNOLOGY LIKE BLOCKCHAIN?	0	1
16	DO YOU HAVE ANY VIDEOGRAPHY SYSTEM FOR LOGISTICS?	1	1
17	DO YOU HAVE BETTER INFORMATION SYSTEM IN LOGISTICS?	1	1
18	DO YOU HAVE PREDICTION MECHANISM OF LOGISTICS PATTERN?	1	1
19	DO YOU HAVE ON-DEMAND LOGISTICS SERVICE?	1	1
20	DO YOU HAVE MECHANISM TO IDENTIFY VEHICLE LOCATIONS?	1	1
21	DO YOU HAVE SOCIAL MEDIA DATA ON TRAFFIC SITUATION?	0	1
22	DO YOU HAVE SURVEILLANCE AND CONTROLLERS?	1	1
23	DO YOU HAVE BROADBAND/RFID/DIGITAL DISPLAY SYSTEMS?	1	1
24	DO YOU HAVE SMART TRANSACTION PROCESSING SYSTEM?	1	1
25	DO YOU HAVE DIGITAL DATA SHARING IN FARMER/ MANUFACTURER/WARE HOUSE KEEPER/ TRADER/RETAILER?	1	1
26	DO YOU HAVE ANY SMART VEHICLE SECURITY SYSTEM?	1	1
27	DO YOU ANY SMART/INTELLIGENT LOGISTICS SYSTEM?	1	1
28	DO YOU HAVE BLOCKCHAIN VEHICLE NETWORK ARCHITECTURE	0	1
29	DO YOU HAVE JOINT PROOF OF WORK/ PROOF OF STAKE CONSENSUS MECHANISM?	0	1
30	DO YOU MAINTAIN CONFIDENTIALITY OF INFORMATION IN LOGISTICS (COMMERCIAL IN CONFIDENCE)?	0	1
31	DO YOU HAVE LOGISTICS EVENT TRACKING IN BLOCKCHAIN?	0	1
32	DO YOU HAVE WHAT/WHY/WHEN/WHERE/WHO (BLOCKCHAIN)?	0	1
33	DO YOU HAVE COST TRANSPARENCY IN FARMER/ MANUFACTURER/WARE HOUSE KEEPER/ TRADER/RETAILER?	0	1
34	DO YOU HAVE REAL TIME DATA COLLECTION SYSTEM?	1	1
35	DO YOU HAVE ANY FEAR OF TECHNOLOGY FAILURE?	1	0
36	DO YOU HAVE ANY DIGITAL SKILLS IN RURAL AREAS?	1	1
37	DO YOU HAVE SUSTAINABLE DEVELOPMENT GOALS FOR SMART LOGISTICS?	1	1
38	DO YOU FIND LACK OF TRANSPARENCY DUE TO INCOMPLETE DATA SHARING OR DUE TO UNAVAILABILITY OF DATA?	1	0
39	DO YOU HAVE SUFFICIENT INFORMATION FOR TRACEABILITY?	1	1
40	DO YOU HAVE DIGITAL DATABASE THAT RECORDS TRACKS, MONITORS AND TRANSACTS PHYSICAL AND DIGITAL ASSETS?	1	1
41	DO YOU HAVE QUALITY TRANSACTIONS AND ENHANCED TRACEABILITY?	0	1
42	DO YOU MAINTAIN IMMUTABLE AND TRANSPARENT RECORDS?	0	1
43	DO YOU ENSURE AUTHENTIC RURAL LOGISTICS SERVICES?	0	1
44	DO YOU USE ADVANCED PACKAGING TECHNIQUES LIKE CRYPTO-ANCHORS/QR CODES/DIGITAL FINGER PRINTS?	0	1
45	DO YOU USE MOBILE APPLICATION TO TRACE PRODUCT ORIGIN AND MOVEMENTS ALONG EACH STEPS OF LOGISTICS?	1	1
46	DO YOU HAVE DATA ON QUALITY, SAFETY, AND PRODUCT SUSTAINABILITY?	1	1
47	DO YOU HAVE DISTRIBUTED LEDGER TECHNOLOGY IMPLEMENTED IN LOGISTICS?	0	1
48	DO YOU HAVE COLLABORATIVE COMMERCE PLATFORM FOR PAYMENTS THROUGH BLOCKCHAIN?	0	1
49	DO YOU HAVE TIME EFFICIENT DOCUMENT AND DATA PROCESSING SYSTEM?	0	1
50	HAVE YOU TAKEN CORRECTIVE ACTION DURING TECHNOLOGY SERVICE FAILURE?	1	1

Table 2: Desired Outcome of Standard & Advanced Statistics

S.NO.	THE STAKEHOLDERS RESPONDED "NO" TO THESE QUESTIONS
1	DO YOU FIND MOBILITY AS A SERVICE IN BLOCKCHAIN?
2	DO YOU HAVE TECHNOLOGICAL FRAME WORK FOR LOGISTICS?
3	DO YOU HAVE ANY SCOPE FOR CAPACITY BUILDING?
4	DO YOU USE SMART PHONE SENSORS FOR LOGISTICS?
5	DO YOU HAVE OPTIMIZED VEHICLE TRACKING SYSTEM?
6	DO YOU HAVE REQUISITE FOR TECHNICAL SKILLS IN LOGISTICS?
7	DO YOU HAVE ANY GPS SYSTEM?
8	DO YOU USE ANY DISRUPTIVE TECHNOLOGY LIKE BLOCKCHAIN?
9	DO YOU HAVE ANY VIDEOGRAPHY SYSTEM FOR LOGISTICS?
10	DO YOU HAVE BETTER INFORMATION SYSTEM IN LOGISTICS?
11	DO YOU HAVE PREDICTION MECHANISM OF LOGISTICS PATTERN?
12	DO YOU HAVE ON-DEMAND LOGISTICS SERVICE?
13	DO YOU HAVE SOCIAL MEDIA DATA ON TRAFFIC SITUATION?
14	DO YOU HAVE SURVEILLANCE AND CONTROLLERS?
15	DO YOU HAVE BROADBAND/RFID/DIGITAL DISPLAY SYSTEMS?
16	DO YOU HAVE SMART TRANSACTION PROCESSING SYSTEM?
17	DO YOU HAVE DIGITAL DATA SHARING IN FARMER/ MANUFACTURER/WARE HOUSE KEEPER/ TRADER/RETAILER?
18	DO YOU HAVE ANY SMART VEHICLE SECURITY SYSTEM?
19	DO YOU ANY SMART/INTELLIGENT LOGISTICS SYSTEM?
20	DO YOU HAVE BLOCKCHAIN VEHICLE NETWORK ARCHITECTURE
21	DO YOU HAVE JOINT PROOF OF WORK/ PROOF OF STAKE CONSENSUS MECHANISM?
22	DO YOU MAINTAIN CONFIDENTIALITY OF INFORMATION IN LOGISTICS (COMMERCIAL IN CONFIDENCE)?
23	DO YOU HAVE LOGISTICS EVENT TRACKING IN BLOCKCHAIN?
24	DO YOU HAVE WHAT/WHY/WHEN/WHERE/WHO (BLOCKCHAIN)?
25	DO YOU HAVE COST TRANSPARENCY IN FARMER/ MANUFACTURER/WARE HOUSE KEEPER/ TRADER/RETAILER?
26	DO YOU HAVE REAL TIME DATA COLLECTION SYSTEM?
27	DO YOU HAVE SUSTAINABLE DEVELOPMENT GOALS FOR SMART LOGISTICS?
28	DO YOU HAVE SUFFICIENT INFORMATION FOR TRACEABILITY?
29	DO YOU HAVE DIGITAL DATABASE THAT RECORDS TRACKS, MONITORS AND TRANSACTS PHYSICAL AND DIGITAL ASSETS?
30	DO YOU HAVE QUALITY TRANSACTIONS AND ENHANCED TRACEABILITY?
31	DO YOU MAINTAIN IMMUTABLE AND TRANSPARENT RECORDS?
32	DO YOU ENSURE AUTHENTIC RURAL LOGISTICS SERVICES?
33	DO YOU USE ADVANCED PACKAGING TECHNIQUES LIKE CRYPTO-ANCHORS/QR CODES/DIGITAL FINGER PRINTS?
34	DO YOU USE MOBILE APPLICATION TO TRACE PRODUCT ORIGIN AND MOVEMENTS ALONG EACH STEPS OF LOGISTICS?
35	DO YOU HAVE DATA ON QUALITY, SAFETY, AND PRODUCT SUSTAINABILITY?
36	DO YOU HAVE DISTRIBUTED LEDGER TECHNOLOGY IMPLEMENTED IN LOGISTICS?
37	DO YOU HAVE TIME EFFICIENT DOCUMENT AND DATA PROCESSING SYSTEM?

Table 3: The Stakeholders responded "NO" to these Questions

Dewas has scored the highest outcome out of **19.6%** out of 69.6% minimum valid outcome without using technology.

Ujjain & Sagar both have scored an equal **17.4%** out of 69.6% minimum valid outcome without using technology.

Khandwa has scored **16.8%** out of 69.6% minimum valid outcome without using technology.

Hoshangabad has scored **15.5%** minimum valid outcome without using technology.

Sehore has scored **15.2%** minimum valid outcome without using technology.

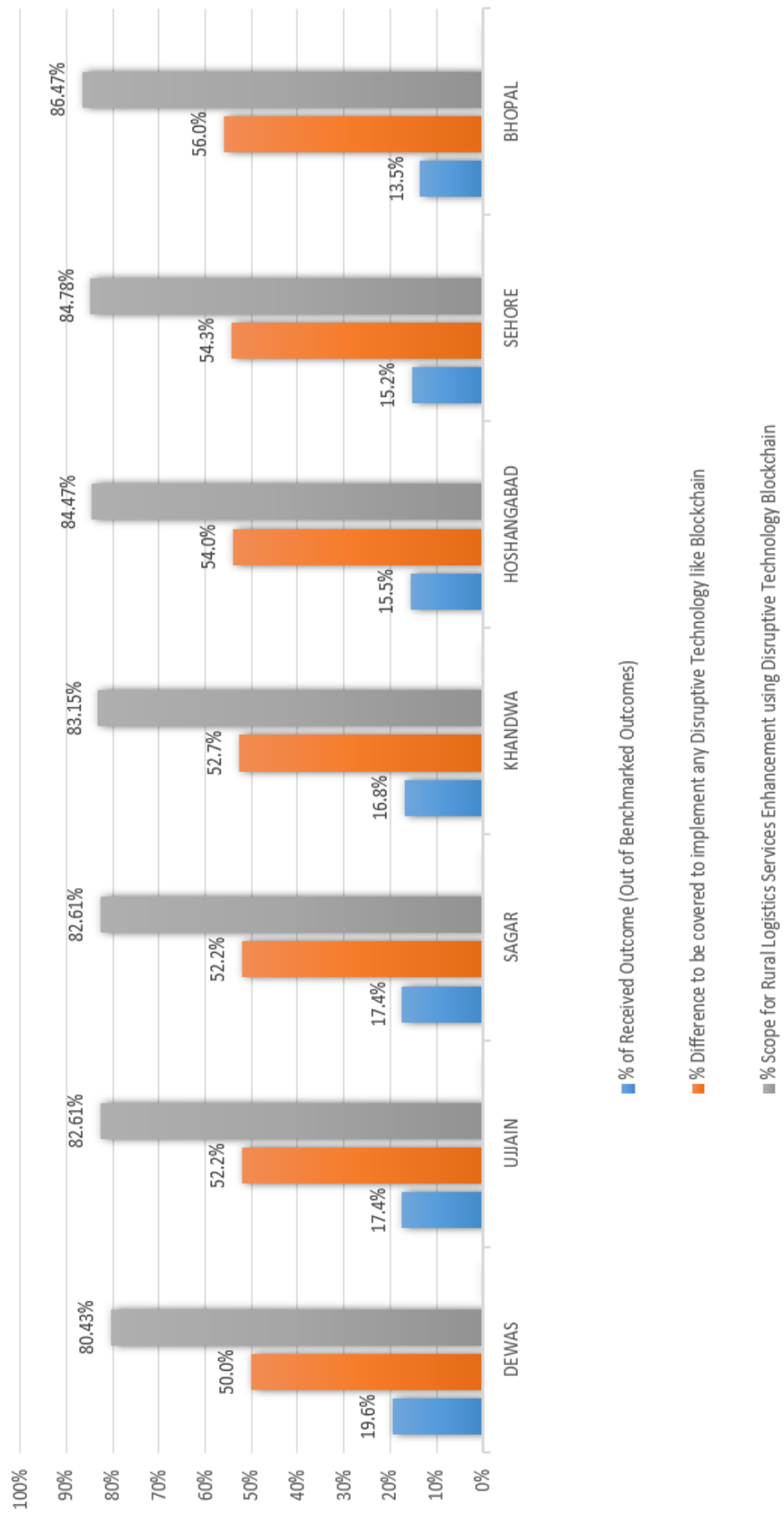
Bhopal has scored the lowest outcome of **13.5%** minimum valid outcome without using technology.

DISTRICT	Ranking of Districts based on Performance of Rural Logistics	Difference to be covered to implement any Disruptive Technology like Blockchain
DEWAS	RANK 1	50.0%
UJJAIN	RANK 2	52.2%
SAGAR	RANK 2	52.2%
KHANDWA	RANK 3	52.7%
HOSHANGABAD	RANK 4	54.0%
SEHORE	RANK 5	54.3%
BHOPAL	RANK 6	56.0%

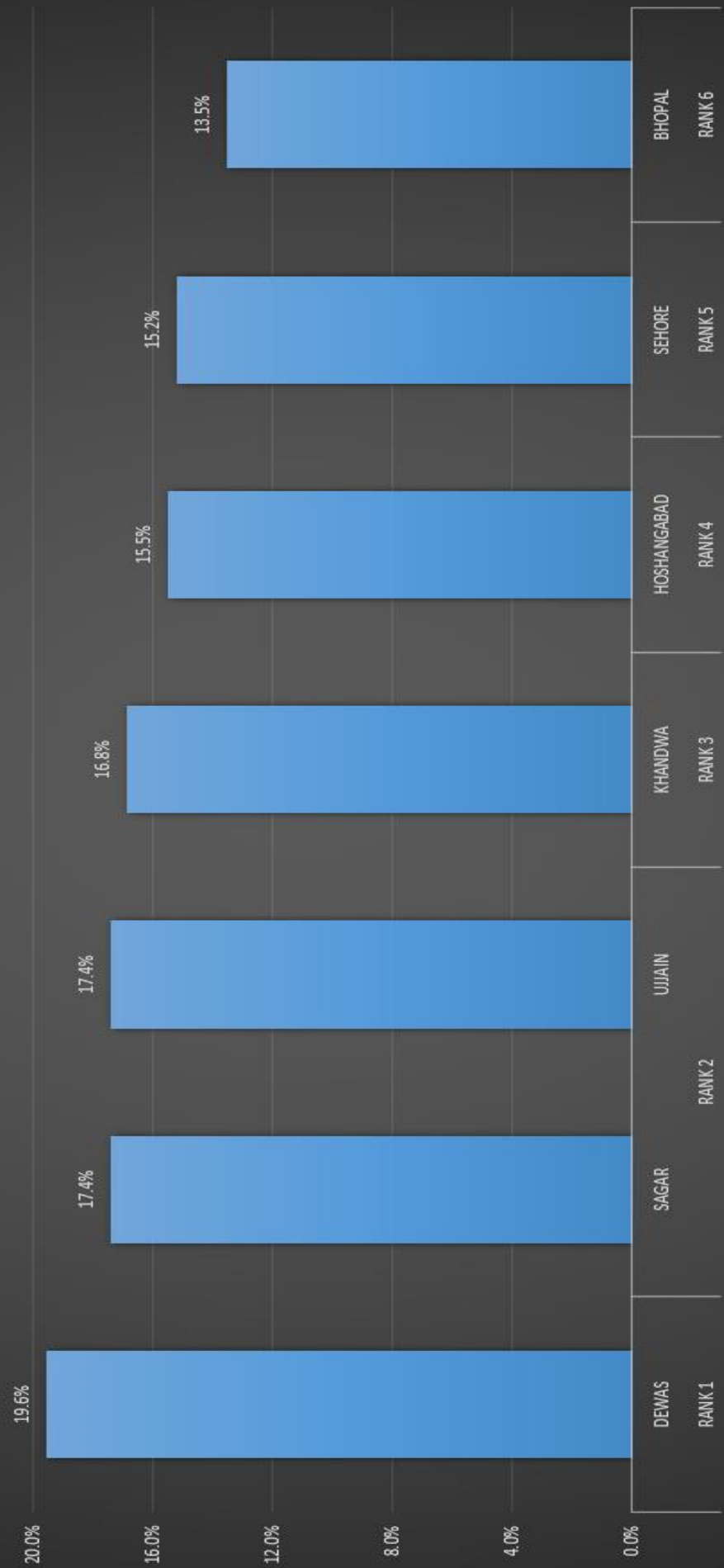
DISTRICT	% Scope for Rural Logistics Services Enhancement using Disruptive Technology Blockchain
DEWAS	80.43%
UJJAIN	82.61%
SAGAR	82.61%
KHANDWA	83.15%
HOSHANGABAD	84.47%
SEHORE	84.78%
BHOPAL	86.47%

Table 4: Ranking of districts, % Differences & % Scope of Rural logistics

STATISTICS ON FINDINGS OF DIGITAL INTERVENTIONS IN RURAL LOGISTICS



Ranking of Districts based on Performance of Rural Logistics

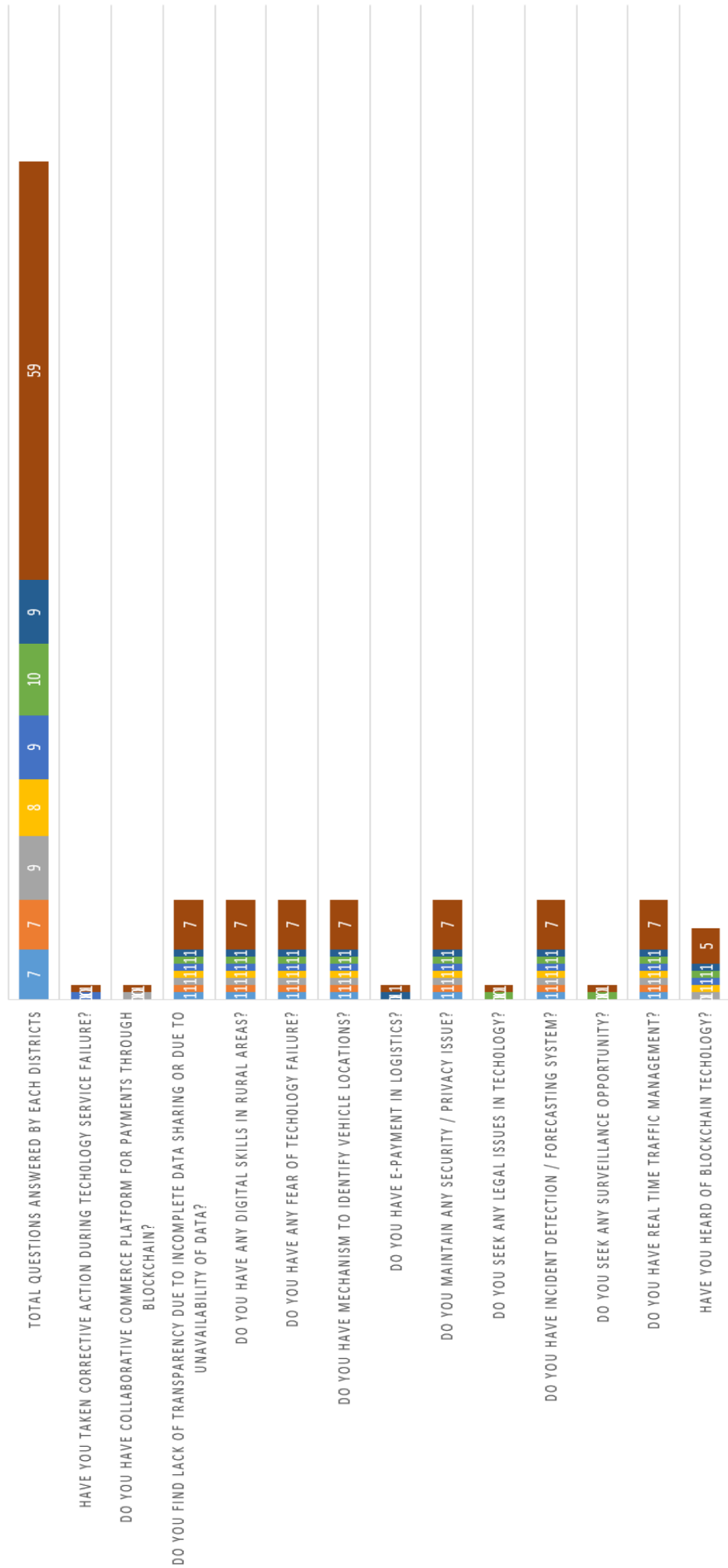


No.	Questions Responded by the Districts	Bhopal	Sehore	Dewas	Ujjain	Hoshangabad	Khandwa	Sagar	TOTAL No. of times Questions were answered by all districts
1	HAVE YOU HEARD OF BLOCKCHAIN TECHNOLOGY?	0	0	1	1	1	1	1	5
2	DO YOU HAVE REAL TIME TRAFFIC MANAGEMENT?	1	1	1	1	1	1	1	7
3	DO YOU SEEK ANY SURVEILLANCE OPPORTUNITY?	0	0	0	0	0	1	0	1
4	DO YOU HAVE INCIDENT DETECTION / FORECASTING SYSTEM?	1	1	1	1	1	1	1	7
5	DO YOU SEEK ANY LEGAL ISSUES IN TECHNOLOGY?	0	0	0	0	0	1	0	1
6	DO YOU MAINTAIN ANY SECURITY / PRIVACY ISSUE?	1	1	1	1	1	1	1	7
7	DO YOU HAVE E-PAYMENT IN LOGISTICS?	0	0	0	0	0	0	1	1
8	DO YOU HAVE MECHANISM TO IDENTIFY VEHICLE LOCATIONS?	1	1	1	1	1	1	1	7
9	DO YOU HAVE ANY FEAR OF TECHNOLOGY FAILURE?	1	1	1	1	1	1	1	7
10	DO YOU HAVE ANY DIGITAL SKILLS IN RURAL AREAS?	1	1	1	1	1	1	1	7
11	DO YOU FIND LACK OF TRANSPARENCY DUE TO INCOMPLETE DATA SHARING OR DUE TO UNAVAILABILITY OF DATA?	1	1	1	1	1	1	1	7
12	DO YOU HAVE COLLABORATIVE COMMERCE PLATFORM FOR PAYMENTS THROUGH BLOCKCHAIN?	0	0	1	0	0	0	0	1
13	HAVE YOU TAKEN CORRECTIVE ACTION DURING TECHNOLOGY SERVICE FAILURE?	0	0	0	0	1	0	0	1
	TOTAL Questions answered by each Districts	7	7	9	8	9	10	9	59

Table 5; Questions Responded by the Districts

DISTRICTS WISE REPORT

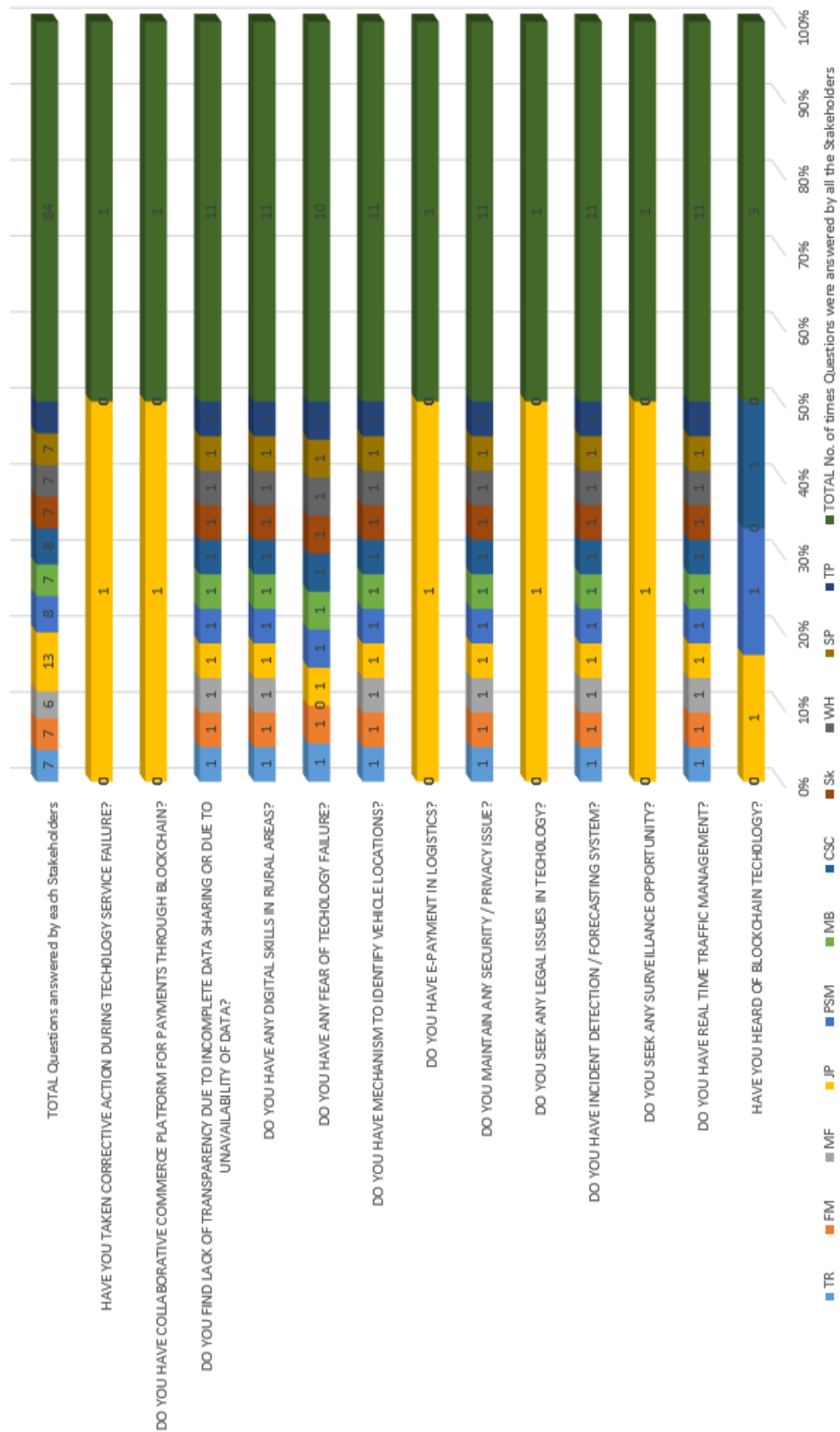
■ Bhopal ■ Sehore ■ Dewas ■ Ujjain ■ Hoshangabad ■ Khandwa ■ Sagar ■ TOTAL No. of times Questions were answered by all districts



No.	Questions Responded by the Stakeholders	TR	FM	MF	JP	PSM	MB	CSC	Sk	WH	SP	TP	TOTAL No. of times Questions were answered by all the Stakeholders
1	HAVE YOU HEARD OF BLOCKCHAIN TECHNOLOGY?	0	0	0	1	1	0	1	0	0	0	0	3
2	DO YOU HAVE REAL TIME TRAFFIC MANAGEMENT?	1	1	1	1	1	1	1	1	1	1	1	11
3	DO YOU SEEK ANY SURVEILLANCE OPPORTUNITY?	0	0	0	1	0	0	0	0	0	0	0	1
4	DO YOU HAVE INCIDENT DETECTION / FORECASTING SYSTEM?	1	1	1	1	1	1	1	1	1	1	1	11
5	DO YOU SEEK ANY LEGAL ISSUES IN TECHNOLOGY?	0	0	0	1	0	0	0	0	0	0	0	1
6	DO YOU MAINTAIN ANY SECURITY / PRIVACY ISSUE?	1	1	1	1	1	1	1	1	1	1	1	11
7	DO YOU HAVE E-PAYMENT IN LOGISTICS?	0	0	0	1	0	0	0	0	0	0	0	1
8	DO YOU HAVE MECHANISM TO IDENTIFY VEHICLE LOCATIONS?	1	1	1	1	1	1	1	1	1	1	1	11
9	DO YOU HAVE ANY FEAR OF TECHNOLOGY FAILURE?	1	1	0	1	1	1	1	1	1	1	1	10
10	DO YOU HAVE ANY DIGITAL SKILLS IN RURAL AREAS?	1	1	1	1	1	1	1	1	1	1	1	11
11	DO YOU FIND LACK OF TRANSPARENCY DUE TO INCOMPLETE DATA SHARING OR DUE TO UNAVAILABILITY OF DATA?	1	1	1	1	1	1	1	1	1	1	1	11
12	DO YOU HAVE COLLABORATIVE COMMERCE PLATFORM FOR PAYMENTS THROUGH BLOCKCHAIN?	0	0	0	1	0	0	0	0	0	0	0	1
13	HAVE YOU TAKEN CORRECTIVE ACTION DURING TECHNOLOGY SERVICE FAILURE?	0	0	0	1	0	0	0	0	0	0	0	1
	TOTAL Questions answered by each Stakeholders	7	7	6	13	8	7	8	7	7	7	7	84

Table 6: Questions Responded by the Stakeholders

STAKEHOLDERS WISE REPORT



OUTCOMES

Rural Logistics aims to have ICT based transit management & Traffic Management System which shall add value to citizens, city authorities and society in general by bringing down travel time, reducing travel-related energy consumption's, increasing comfort and safety of travel, establishing efficient and effective management procedures and working towards environmental sustainability. A robust intelligent traffic management system infrastructure can be developed that would be reliable and efficient leading to effective traffic management in the state to improve journey time reliability, to increase operational efficiency, to improve customer services and to create a blockchain-enabled platform to share traffic information.

Installation of Traffic Signals, Surveillance Camera, and integration of the same with police control room and command control centre is required with the purpose to reduce congestion and friction in traffic.

■ ***Rural Logistics Road infrastructure must include:***

Traffic Control System, Surveillance Camera, Automatic Number Plate Recognition System, Red Light Violation Detection System, Variable Message Sign Boards, Public Address System, Emergency Call Box System, Traffic Junctions, Entry-Exit Points, Location for Speed Detection etc.

■ ***In Rural Logistics Vehicle Tracking System involves:***

Attaching a GPS device to a vehicle where the device gathers information about the location of a vehicle and records the position of the vehicle at regular intervals, sending all this information to a centralized location. A person at the centre location can monitor the information to know the exact location of a vehicle at a given time, the route followed by the vehicle can be known. The solution must include hardware installation provisioning, repair and replacement service of terminals. This system would apply the information, communication and control technologies built on a blockchain platform to improve the operation of logistics networks. It will save time and lives, will improve the quality of logistics, environment, and will also improve the productivity of logistics activities. Integrated System is required due to

- Low road network speeds
- Higher travel times
- The increased cost of travel
- Increased energy consumption
- Increased pollution (both, noise and air)
- The decline in human productivity
- Decrease in the overall competitiveness of the city
- The decline in overall quality of life

The Transport Department in Madhya Pradesh aims to computerize the transport department's activities by issuing Smart Cards for Driving Licenses and Vehicle Registration. Presently all activities of RTO offices are computerized. Information of vehicles registered in MP is available via SMS & the Internet. Now, the system is proposed to be taken up on a Blockchain platform integrating with the Traffic management and vehicle tracking system.

Mandi Board project is modelled on a public-private partnership basis. The project empowers the farmers with the latest information on the rates, arrivals etc. in the neighboring state / national Mandis. This not only improved the effectiveness of trading in the Mandis but also brought transparency in the Mandi operations. This system is proposed to be taken up on a Blockchain platform integrating with the transport /traffic management and vehicle tracking system. Presently 516 regulated markets are there in the state out of which 246 are main wholesale markets having elaborate infrastructure also known as Krishi Upaj Mandi and the balance 270 having a lower level of infrastructure known as Sub Mandi. In addition to these, there are haat bazaars in the rural areas where farmers and other people congregate periodically to sell their farm marketable surpluses and buy their essential requirements. The mandi board is a three-tier organization. These are in the nature of physical and institutional infrastructure at the first contact point for farmers to encash their farm marketable surpluses. In the routine mandi, farmers do not have to furnish identity proof, just provide their name and village, and payments are made in cash. This does mean that village traders and aggregators can also easily sell in the mandi as well, but it does not prevent any farmer from doing so either. Second, mandis – especially after the improvements in road conditions – are open and relatively accessible all year round.

- ***Agricultural Marketing Information System Network (Agmarknet):***

AGMARKNET caters to the availability of prompt and reliable market information about arrivals and prices of commodities which considerably improves the decision-making capability of the farmers and strengthens their bargaining power.

- ***Krishinet:***

Krishinet project is developed for strengthening/promotion of ICT at the State, District, Agricultural Block and grass-root level and departments for faster information exchange.

- ***Panchlekha:***

Panchayat Raj Institution Accounting System Software (PRIA soft) since 2005 is aimed at efficient management and monitoring of funds at Janpad Panchayat, Zilla Panchayat & State Head Quarters and is empowering the administrators to monitor the fund receipt, availability and expenditure at all four-tier administrative setup of PRIs.

- ***e-Gram Suvidha:***

Implemented in Collectorate / Zila Panchayats of 5 districts (Chhatarpur, Bhopal, Mandla, Dhar & Damoh). e-GRAM Suvidha is a Geomatics-based Decision Support System towards the creation and management of facilities at the village level in rural areas. It covers about 20 facilities organized under 10 major sectors like Education, Health, Communication and Roads.

- ***Parakh (Basic Services/Amenities Management System):***

Government of Madhya Pradesh, recognizing the fact that access to the minimum level of social infrastructure facilities must be an integral part of a strategy for improving the quality of life of the people and for eradicating poverty. GoMP has introduced the Basic Services/Amenities Management System called “PARAKH” for improving the delivery of the Basic Services/Amenities in Rural Areas of the state. For this purpose, a computerized system for maintaining the Basic Services/Amenities is put into place.

- ***Web-based Rural Soft Monitoring System:***

Rural Soft is a computerized Web-based monitoring system for the monthly progress of various developmental schemes of the Department of Rural Development, Government of Madhya Pradesh. This system is proposed to be integrated with the integrated system of transport/traffic/vehicle tracking software.

STAKEHOLDERS’ CURRENT STATE VS FUTURE STATE

Stakeholders’	Current State	Future state
Manufacturer	Has limited visibility and control into the system date and processes.	Complete provenance trail of every asset.
	No insight into lost/spilled goods.	Visibility into process flow and claim data via POS integrations.
	Dependency on the paper trail	Losses are reported in real-time via Tol sensors.
		Real-time shipment acknowledgements
Warehouse	No visibility of incoming shipments.	Complete provenance trail of every asset.
	Real-time stock and sales data are not available.	Visibility into process flow and claim data via POS integration
	Slow and isolated processes.	Losses are reported in real-time via lot sensors.
		Real-time shipment acknowledgements.
Retailer	Fertilizer quality isn't guaranteed	Fertilizer quality can be traced back to the manufacturing source and B2 certificate.
	No visibility of incoming shipments.	Tol devices can help identify pilferage sources.
	Fertilizer losses along the way	
Government Agencies	Auditing inventory and sales data is complex	Holistic participant data View for each participant
	Isolated process structures and inconsistent soiled data	Consensus and immutability ensure data is valid and can be trusted.
		Minimizes the need for accounting and auditing.

Table 7: Stakeholders’ Current State Vs. Future State

- **SUGGESTIONS:**

- ***Reverse Logistics***

The full definition of reverse logistics, according to The Council of Logistics Management, is the process of implementing, controlling, and planning the cost-effective flow of finished goods, raw materials, and in-process inventory. Some reverse logistics examples are the Return of goods by customers.

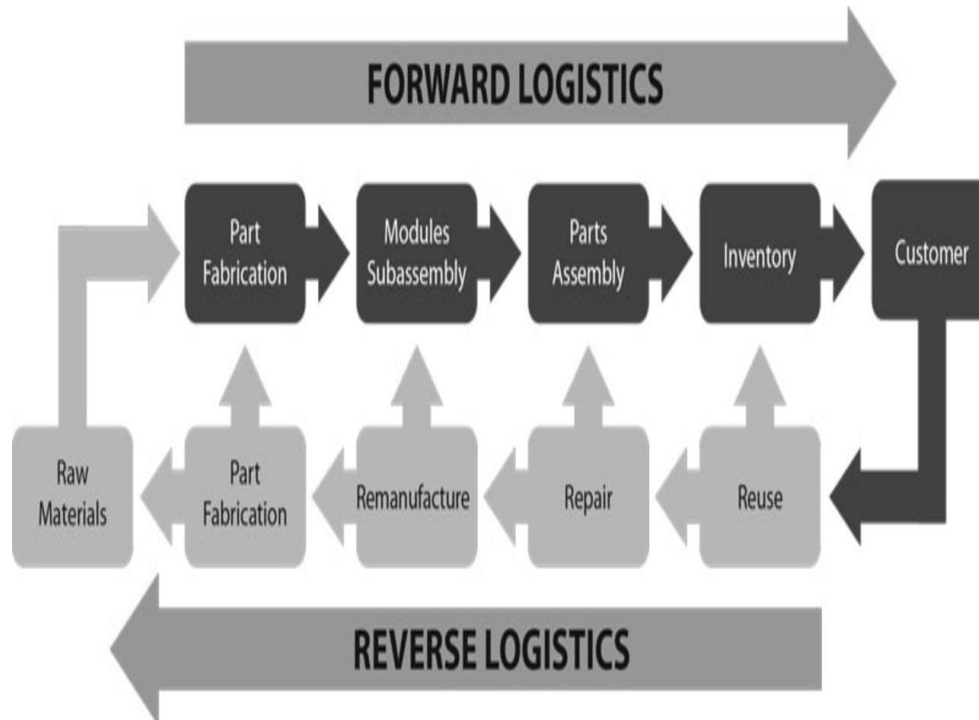


Fig. 6: Reverse logistics

- ***Online platform to organize logistics:***

With increasing digitization, platform-based business models will connect new players, wash away inefficient old ones, and harness the cloud. Multi-party coordination of this asset-intensive industry adds to the overall complexity. A blockchain-based platform for managing global shipments involving multiple stakeholders. Events across the shipping life cycle – credit checks, contract signing, arrival at the port, and payment – can be recorded publicly. On Trade Lens, event data and document information can be written on the blockchain, which creates a single source of truth that all can see. Contracts can also execute automatically on the blockchain. When a specific event is recorded — say a delivery at a port — the corresponding contracts encoded in the blockchain are automatically activated, removing human errors, delays, and lost documentation.

- **RURAL LOGISTICS COLLABORATION INDEX**

- ***Rural logistics collaboration index***

“Knowledge is power,” as they say, and in rural logistics collaboration, sharing of information leads to enhanced knowledge across the chain that allows you to achieve-

- Lower inventory levels and higher inventory turns
 - Lower transportation and warehousing costs
 - Lower out-of-stock levels
 - Shorter lead times
 - Improved customer service metrics
 - Visibility into customer demand and supplier performance
 - Earlier and quicker decision-making

Blockchain enabled system will have the flexibility to allow everyone, at every location across the globe, to understand what is happening when and where, in real-time, via an easy-to-navigate dashboard. The platform would be able to manage massive amounts of current inventory specifics and has the power to analyze past activities, anticipate future needs through “what if” modeling, understand and plan replenishment cycles, manage accounting functions, track productivity and collaborate throughout the entire supply management process. The system would also have the transparency and interoperability to integrate completely with customers’ systems, even if it is a patchwork of legacy systems.



Fig. 7: Rural Logistics collaboration

▪ ***Regional Level Blockchain-enabled Rural Logistics Policy Making:***

The State level Logistics Policy that should be released by the Government of MP aiming to promote seamless movement of goods across the state. It will focus on several areas such as process re-engineering, digitization, focus on multi-modal transport, EXIM trade etc. and will look at improving logistics in core sectors. It will seamlessly address many issues. Effective implementation of the policy would help provide an impetus to trade, enhance export competition.

A. Public sector recommendations

1. **Enhance government** support with the wide variety of institutions and stakeholders involved in rural logistics, special attention should be given to making policy formulation and implementation more effective, and this should involve authorities at the national, provincial, and local levels. The role of markets should be strengthened, with private enterprises as the main driver in creating logistics information platforms and mobile applications. The government should promote interconnectivity among logistics information platforms and enterprise information systems to effectively link various players in the rural logistics.

2. **Strengthen rural Logistics infrastructure:** - There should be improvements in the coordination of rural logistics infrastructure planning especially with regard to infrastructure locations, resource sharing, and co-development. The central government should promote the unified planning of rural logistics in selected provinces, and prefectural or city-level rural logistics planning should be synchronized with provincial development planning. The government and the private sector should cooperate in developing logistics parks with comprehensive functions pertaining to agricultural product circulation, processing, storage, transport, and distribution. They should strengthen the linkages between logistics park planning and other planning related to the development of the PRI's agricultural market system. They should also cooperate in the construction of supporting logistics parks (cargo hubs) with circulation, processing, storage, transport, and distribution functions. And they should strengthen the overall planning and construction of logistics parks (cargo hubs) and postal logistics distribution centres, to intensively integrate the logistics resources of the transport and postal sectors. Finally, they should strengthen the interconnectivity between existing logistics parks and agricultural production bases, agricultural product wholesale markets and distribution nodes, and agricultural input distribution centres, as well as postal distribution centres, to upgrade the effectiveness of rural logistics. The state government and local authorities should work to integrate the rural logistics resources pertaining to transport, commerce, farm supply

and marketing, and postal services; develop a rural logistics network based on three levels of nodes (county or district, township, and administrative village); and follow the model of “multiple functions in one node, with resource sharing.” With rural logistics centres serving as a base, they should also collocate rural markets, agricultural product collection points, renewable resource recycling centres, and agricultural-input distribution centres.

B. Private sector recommendations

1. Increase the informatization of rural logistics systems. The business model for small rural supermarkets must be revised to enable stable, long-term development. Due to the remote locations and low levels of informatization in rural areas, villagers lack the conveniences of urban life. Transforming small rural supermarkets into multifunctional commerce and distribution centres would enable them to provide a variety of services to rural residents, such as helping customers order tickets online or purchase goods from e-commerce websites. Mobile communication technology could provide convenient links between rural supermarkets and villagers. Smartphone apps could make it easier for local villagers to deliver parcels or small lots of cargo to other villagers—via farm shops or rural supermarkets. Increasing e-commerce initiatives and a crowdsourcing approach would speed up the delivery and lower the delivery cost for the receiver. Overall, logistics costs and services, as well as sustainability, would improve with this new approach, enabling substantial improvements in rural logistics services to cultivate strong rural Logistics enterprises. Logistics knowledge is a critical element in creating an efficient and reliable rural logistics system. Field studies have revealed a strong need to strengthen the logistics competency of rural transport and logistics operators. Unless logistics performance is measured, there is no objective way of telling if the results are getting better or worse. The managers of logistics enterprises should thus be encouraged to use performance indicators. Standards and specifications are essential for the efficient operation of a rural logistics system. The existing transport and logistics networks need to be rationalized to facilitate the movement of multiple types of cargo via multiple transport modes. The government should support private sector development of low-cost rural logistics terminals to consolidate shipments of agricultural products brought in by farmers, and to distribute consumer goods and non-locally produced food to the villagers.

- **RECOMMENDATIONS FOR THE GOVERNMENT OF MP & DEPARTMENT OF PANCHAYAT RAJ & RURAL DEVELOPMENT**

Development of Multi-Modal Logistics Parks in Madhya Pradesh: It is a freight-handling facility and to be constructed in a minimum area of 100 acres providing access to different modes of transportation. MMLP also provides storage solutions like mechanized warehouses and cold storage with other services like customs clearance and quarantine zones with the aid of transportation department. These parks will help reduce freight & warehouse costs, and vehicle congestion.

Development of Integrated Mobile App mLogistics: The Government is required to standardize processes across PAN-Madhya Pradesh to make sure that correct data can easily be shared between systems irrespective of their location. The Transportation Department should integrate the Procurement, Processing, Storage & Distribution activities with already launched software's – **SARATHI** for driving license processes, **VAHAN** for vehicle registrations & **E-Way Bill** which is an electronic document, generated from the E-way site, that is required to be carried by a person carrying a truckload worth more than Rs. 50,000. SARATHI offers services like Common Service Centre (CSC), E-Payment Gateway & State Service Delivery Gateway (SSDG) and VAHAN offers services like fitness, permit taxes, and registration. E-Way bill helps in the elimination of state boundary check posts and physical paperwork which facilitate vehicles' movement across the states and reduce their overall turnaround time. All these services should be offered in one mobile app and there should also be an SMS alert service to constantly notify the user.

Amendment of e-Governance Model for Information Sharing: This would require the government to change itself – its processes, its outlook, laws, rules and regulations and also its way of interacting with the citizens. It would also require capacity building within the government and creation of general awareness about e-Governance among the citizens to bring about transparency, to increase access to information, and to catalyze rural transformation, while enabling efficiencies and low-cost distribution that make the system profitable and sustainable.

Need of Logistics Synchronization: Manufacturing systems, transportation networks, and supply chains are all logistics systems, which are required to operate efficiently without waste of resources or time. Synchronization is required to increase efficiency by coordinating supply and demand over time and space that is intended to foster future

developments of a concrete quantification and operationalization of synchronization in logistics systems. The phenomenon of synchronization in logistics should be enforced for ***Rapid Response, Minimum Variance, Minimum Inventory, Movement Consolidation, Quality Improvement, Life-Cycle Support*** that is mainly composed of a temporal and performance- related coupling of the state of individual logistics elements.

Requirement for enhancement of Incentive Alignment: Government can improve incentive alignment by, adopting revenue-sharing contracts, using technology to track previously hidden information, or working with intermediaries to build trust among network partners. It's also important to periodically reassess incentives, because even top-performing networks find that changes in technology or business conditions alter the alignment of incentives.

Environment Safety is a Necessity: Green logistics, i.e., environmental logistics, refers to the sustainable policies and measures focusing on lowering the impact logistics has on the environment that includes the configuration of processes, structures, systems, and equipment used in the transportation, distribution, and warehousing of goods. The logistics transportation emits high greenhouse gas emission rates. Transport and the road traffic in particular produce fine particles that pollute the outside air. These particles are not only dangerous and carcinogenic to humans, but they are also toxic to ecosystems.

Proper Management of Logistics Cost: Expect to continually look for ways to reduce logistics costs while still operating your business efficiently. One of the simplest ways to keep logistics costs under control is to manage orders and deliveries effectively through ***emerging technology like Blockchain***. It can be used for any data exchange, whether it is contracts, tracking of shipments and financial exchanges (payments). Each action is captured in the block and the data is distributed over many nodes (computers), making the system transparent. ***Blockchain technology*** possesses the potential for creation of new logistics services, as well as new business models. As a relatively new technology, blockchain is designed to achieve decentralization, real-time peer-to-peer operation, anonymity, transparency, irreversibility and integrity in a widely applicable manner.

Need of Redesigning of Logistics Network Structure: There exists a need to redesign logistics process, networks, Information System, Organizational Structure.

Need of Enforcement of Flexibility principle, Simplification Principle & Gravity principle in Material Handling: Flexibility Principle encourages methods and equipment which are possible to utilize in all types of condition. Simplification Principle encourages

simplification of methods and process by removing unnecessary movements and Gravity Principle encourages usage of gravity principle in movement of goods.

Need to develop a Blockchain enabled Policy Framework for transportation: There exists a need to develop a policy framework to improve rural transport connectivity to local, national & regional transport networks as an integrated transport network.

Need of a Robust Packaging System: There is a need of quality packaging to protect products from damage, allows for their efficient distribution, communicates to the consumers. A good logistics packaging is required to keep products safe, and ensure that your product arrives at their address in the perfect form and free from any damage.

Need of Enhancement of Measured Services like Availability & Service Reliability: Product unavailability could mean lost sales and possibly lost opportunities, sometimes to the point that it can determine the long-term survival of the business. Blockchain enabled system is required to ensure the availability rate is the % of products available at given time

Eradication of Lack of Awareness and Education on Rural Logistics Management System: The blockchain technology is required to permit to forecast demand about enough or too much inventory at different points in your supply chain. Education is required to access to better technology.

Requirement of Sufficient Actionable Data: Sufficient data is required to create new insights that help improve supply chain decision-making, all the way from the improvement of front-line operations, to strategic choices, such as the selection of the right supply chain operating models. It is possible through robust ***Blockchain enabled Digital Ledger Technology***.

Need to improve the Low frequency visit of APMC (Agricultural Produce Market Committee): The visit to market by the farmer is low as most of the produce is sold to village aggregators and its uneconomical to transport a small lot of produce to the market which is at a distance. Most of the farmers sell their produce to traders outside of Ready-Mix Concrete (RMC) yards. The next large category is comprised of farmers who sell their produce to village level aggregators. Only few farmers sell their produce to traders/wholesalers sitting inside the yards.

Need to eradicate Non-participation of buyer at RMC markets (Ready Mixed Concrete): Buyers have no motivation to trade in the market as farmer producers do not visit these markets

to sell the produce. However, buyers are willing to engage in markets provided sellers have sufficient produce to trade. The three major reasons that emerged from farmer survey behind not utilizing RMC platform are the location of RMC, the absence of traders at RMC and transportation problems. The other reasons which were cited by the farmers were small surplus with farmers and uncertainty about getting a deal and price.

Need of Mandi Board Operations to be taken up on Blockchain Platform: Mandi Board project is modelled on public private partnership basis. The project empowers the farmers with the latest information on the rates, arrivals etc. in the neighboring state / national Mandis. This system is proposed to be taken up on Blockchain platform integrating with the transport /traffic management and vehicle tracking system.

Need of integration of Agricultural Marketing Information System Network (Agmarknet) with Mandi Board: AGMARKNET caters to the availability of prompt and reliable market information about arrivals and prices of commodities which considerably improves the decision-making capability of the farmers and strengthens their bargaining power. This system is proposed as an integrated system to be integrated with the Mandi Board along with integrated system of transport/traffic/vehicle tracking software.

Need of Integration of database of Krishinet, Panchlekha, e-Gram Suvidha, Parakh, & Web based Rural Soft monitoring System onto single Blockchain Platform: Krishinet project is developed for strengthening / promotion of ICT at the State, District, Agricultural Block and grass root level and departments for faster information exchange / dissemination. ***Parakh***, is the Basic Services/Amenities Management System Software for improving the delivery of the Basic Services/Amenities in Rural Areas of the state. For this purpose, a computerized system for maintaining the Basic Services/Amenities is put into place. ***Rural Soft*** is a computerized Web-based monitoring system for monthly progress of various developmental schemes of Department of Rural Development, Government of Madhya Pradesh. ***Panchlekha***, Panchayat Raj Institution Accounting System Software aimed at efficient management and monitoring of funds at Janpad Panchyat, Zilla Panchayat & State Head Quarters and is empowering the administrators to monitor the fund receipt, availability and expenditure at all four-tier administrative setup of PRIs. ***e-Gram Suvidha*** implemented in Collectorate / Zila Panchayats of 5 districts (Chhatarpur, Bhopal, Mandla, Dhar & Damoh). e- GRAM Suvidha is a Geomatics-based Decision Support System towards creation and management of facilities at village level in rural areas. It covers about 20 facilities organized under 10 major sectors like Education, Health, Communication and Roads etc. These softwares are proposed to be integrated on a common database using Blockchain.

Need of Emerging Technology Blockchain: A Robust Blockchain enabled integrated Rural Logistics Architecture is proposed for all the Retailers, Farmers, Warehouses & Distributors, Transportation Providers, Manufacturers, Suppliers, Mandi Board, Shop keepers, Traders to operate on a single platform in a decentralized manner with proper information sharing.

Need of Reverse Rural Logistics: There exists a need for the Reverse Rural Logistics Process of implementing, controlling, and planning the cost-effective flow of finished goods, raw materials, and in-process inventory.

Need of Rural Logistics COLLABORATION INDEX: Rural Logistics Collaboration Index must have the full coverage of Transportation Sourcing, Reverse Logistics, inbound and Outbound Management, Contracts & rate Management, Audit Payments & Claims, Freight Rate Index, Appointment Scheduling. It must cover all the stakeholders and this CollaborationIndex must include the following points:

Lower inventory levels and higher inventory turns; Lower transportation and warehousing costs; Lower out-of-stock levels; Shorter lead times; Improved customer service metrics; Visibility into customer demand and supplier performance; quicker decision-making.

Need of State Level Blockchain enabled Rural Logistics Policy Making: There is need of necessary policy making to promote logistics development in rural areas: (i) enhance government support, (ii) strengthen rural logistics infrastructure, (iii) increase the informatization of rural logistics systems, and (iv) cultivate strong rural logistics enterprises.

There is a Need to Eradicate Challenges/ Issues being faced by Traders, Farmers, Manufacturers, Jila Panchayat, Common Service Centers, Public Service Management Department, Mandi Board, Shopkeepers, Warehouses, Suppliers and Transporters of the districts of MP in Rural Logistics:

- ☐ Need for mobility as a service through blockchain.
- ☐ Need of technological framework for rural logistics
- ☐ Need of smartphone sensors for logistics.
- ☐ Need of optimized vehicle tracking system.
- ☐ Need of videography system for logistics.
- ☐ Need of better information system in logistics.
- ☐ Need to have a prediction mechanism of logistics patterns.
- ☐ Need to have an on-demand logistics service.
- ☐ Need to have social media data on the traffic situation.
- ☐ Need to have surveillance and controllers.

- ☐ Need to have Broadband/RFID/Digital Display Systems.
- ☐ Need to have a smart transaction processing system.
- ☐ Need to have data sharing for farmers/manufacturers/warehouse keepers/traders/retailers.
- ☐ Need to have a smart vehicle security system.
- ☐ Need to have smart & intelligent logistics system.
- ☐ Need to have blockchain vehicle network architecture
- ☐ Need to have joint proof of work & proof of stake consensus mechanism.
- ☐ Need to maintain the confidentiality of information in logistics (commercial in confidence).
- ☐ Need to have logistics event tracking in the blockchain.
- ☐ Need to have cost transparency in farmer/manufacturer/warehouse keeper/trader& retailer.
- ☐ Need to have a real-time data collection system.
- ☐ Need to have sustainable development goals for smart logistics.
- ☐ Need to have sufficient information for traceability.
- ☐ Need to have quality transactions and enhanced traceability.
- ☐ Need to maintain immutable and transparent records.
- ☐ Need to ensure authentic rural logistics services.
- ☐ Need to use advanced packaging techniques: crypto-anchors/QR codes/digital fingerprints.
- ☐ Need to use mobile apps to trace product origin and movements along each step of logistics.
- ☐ Need to have time-efficient document and data processing systems.

● CONCLUSION:

- Dewas has scored the highest outcome out of **19.6%** out of 69.6% minimum valid outcome without using technology.
- Ujjain & Sagar both have scored an equal **17.4%** out of 69.6% minimum valid outcome without using technology.
- Khandwa has scored **16.8%** out of 69.6% minimum valid outcome without using technology.
- Hoshangabad has scored **15.5%** minimum valid outcome without using technology.
- Sehore has scored **15.2%** minimum valid outcome without using technology.
- Bhopal has scored the lowest outcome of **13.5%** minimum valid outcome without using technology.

Blockchain technology offers an innovative platform for a new decentralized and transparent transaction mechanism in industry and business. Features of this technology increase confidence through transparency within any transaction of data, goods, and financial resources. Blockchain technology can easily provide secure business operations in logistics. In the logistics sector, blockchain technology could dramatically reduce time delays, added costs and human errors. Finally, by using blockchain technology, the challenges encountered by the logistics sector can be minimized or even eliminated, and sustainability can be greatly increased, based on previous research, appropriate conclusions are derived about possible obstacles and advantages in blockchain technology implementation. This technology can facilitate logistics tasks: it can be used to track purchase orders, order changes and freight documents, and it can help in information sharing about manufacturing process and delivery. Blockchain technology has huge potential for development and application in the logistics sector and supply chain, presenting challenges for further research.

Some of the major benefits of adopting an integrated Blockchain platform are as follows:

- The citizen benefits because there is transparency, efficiency and integrity in his dealings with the government; furthermore, there is easy information access.
- The government benefits because it reduces redundancy and duplication. The processes of data collection, analysis and audit are made much easier. Decision making gets expedited.
- The business community benefits because e-Governance can become a catalyst and a channel for e-Business, furthermore a web-based government will enable tax-paying online, reduce corruption and bending of laws.

We at Madhya Pradesh envision the commitments made to the citizens and works for nurturing our dreams to come true.

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ANNEXURE: 1

Government Official Stake Holders Record of 7 Districts

S.No.	Name	Designation	Department	District	Contact
1	Ms. Sharmila Mandloi	Asstt. Secretary	Mandi Board	Khandwa	9174143455
2	Ms. Priyanka Siroke	Statistics Clerk	Mandi Board	Khandwa	8319766857
3	Mr. J.K. Chowdhary	Secretary	Mandi Board	Khandwa	
4	Mr. Shailendra Singh Jadam	District manager-Public Service	Public Service Management	Khandwa	9907445535/ 07332222383
5	Ms. Nanda Bhalawe Kushre	CEO	Jila Panchayat	Khandwa	9425015229/ 07332226341
6	Mr. Maheshdra Ghanghoriya	CEO	Janpad Panchayat	Khandwa	8889164306
7	Mr. Anay Dwivedi	Collector	Collectorate	Khandwa	
8	Ms. Sandhya Thakre	PA to CEO	Jila Panchayat	Ujjain	7974864073/ 0734-2517700
9	Mr. Ankit Asthana	CEO	Jila Panchayat	Ujjain	9424455005
10	Mr. Ravi Chandra	Incharge	Digital Center	Ujjain	8817221572
11	Mr. Mahendra	Incharge	Digital Center	Ujjain	9827657181
12	Ms. Anita Jesani	Incharge	Common Service Centre	Ujjain	7974099442
13	Mr. Ashish Singh	Collector	Collectorate	Ujjain	
14	Mr. Pathak	PA to Collector	Collectorate	Ujjain	9827350589
15	Mr. Dhananjay Singh	Collector	Collectorate	Hoshangabad	
16	Ms. Mohini Sharma	Joint Collector	Collectorate	Hoshangabad	9617032702
17	Mr. Shailesh	Project officer	Jila Panchayat	Hoshangabad	9424978272
18	Mr. Rathore	Distt. Manager MPWLC	Jila Panchayat	Hoshangabad	
19	Mr.	Secretary	Mandi Board	Hoshangabad	
20	Mr. Deepak Singh	Collector	Collectorate	Sagar	
21	Mr. Ichit	CEO	Jila Panchayat	Sagar	9826071047
22	Mr. Anup Tiwari	Distt. Coordinator-SRLM	Jila Panchayat	Sagar	9406809008/ 8349901708
23	Mr. Prabhash	DM-MED	Jila Panchayat	Sagar	9406904767
24	Mr. Ashish Gupta	Project Incharge	Jila Panchayat	Sagar	9977329955
25	Mr. Yogesh Dubey	Asstt. Nodal Officer	Jila Panchayat	Sagar	9302214423
26	Mr. Harsh	CEO	Jila Panchayat	Sehore	
27	Mr. Ajay Gupta	Collector	Collectorate	Sehore	
28	Mr. Chandra Mauli Shukla	Collector	Collectorate	Dewas	
29	Mr. Prakash Singh Chouhan	CEO	Jila Panchayat	Dewas	9685980222/ 07272252540
30	Mr. Y.P. Shrivastava	PA to Collector	Collectorate	Bhopal	9425661589

ANNEXURE: 2

Non-Official Stake Holders Record of 7 Districts

S.NO.	NAME	DESIGNATION	CATEGORY	DISTRICT	CONTACT
1	sandeep parmar	farmer	farmer	sehore	8357875025
2	neeraj parmar	farmer	farmer	sehore	8959143605
3	kanta prashad	farmer	farmer	sehore	
4	rohit malviya	farmer	farmer	sehore	9617482945
5	ramesh prashad	farmer	farmer	sehore	8349727880
6	sunil parmar	farmer	farmer	sehore	7477737999
7	rajesh	farmer	farmer	bhopal	9856570322
8	raju sahu	farmer	farmer	bhopal	7697643832
9	umesh sahu	farmer	farmer	hoshangabad	9926383144
10	ramesh	farmer	farmer	hoshangabad	9098091604
11	vipin rathore	owner	manufacturer	sehore	9691189788
12	manoj kumar	owner	manufacturer	bhopal	9893711561
13	m.k. singh	manager	manufacturer	bhopal	9893662530
14	dharmesh khare	owner	manufacturer	hoshangabad	8770925900
15	vishal tyagi	owner	shopkeeper	sehore	9926761279
16	bharat singh	owner	supplier	bhopal	8085626380
17	om prakash	owner	supplier	bhopal	8109076626
18	ankit	trader	trader	sehore	8109405221
19	ankit rathore	trader	trader	sehore	9827511646
20	raj kumar	trader	trader	sehore	6266208347
21	paikesh rathore	trader	trader	sehore	7999906037
22	yash	tader	trader	sehore	8889991139
23	rajesh	trader	trader	bhopal	9039919749
24	ramesh sahu	trader	trader	bhopal	9826306406
25	vishal jain	trader	trader	bhopal	7000090325
26	devendra sagar	trader	trader	hoshangabad	992654032
27	pradeep vishwakarma	owner	transport	sehore	9752330988
28	rahul vishwakarma	owner	transport	bhopal	9340010627
29	pratap	supervisor	warehouse	sehore	888969522
30	mukesh patel	manager	warehouse	sehore	