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Global Supply Chain Agility Through ERP Systems: A Decision Support Model for Emerging Economies

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Abstract

In today's highly dynamic and interconnected global markets, supply chain agility—the capacity to sense environmental changes and respond rapidly and effectively—has emerged as a critical success factor. This is particularly significant for firms operating in emerging economies, where market volatility, infrastructural limitations, policy uncertainties, and resource constraints pose persistent challenges. Enterprise Resource Planning (ERP) systems, with their ability to integrate cross-functional processes, centralize data, and provide real-time decision-making support, offer promising avenues to enhance supply chain agility. This review article systematically synthesizes existing literature on supply chain agility, ERP implementation, and their synergistic relationship, especially in the context of emerging markets. It identifies and categorizes key enablers (such as top management support, digital literacy, and cloud-based ERP solutions), barriers (including high implementation costs, resistance to change, and inadequate IT infrastructure), and critical success factors (such as change management, user training, and alignment with strategic objectives). Building on these insights, the article proposes a novel decision support model specifically designed to address the unique constraints and opportunities in emerging economies. The model focuses on four pillars: internal integration (e.g., real-time data sharing across departments), external integration (e.g., supplier and customer collaboration), flexibility (e.g., rapid reconfiguration of processes), and responsiveness (e.g., quick adaptation to market signals), underpinned by digital infrastructure readiness. Real-world and hypothetical case illustrations are presented to demonstrate practical applications. The article concludes with actionable recommendations for industry practitioners aiming to leverage ERP for agile supply chains and offers a future research agenda to guide academic inquiry in this evolving domain.

Keywords:

Supply Chain Agility; ERP Systems; Decision Support Model; Emerging Economies; Internal and External Integration; Responsiveness; Flexibility; Digital Infrastructure

1. Introduction

Supply chain agility (SCA) has become a major concern in both academic research and practice, especially under global disruptions such as pandemics, trade wars, natural disasters, and rapid changes in consumer preferences. Agility involves not only being flexible, but being resilient,

responsive, quick, and competent in sensing and responding to changes. Emerging economies typically contend with additional constraints: less stable infrastructure, weaker institutional support, smaller firms with limited resources, greater exposure to supply and demand shocks. ERP systems, by integrating business processes (procurement, production, inventory, sales, logistics, finance, HR) and enabling real-time or near real-time information, have the potential to strengthen agility. However, ERP implementations are often costly, complex, and risky; thus, a decision support model that helps firms in emerging economies decide *how, where, and what to prioritize* in implementing ERP for agility is valuable [1-3].

This article reviews the existing literature, synthesizes insights, outlines applications, and proposes a decision support model for achieving global supply chain agility through ERP systems in the context of emerging economies.

2. Literature Review

This section surveys what is known about supply chain agility, ERP systems' impact on supply chains, their interplay, and the special context of emerging economies.

2.1 Supply Chain Agility: Definitions, Dimensions, Enablers, and Barriers

- **Definitions and concepts:**
Supply Chain Agility (SCA) differs from related terms like flexibility, resilience, adaptability, responsiveness, etc. Al Humdan, E., Shi, Y., Behnia, M. and Najmaei, A. (2020) provide a systematic review of definitions and enablers. They note that key dimensions of agility include quickness (speed of response), responsiveness (meeting customer demands), competency (capability to perform), and flexibility (ability to change or adapt).
- **Enablers of agility:**
Literature identifies both internal factors (e.g., supply chain integration, information technology capability, internal process flexibility, organizational culture) and external factors (supplier networks, external integration, market turbulence) as key [4-5].
- **Barriers and challenges:**
These include lack of visibility, poor data sharing, legacy systems, low digital readiness, cost constraints, resistance to change, infrastructure limitations and institutional/cultural issues—often more acute in emerging economies.

2.2 ERP Systems: Features, Benefits, Risks

- **Features and capabilities:**
ERP systems integrate multiple business functions, centralize data, standardize processes, support analytics/reporting, and can enable internal and external integration (e.g., seamless data sharing with suppliers, customers). Modern ERP can include modules for supply chain planning, supplier relationship, customer management, inventory, logistics, demand forecasting, etc [6-7].
- **Benefits relevant to agility:**
 - Improved visibility: real-time data across functions helps detect issues early.
 - Standardization and process discipline: helps avoid delays caused by process inefficiencies.

- Better coordination: across internal functions (procurement, production, sales) and external partners.
- Decision support: analytics and reporting facilitate faster, more informed decisions.
- Flexibility and scalability (especially when ERP is cloud-based or modular).
- **Risks, challenges, costs:**
 - High upfront investment (software, hardware, consultancy).
 - Complexity in implementation, data migration, customization.
 - Need for change management, employee training, organizational culture shifts.
 - Infrastructure issues: internet connectivity, power, reliable technologies.
 - Vendor lock-in, maintenance costs.

2.3 Intersection: ERP & Supply Chain Agility

- **Empirical studies:**
For example, *Harianto et al.* (2024) studied manufacturing firms in East Java (Indonesia) and found that digital ERP implementation enhances internal and external supply chain integration, which in turn increases supply chain flexibility and business performance [8]. There are also studies on how ERP combined with technologies such as RFID enhances SCM performance (inventory accuracy, visibility).
- **Mechanisms:**
ERP contributes to agility via the following mechanisms:
 1. **Internal Supply Chain Integration:** aligning procurement, production, inventory, sales so that the firm can reallocate resources internally quickly.
 2. **External Integration:** sharing data and coordination with suppliers, logistics providers, customers.
 3. **Flexibility of operations:** the ability to reconfigure process flows, alter product sequences, adjust schedules.
 4. **Decision Support & Analytics:** dashboards, forecasting, scenario planning enable preemptive responses rather than reactive.
- **Mediating/moderating factors:**
The effect of ERP on agility depends on organizational readiness (culture, skills), digital infrastructure, managerial support, scale of ERP deployment (modules used), the nature of supply chain (stable vs volatile environment). In emerging economies, these moderating factors are especially potent.

2.4 Emerging Economies: Special Context

- **Constraints:**
Firms often have limited financial resources, weaker ICT infrastructure (bandwidth, reliable power), less mature supplier networks, lower workforce skills in digital systems, potentially more bureaucratic or regulatory obstacles [9].

- **Opportunities:**
Emerging economies can leapfrog legacy systems, adopt cloud ERP or modular/Software-as-a-Service ERP models, integrate mobile and low-cost ICT, use local vendors, and tailor ERP deployment to their specific supply chain type (e.g., agro-supply chains, textiles, manufacturing).
- **Case and empirical evidence:**
The study in East Java noted above is one example. There are also IGI Global's work "A Systematic Review on ERP and Supply Chain Management" which suggests many benefits from ERP in SCM in emerging contexts, though also notes challenges with adaptability/customization and cost.

3. Proposed Decision Support Model

Based on the literature, I propose a **Decision Support Model (DSM)** for firms in emerging economies to leverage ERP systems to enhance supply chain agility. The model helps firms decide *what to implement first, how to sequence modules, which enablers to strengthen, and how to monitor outcomes [10]*.

3.1 Components of the Model

| Component | Description |
|---|--|
| Strategic Drivers | Market volatility, customer demand variability, competition, regulatory environment, disruptions, cost pressures. |
| Readiness Assessment | Infrastructure (ICT, internet, power), human resources (IT skills, change management), financial resources, organizational culture, supplier and customer network maturity. |
| Key Agility Dimensions | Quickness (speed), Responsiveness, Flexibility, Competency (capability). |
| ERP Modules & Features | Core modules (Finance, Sales, Procurement, Inventory, Production), Supply Chain Planning, Supplier Relationship Management, Customer Relationship Management, Analytics / BI, Cloud vs On-premise. |
| Integration Level | Internal integration (process alignment across functions), External integration (suppliers, logistics, customers), Data visibility/sharing. |
| Implementation Priorities & Sequencing | Prioritize modules and features based on strategic drivers and readiness; e.g., start with internal integration of high-impact modules, then expand to external partners. |
| Performance Measures | Lead times; order fulfillment rate; inventory turnover; forecast accuracy; responsiveness to orders; cost vs service trade-offs. |
| Continuous Improvement & Feedback Loop | Monitor, learn, adjust; upgrade ERP features; retrain staff; expand integrations; adapt to changing environments. |

3.2 Decision Process (Flow)

1. **Assess Strategic Need:** Identify external pressures (market, supply, technology) making agility important.
2. **Readiness Assessment:** Use a checklist or survey instrument to rate readiness across infrastructure, people, finances, partner network.
3. **Map Key Agility Dimensions:** Decide which agility dimensions are most critical for the firm (e.g., speed vs flexibility).
4. **Select ERP Modules & Integration Scope:** Considering resources and readiness, choose core modules first. For example, internal modules like Inventory & Production may be lower risk vs external integration.
5. **Pilot Implementation:** Trial with small scope (e.g., certain product lines, certain suppliers) to test processes and user acceptance.
6. **Measure Performance:** Use performance measures to evaluate, compare against baseline.
7. **Scale and Extend:** Based on pilot, extend modules, integrate more partners, refine processes.
8. **Iterate:** Continuous improvement, considering environmental changes (e.g., supply disruptions, demand shifts), upgrade features (analytics, real-time dashboards).

3.3 Model Tailoring for Emerging Economies

- Favor **modular or cloud-based ERP** to reduce upfront costs and infrastructure burden.
- Emphasize **training and change management**, since organizational culture can be a bottleneck.
- Ensure strong **supplier network** engagement – sometimes external partners (suppliers, logistics) are less digitally mature.
- Use **scalable and realistic performance metrics**; avoid overambitious KPIs initially.
- Consider **hybrid deployment** where offline/low bandwidth options are included.

4. Applications

This section illustrates how the model could apply in practice, with hypothetical or actual examples drawn from the literature or plausible scenarios.

4.1 Case: Manufacturing Firm in East Java, Indonesia

- **Context:** A medium-sized manufacturer supplying consumer goods, has implemented core ERP modules (Procurement, Inventory, Production), but external integration with suppliers and customers is minimal. Frequent demand variability and raw material supply disruptions.
- **Application of DSM:**
 1. Strategic drivers: Demand swings and supply delays are causing stockouts and high safety stocks. Agility priority: responsiveness and reducing lead times.

2. Readiness: ICT infrastructure (internet) is acceptable; human resources need training; financial constraints moderate; supplier network partly digital.
 3. Key agility dimensions: Prioritize responsiveness and quickness.
 4. Module & integration selection: Next module to deploy: Supply Chain Planning & Supplier Relationship Management; integrate external suppliers for order visibility; use cloud analytics to forecast demand.
 5. Pilot: Use one product line; engage a handful of suppliers with data exchange; measure order fulfillment rates, lead time reductions.
 6. Performance: Benchmarks include 30% reduction in production lead time; forecast accuracy improved by 20%; supplier lead time variability reduced.
 7. Scale: Once pilot success is confirmed, extend to other product lines and customers; integrate customer feedback in real time.
 8. Continuous improvement: Train staff, improve data flows, upgrade ERP features.
- **Outcome:** As per Harianto et al. (2024), such approaches have shown improvements in internal and external integration, supply chain flexibility, and improved business performance.

4.2 Case: Agricultural Supply Chain in Sub-Saharan Africa (Hypothetical)

- **Context:** A cooperative of small farmers supplies perishable produce to regional markets. Multiple small suppliers, limited cold chain infrastructure, irregular market access, variable demand.
- **DSM Application:**
 - Strategic drivers: perishability, market demand volatility, spoilage, need for faster product flow.
 - Readiness: limited ICT, weak infrastructure, low digital skills; suppliers often offline.
 - Agility dimensions: Quickness and responsiveness are critical.
 - Modules/features: lightweight ERP or cloud-ERP with mobile interfaces; modules for inventory, quality, logistics; simple forecasting.
 - Integration: Start with internal operations (collection, storage, transport scheduling), then engage logistics partners; simple data sharing with buyers (markets).
 - Pilot: Use one region/market; track produce from farm to market; measure spoilage, time to market.
 - Performance metrics: percentage of produce reaching market fresh, delivery lead times, customer satisfaction, inventory losses.
 - Scaling: add more suppliers, integrate cold chain logistics partners, upgrade modules for predictive analytics.
- **Potential impact:** Reduced spoilage, more consistent supply, higher margins for farmers, more competitive in markets sensitive to freshness.

5. Discussion: Key Enablers, Barriers, Trade-offs

From literature and model application, several enablers, barriers, and trade-offs emerge.

5.1 Enablers

- Strong leadership and top management support.
- Organizational culture open to change and digital transformation.
- Adequate training and human capital.
- Reliable digital infrastructure (internet, power, hardware).
- Modular, scalable ERP solutions (cloud, SaaS).
- Good supplier and customer network maturity (partners capable of digital integration).
- Real-time or near real-time data and analytics capabilities.

5.2 Barriers

- Financial cost and risk.
- Resistance to change among employees.
- Lack of maturity of external partners.
- Poor infrastructure (connectivity, power).
- Misalignment between ERP features/modules and firm's actual needs.
- Data quality issues (garbage in, garbage out).
- Overcustomization can lead to complexity and maintenance burdens.

5.3 Trade-offs

- Speed versus cost: implementing more modules or integrating external partners may increase speed but also cost and risk.
- Flexibility vs standardization: more flexibility may mean less standardization, which can reduce efficiencies.
- Internal vs external focus: too much internal investment without external integration might limit agility; external integration can be harder to manage.
- Cloud vs on-premise: cloud reduces up-front cost and infrastructure burden but may raise concerns of security, dependence on third-party providers, and connectivity reliability.

6. Conclusion

Supply chain agility is an essential capability in today's volatile, uncertain, complex and ambiguous (VUCA) global environment. For firms in emerging economies, where disruptions are more frequent and resources are more constrained, leveraging ERP systems in a structured way offers a promising

route toward enhanced agility. This review synthesizes literature on supply chain agility and ERP, constructs a decision support model tailored to emerging economies, and demonstrates its application.

Key takeaways:

- ERP systems' impact on agility is strongest when both **internal and external integration** are addressed.
- Readiness in infrastructure, human resources, culture, supplier networks is critical.
- Modular / cloud / SaaS ERP models can significantly reduce barriers in emerging economies.
- Pilot implementations with measured KPIs help manage risk and enable scaling.
- Trade-offs (cost vs speed, flexibility vs standardization) must be managed thoughtfully.

For practitioners, the DSM provides a roadmap to decide what to prioritize in ERP implementation to gain agility. For researchers, further empirical validation of the model in different sectors and regions is needed.

7. Future Research Directions

- Empirical studies validating the DSM in varied emerging economies (e.g., Africa, Latin America, Southeast Asia), across sectors (manufacturing, agriculture, services).
- Examination of the impact of newer technologies (IoT, AI, blockchain) embedded within ERP on agility (forecasting, visibility, predictive analytics).
- Exploring the cost-benefit trade-offs more rigorously: what investment yields what agility gains for SMEs in resource-constrained contexts.
- Development of metrics or indices specifically adapted to measure agility in emerging economies.
- Investigating the role of policy, institutional support, regulatory environment in facilitating ERP adoption for agility.

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