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"Tech-Driven Transformations in Supply Chain Management: Innovations and Advancements"

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Abstract—This study investigates the prevalent causes of construction project delays in India, emphasizing material shortages and inefficient procurement systems. The research aims to inform policy formulation for timely project completion, considering factors such as cost overruns, time delays, and potential legal implications. The study identifies influential causes, including corrupt practices, material quality issues, and ineffective project planning.
Additionally, the project delves into the impact of technological innovations on supply chain management, focusing on efficiency, decision-making optimization, and ethical considerations. It evaluates the influence of technologies such as data analytics and real-time information on supply chain performance, highlighting both benefits and challenges. The study contributes to understanding the transformative effects of technology on supply chains and emphasizes key factors for successful implementation while addressing ethical consideration

Keywords—Cost benefit analysis, Material management, Technology-driven innovations,efficiency, challenges, opportunities, data analytics, real-time information, Android Application, etc.

INTRODUCTIO N

"Supply chain management (SCM) involves coordinating the processes that create value in products and services for consumers. SCM in construction focuses on efficiently directing materials, equipment, and personnel from supply points to the construction site. Efficient SCM is crucial in addressing challenges related to productivity in the construction industry, where factors like labor performance, time, cost, resources, and quality impact overall project success.
Productivity issues, often linked to labor performance, play a significant role in construction management. Understanding and managing factors influencing productivity, such as SCM, labor, equipment, and cash flow, are essential for achieving project goals.
Delays in construction projects lead to cost overruns, time delays, contract termination, and legal disputes. Investigating influential causes of delays, including corruption, material shortages, design errors, and inefficient project planning, is crucial. This study assesses the impact of delays on construction projects in India and proposes remedial measures to enhance timely project delivery."

The benefits for individual companies in the supply chain include:

- Reduced real costs, with margins maintenance
- Incentive to remove waste from the process
- Greater certainty of out-turn costs
- Delivery of better underlying value to the client
- More repeat business with key clients
- Greater confidence in longer-term planning

Productivity rates are used as indicators of the construction time performance. They are used in planning and scheduling of construction, controlling of the cost and worker performance, estimating and accounting.

Changes in labour productivity shows whether output is increasing or decreasing per worker and is often used in wage settlements to compensate workers for productivity improvements. Growth in productivity is the key to higher living standards as a country can sustain real wage increases without losing competitiveness, only if labour productivity grows.
If a company wishes to reduce risk, increase profits, or gain market share, there is direct need within the firm to haveaccuracy data on and use of labor productivity.

The most challenging issue in Construction industry is labour productivity. Labour productivity directly effects on the construction performance. If a company wishes to reduce risk, increase profits, or gain market share, there is direct need within the firm to have accuracy data on and use of labor productivity.

Aim

"The aim of this research was to evaluate the various types of factors in supply that occur in construction projects and the reasons why time management occur and the measures that can be implemented to reduce or eliminate these delays by mitigation or acceleration of supply chain management".

Objectives

- To assess the impact of technology-driven innovations on supply chain efficiency.
- To analyse the challenges and opportunities of implementing technology-driven innovations in supply chain management.
- To design Questionnaire Survey with pilot analysis using SPSS Tool
- To examine the role of data analytics and real-time information in optimizing supply chain decision-making.
- To Identify the potential ethical and social implications of technology-driven innovations in supply chain management

Problem statement

To study supply chain management, low labour productivity on site such effect on construction site and find out the best solution for the efficient work by reducing the cycle time that increase project performance

RESEARCH METHODOLOGY

- It consists of introduction, history, effects of productivity on construction industry, advantages, salient features. Also introduce the objectives of this study.
- Literature review related to the project.
- Analyze the factors affecting labour productivity.
  - Overtime
  - Morale and Attitude
  - Fatigue
  - Stacking of Trades
  - Joint Occupancy
  - Beneficial Occupancy
  - Concurrent Operations
  - Absenteeism and Turnover
  - Mobilize/Demobilize
- Time, Cost Management and material management in Construction site productivity.
- Preventive methods to improve the SCM & Labour productivity.
- Conclusion and lastly discussed on future scope of this project.

Research Framework

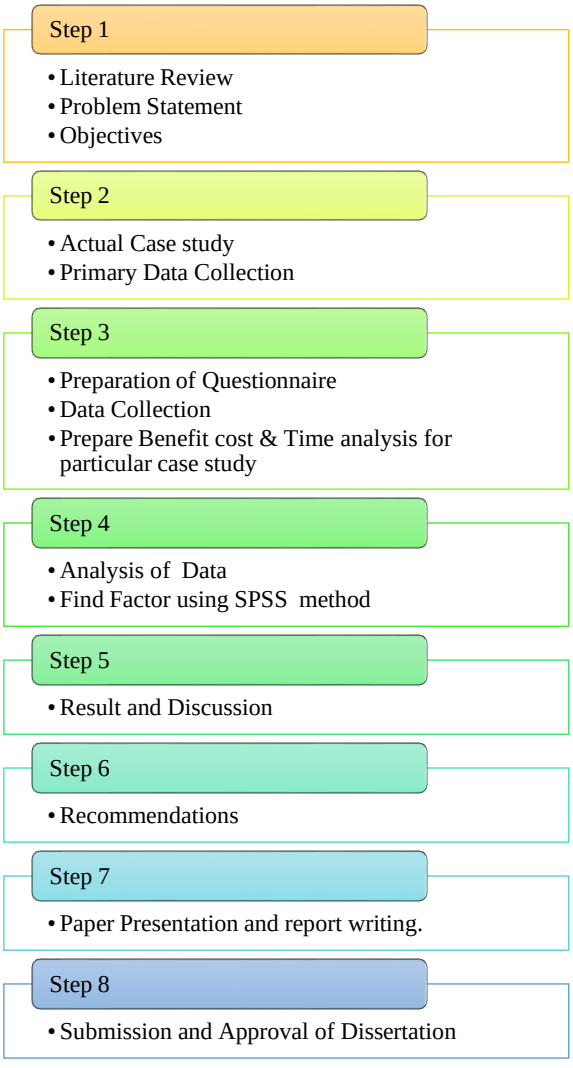

Fig1.1: Flowchart of Methodology

1. To study the literature review to know about present scenario of Infrastructure projects and conduct open interviews.
2. Define the objective based on the necessity concluded from present scenario.
3. Preparation of set of questions based on literature review, survey of the SCM, Material, labours, and for conducting the questionnaire survey focused on defined objective.
4. Interviews and discussions with labours to validate the factors like disputes, resources, material chain and time-cost management.
5. Analysis of data, by relative importance index method, obtained from the Questionnaire survey to rank the attributes frequently affecting the performance of the project.
6. Analysis of data, by relative importance index method, obtained from the Questionnaire survey to know the impact of attributes on the project affecting the performance of the project.
7. Productivity and recommendation through case study.

Innovation and data Driver Technology

"Innovative Applications in Supply Chain Management for Android" is a dynamic mobile solution designed to revolutionize the way supply chain processes are managed. This app integrates cutting-edge technologies to streamline sourcing, procurement, conversion, and logistics activities on the Android platform. Users can expect a user-friendly interface, real-time tracking, and data-driven decision-making, enhancing efficiency in the supply chain. The application provides a comprehensive exploration of innovative features tailored for Android users, promising a seamless and responsive experience for professionals engaged in supply chain management.

Role of Technology in Supply Chain Management

1. **E-commerce Impact:** The rise of e-commerce and digital commerce has elevated the significance of supply chain management for businesses.
2. **Critical for Manufacturing:** Supply chain management is particularly crucial for manufacturing companies, relying heavily on partners to ensure timely product delivery.
3. **Stakeholders in Manufacturing Supply Chain:** Major stakeholders include manufacturers, suppliers, retailers, shippers, and distributors, collectively contributing to the end-to-end product delivery process.
4. **Technological Emphasis:** The increasing emphasis on technological advancements underscores the need for an integrated supply chain management system.
5. **Changing Customer Expectations:** Evolving customer expectations in the digital age necessitate a revaluation and optimization of supply chain processes.
6. **Integrated Supply Management:** The integration of supply management has become more vital, considering the complex network of entities involved in the supply chain.
7. **Digitization as a Necessity:** For manufacturing companies to expand customer bases, digitization of business processes is not just a value-add but a necessity.
8. **Creating a Digital Environment:** The demand for a seamless digital environment is rising, encouraging the integration of operations throughout the supply chain entities.

In summary, the new era of shopping, driven by e-commerce, emphasizes the importance of supply chain management, especially for manufacturing companies.

This necessitates a strategic focus on technology integration and digital processes to meet changing customer expectations and build a robust customer base.

Aspects in economic order quantity

Now let us discuss the various aspects in economic order quantity one by one briefly.

Annual demand (d)

It refers to the amount of demand an organization gets for its product each year. This can be determined by looking into the historical order data.

Volume per Order

It refers to the amount of volume an organization goes for per order. This can be determined by analyzing historical inventory or sales data.

Ordering cost (s)

Ordering cost means the cost of an order per purchase. Experts also refer to it as the 'setup cost'. This particular cost is inclusive of both the shipping and handling costs.

Variable costs, often known as unit costs, are expenses that can alter in response to changes in volume.

- Fees for credit cards are included
- Packaging materials
- Delivery expenses
- Production materials
- Labor at piece rate;
- raw supplies;
- commissions

Holding costs (h):

The overall cost of maintaining inventories is referred to as holding costs. One important supply chain management tactic is lowering these expenses.The costs incurred by a company to keep goods on hand are referred to as carrying costs, or interest rates.

Design and Development of Application

The Supply Chain Hub App is a comprehensive and user-friendly solution designed to optimize and streamline the complexities of supply chain management. Tailored for businesses of all sizes, this application encompasses a range of features to enhance efficiency, transparency, and collaboration throughout the supply chain.

1. **End-to-End Visibility:** Gain real-time visibility into every stage of the supply chain, from sourcing raw materials to final product delivery.
2. **Inventory Management:** Efficiently manage and track inventory levels, reducing the risk of stockouts and overstock situations.
3. **Supplier Collaboration:** Foster seamless communication and collaboration with suppliers, ensuring timely deliveries and maintaining strong partnerships.
4. **Order Tracking:** Enable customers and internal stakeholders to track orders in real-time, enhancing transparency and customer satisfaction.
5. **Data Analytics:** Leverage powerful analytics tools to extract actionable insights, identify trends, and optimize decision-making processes.
6. **Mobile Accessibility:** Access critical supply chain information anytime, anywhere, with a mobile-friendly interface for on-the-go management.
7. **Automated Alerts:** Receive instant notifications for events such as low inventory, shipment delays, or production issues, allowing for proactive problem-solving.
8. **Integration Capabilities:** Seamlessly integrate with existing ERP systems, e-commerce platforms, and other relevant tools to ensure a cohesive and synchronized workflow.
9. **Security Measures**: Prioritize data security with advanced encryption and authentication protocols, safeguarding sensitive supply chain information.
10. **User-Friendly Interface:** Designed for ease of use, the intuitive interface ensures that users across various roles can navigate the application effortlessly.

The Supply Chain Hub App is your all-in-one solution for modern supply chain management, promoting efficiency, collaboration, and adaptability in today's dynamic business environment.

The SCM Navigator App is designed to be a versatile and powerful tool, providing supply chain professionals with the agility and insights needed to navigate today's dynamic business landscape.

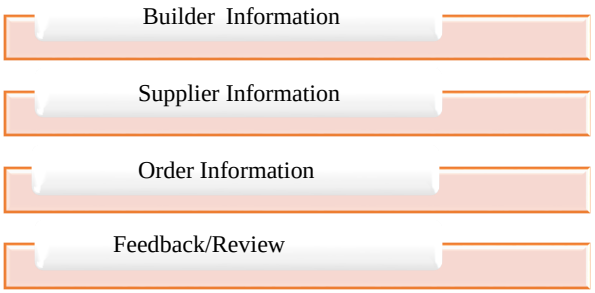

Figure: Design and content

Builder Connect SCM App

BuilderConnect SCM App is a tailored solution catering to the specific needs of builders, suppliers, and order management within the supply chain. This user-friendly application facilitates seamless collaboration and efficient management of construction projects.

Order Placement and Tracking: Builders can easily place orders for construction materials directly through the app, and track the status and delivery timeline in real-time.

Supplier Network: Connects builders with a network of trusted suppliers, providing a diverse range of construction materials with transparent pricing and availability.

Inventory Visibility: Suppliers can manage and update their inventory, allowing builders to view real-time stock levels and make informed decisions when placing orders.

Delivery Scheduling: Builders can schedule deliveries based on project timelines, and suppliers receive automated alerts to ensure on-time delivery of materials to the construction site.

Billing and Invoicing: Transparent billing and invoicing functionalities enable builders to review and approve invoices, promoting financial clarity in the procurement process.

Quality Assurance: Builders can input quality specifications, and suppliers can upload quality documentation, ensuring that materials meet the required standards.

Collaborative Communication: Facilitates communication between builders and suppliers through an integrated messaging system, enhancing collaboration and resolving queries efficiently.

Project Dashboard: Builders have access to a comprehensive project dashboard, providing a holistic view of ongoing orders, deliveries, and project timelines.
Analytics and Reporting: Generates analytical reports on order history, supplier performance, and inventory trends, empowering builders to make data-driven decisions.
BuilderConnect SCM App serves as a centralized platform, fostering collaboration between builders and suppliers, streamlining order processes, and ensuring the efficient flow of materials for construction projects.

Builder Information

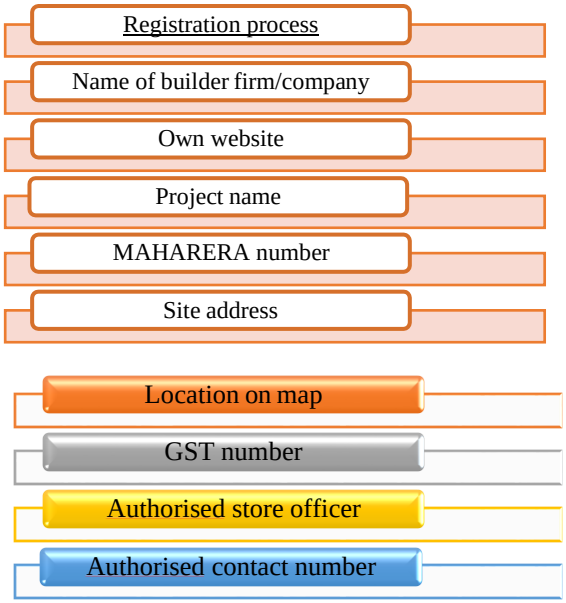

Figure: Builder Information Filling Window

SupplierInfo SCM App is a dedicated Android application designed to streamline and centralize supplier information for effective supply chain management. This user-friendly app provides quick access to essential details, fostering transparency and efficiency in supplier interactions.

Supplier Database: Maintain a comprehensive database of suppliers, including contact information, location, product offerings, and historical performance.

Performance Metrics: Track and analyze supplier performance based on key metrics such as on-time deliveries, quality consistency, and responsiveness to queries.

Document Repository: Store and manage important documents such as contracts, certifications, and compliance records for each supplier, promoting regulatory compliance.

Communication Hub: Facilitate direct communication between procurement teams and suppliers through integrated messaging features within the app.

Order History: View and track the historical data of orders placed with each supplier, helping in decision-making and fostering long-term relationships.

Alerts and Notifications: Receive alerts for critical events such as changes in supplier status, upcoming contract renewals, or potential disruptions in the supply chain.

Collaborative Feedback: Enable a feedback system where both parties can provide comments and ratings, fostering transparency and continuous improvement.
Supplier Segmentation: Categorize suppliers based on their specialization, reliability, and other criteria, allowing for targeted engagement and strategic decision-making.
Security Measures: Prioritize data security with secure login features and encryption protocols to protect sensitive supplier information.

Suppliers Information

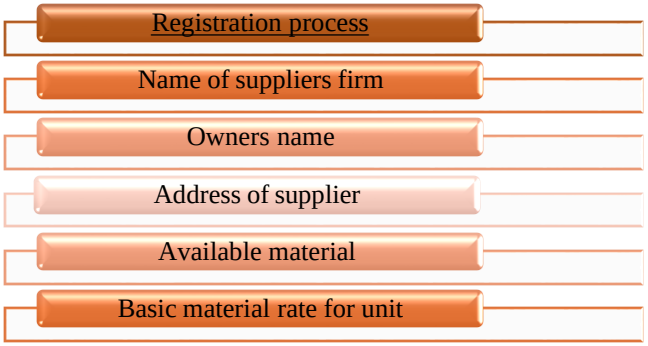

Figure: Supplier Information

In the realm of Supply Chain Management (SCM), a supplier is a key participant in the supply chain network. Suppliers are entities or businesses that provide raw materials, components, products, or services to another organization, often referred to as the buyer or customer. Suppliers play a critical role in ensuring the smooth functioning of the supply chain by delivering the necessary inputs for manufacturing or service delivery.

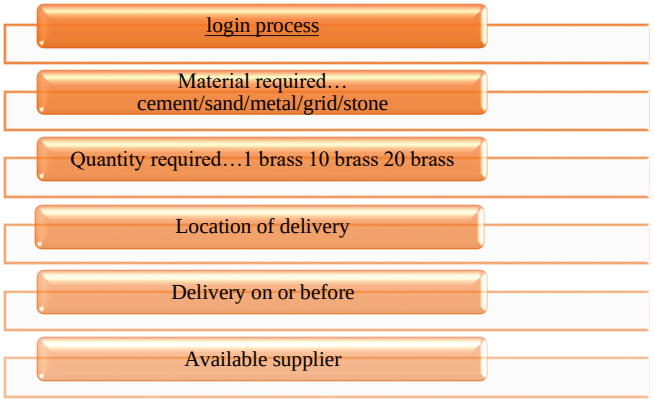

Figure: Order Window

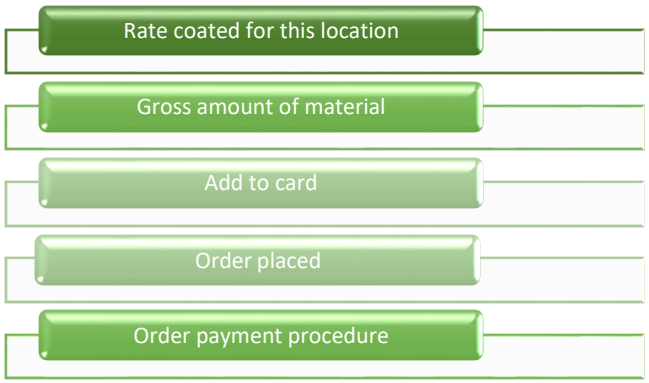

Figure: Order Confirmed

A successful order in Supply Chain Management (SCM) is characterized by a seamless and efficient process that fulfils customer demands while optimizing the supply chain. Here's an overview of the key elements of a successful order in SCM:

Accurate Demand Forecasting: Before placing an order, accurate demand forecasting is essential. This involves analyzing historical data, market trends, and customer preferences to predict the quantity and types of products needed.

Transparent Communication: Open communication between the buyer and supplier is crucial. Clear and transparent communication ensures that both parties understand order specifications, delivery timelines, and any specific requirements.

Efficient Order Processing: The order processing phase involves converting a customer's purchase order into a detailed instruction for the supply chain. This includes verifying product availability, checking pricing and discounts, and confirming delivery schedules.

Inventory Management: Successful orders require effective inventory management. Maintaining optimal stock levels helps prevent overstock or stockouts, ensuring that products are available when needed without tying up excess capital in inventory.

Supplier Collaboration: Collaborating with suppliers is essential for successful order fulfillment. This involves working closely with suppliers to coordinate production schedules, quality standards, and delivery timelines.

Order Tracking and Visibility: Providing real-time tracking and visibility into the status of an order is crucial. This allows both the buyer and supplier to monitor the order's progress, anticipate any potential delays, and make informed decisions.

Quality Control: Ensuring product quality is a key aspect of a successful order. Implementing quality control measures at different stages of the supply chain helps identify and rectify any issues before the products reach the customer.

Timely Delivery: Meeting delivery timelines is critical for customer satisfaction. Successful orders are those that are delivered on time and in the right condition, meeting or exceeding customer expectations.

Adaptability and Flexibility: The ability to adapt to changes in demand, unforeseen disruptions, or modifications to order specifications is crucial. A flexible supply chain can adjust quickly to unexpected circumstances without compromising efficiency.

Customer Satisfaction: Ultimately, the success of an order is measured by customer satisfaction. Providing a positive experience, including timely delivery, product quality, and effective communication, contributes to building a loyal customer base.

In summary, a successful order in SCM involves a well-coordinated and efficient process, from demand forecasting to customer satisfaction.

Effective communication, collaboration with suppliers, and the ability to adapt to changes are key elements in achieving success in order fulfillment.

GUI Interfacing

Designing a graphical user interface (GUI) for a Supply Chain Management (SCM) application involves creating an intuitive and user-friendly platform that facilitates efficient navigation and interaction.

Here's an outline of the key components and features for a GUI in an SCM application:

Dashboard

- Provide a centralized dashboard with key performance indicators (KPIs) and analytics for quick insights into the overall supply chain status.
- Include visual representations such as charts and graphs for easy interpretation.

User Authentication

- Implement secure user authentication to control access levels and ensure that only authorized users can access sensitive information.

Order Management

- Create an intuitive interface for order placement, modification, and tracking.
- Include order history and status updates for easy reference.

Alerts and Notifications:

Implement a notification system that alerts users about critical events, such as low inventory levels, delayed shipments, or changes in order status.

Accessibility:

Ensure that the GUI is accessible to users with different abilities by following accessibility standards.

A well-designed GUI enhances the user experience and contributes to the overall success of the SCM application by making it more user-friendly, efficient, and visually appealing.

CONCLUSION

In utilizing the SCM (Supply Chain Management) application, a notable reduction in fraud occurrences has been observed. The application's multifaceted features and robust framework contribute significantly to enhancing transparency, accountability, and security within the supply chain ecosystem. Here are the key conclusions and remarks:

Enhanced Visibility: The SCM application provides real-time visibility into the entire supply chain, from sourcing to delivery. This transparency makes it more challenging for fraudulent activities to go unnoticed.

Improved Traceability: With the ability to trace each step of the supply chain process, the SCM application minimizes the risk of fraudulent practices, such as unauthorized access, counterfeit products, or mismanagement of inventory.

Secure Transactions: The application incorporates secure transaction protocols, reducing the likelihood of financial fraud. Encrypted communication channels and authentication mechanisms safeguard against unauthorized access and data breaches.

Efficient Supplier Management: By maintaining a comprehensive database of trusted suppliers, the SCM application mitigates the risk of fraudulent supplier engagements. Regular performance evaluations and transparency in supplier interactions contribute to a more secure procurement process.

Data Analytics for Anomaly Detection: The application's data analytics capabilities play a pivotal role in identifying anomalies or irregularities in the supply chain. Unusual patterns in orders, inventory levels, or transaction histories trigger alerts for further investigation, preventing potential fraud.

Collaborative Ecosystem: The SCM application fosters collaboration among stakeholders, creating a network of trust. Improved communication and information sharing among suppliers, manufacturers, and distributors contribute to a more secure and vigilant supply chain community.
Remarks:

The SCM application not only optimizes supply chain operations but also serves as a robust defense against fraudulent activities. While the risk of fraud can never be entirely eliminated, the comprehensive features of the application create a resilient and proactive environment for fraud prevention. Continuous monitoring, adaptive security measures, and collaborative efforts within the supply chain community remain key components in sustaining a secure SCM ecosystem. Overall, the SCM application stands as a powerful tool in fortifying supply chain integrity and resilience against fraudulent practices.

Future Scope

Briefly the scope of the study will be limited to understanding the relationship between SCM performance and construction sector organizational performance in context to Indian Projects. To find out the link i.e. the factor this influences the effective supply chain quality management and organizational performance and their dependencies

Scopeofworkincludesfirstformulationoftheresearchstatementbyreferringliteratureofvarious relevant papers and performing the gap analysis. For that purpose, wehavereferred2journalseach fromSCM&OPstartingfromtheyear2004to2018andstudiedthemthoroughly.

In many research papers, we found that supply chain management is not so popular in construction industry if we compare this with manufacturing industry. Next step will be formulation of the research methodology, which will comprise of research design, sampling design, instrument design, data collection and data analysis.

We have prepared a web-based questionnaire and floated the same to the target population in the Indian construction industry for collection of data. Based on that response statistical data analysis willbeconductedusingSPSSsoftwaretogetthefindingsandconclusionoftheresearch.

Limitations

Followings are the limitations identified for the research undertaken

- A very few numbers of detailed research have been done in this area limiting the literature available for further study.
- The sampling framework of the research is limited to Indian Construction Projects only.
- Data Collection will be aimed to target population from the top contracting firms which are involved in rigorous SCM practices along with their focus to core business.
- The bad part for communication research is that all communication research has some error.

Since this research will be a cross-sectional study, which are generally carried out once and represent a snapshot of one point in time compared to the longitudinal studies, which are repeated over an extended period and hence can leads to changes over time.

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