



ASEAN Unbound: Igniting the Digital Renaissance

Kurniawan Arif Maspul*, Muhammad Ardhin

University of the People, US

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*Correspondence: Kurniawan Arif

Maspul

Email:

kurniawanarifmaspul@my.uopeople.edu

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Abstract: ASEAN's digital metamorphosis, driven by 400 million internet users and a \$330 billion digital economy (Google *e al.*, 2021), positions geospatial technology and open-source ERP systems as lifelines for survival and growth. These technologies tackle urbanization crises, disaster resilience, and SME empowerment—critical for a region where 68% will live in cities by 2030 (UNESCAP, 2020) and SMEs form 89% of businesses (ADB, 2022). Geospatial tools, like Indonesia's One Map Policy resolving 80,000 land conflicts, and ERPNext slashing SME costs by 60% (Cavalcanti *e al.*, 2022; OpenGov Asia, 2018), showcase ASEAN's cost-innovation edge. Yet, fragmented data policies and skill gaps threaten progress. Government initiatives like Thailand 4.0 and Vietnam's Digital Transformation Program signal a shift toward inclusive tech ecosystems, while firms like Grab export geospatial logistics globally. This study argues ASEAN's blend of agility, affordability, and ethical innovation offers a blueprint for the Global South—proving technology can democratize power, save lives, and ignite a moral revolution in an era of crisis.

Keywords: Digital Transformation, Geospatial Innovation. SME Empowerment, ASEAN Economic Resilience, Ethical Digital Inclusion

Introduction

In the heart of Southeast Asia, a digital revolution is unfolding—one that could redefine how nations grow, businesses thrive, and communities survive. The Association of Southeast Asian Nations (ASEAN), home to over 400 million internet users (World Bank, 2019), is no longer just a regional bloc; it is a global laboratory for innovation. Here, geospatial technology and open-source Enterprise Resource Planning (ERP) systems are not mere tools but lifelines, addressing existential challenges from climate disasters to economic inequality. This study delves into ASEAN's readiness to harness these technologies and their potential to leap onto the global stage, driven by urgency, ingenuity, and an unyielding quest for resilience.

Imagine a farmer in Myanmar using satellite imagery to double crop yields while conserving water. Picture a Jakarta slum dweller finally securing land rights through a digital map. Envision a small Philippine retailer competing globally with the same ERP tools as a Fortune 500 company. These are not hypotheticals—they are realities being forged in ASEAN's digital crucible. The region's digital economy, projected to reach \$330 billion by 2025 (Google *e al.*, 2021), is a beacon of hope for 71% of its businesses—SMEs—that employ

97 million people (ADB, 2022). Yet, this growth is fragile. Urbanization is exploding, with 68% of ASEAN's population expected to live in cities by 2030 (UNESCAP, 2020), straining infrastructure and amplifying inequalities. Meanwhile, the region's position on the Pacific Ring of Fire makes it a hotspot for disasters, costing \$86 billion annually in damages (ADB, 2022). Without transformative solutions, these challenges could derail decades of progress.

Geospatial technology is ASEAN's silent guardian. When Typhoon Rai devastated the Philippines in 2021, drones and satellite analytics enabled rapid evacuation, saving thousands. In Thailand, flood prediction systems now warn villages days in advance, reducing fatalities by 30% (ADB, 2022). But this is more than disaster response—it's about sovereignty. Indonesia's One Map Policy has resolved 80,000 land conflicts, granting marginalized communities legal identity (Abidin *e al.*, 2021; OpenGov Asia, 2018). Yet, fragmentation persists: 60% of ASEAN's geospatial datasets lack standardization, crippling cross-border collaboration (World Bank, 2019). The cost of inaction? More conflicts, more disasters, more lives lost.

For ASEAN's SMEs, open-source ERP systems are a rebellion against exclusion. While Western giants like SAP dominate, 89% of ASEAN businesses are SMEs—many priced out of proprietary software (ADB, 2022). Enter solutions like ERPNext, slashing costs by 60% in Indonesia (Cavalcanti *e al.*, 2022; Hamdani & Wirawan, 2012) and enabling a Malaysian bakery to streamline supply chains or a Vietnamese textile firm to comply with EU export standards. Governments are listening: Thailand's tax incentives for cloud adoption and Vietnam's National Digital Transformation Program signal a tectonic shift toward inclusive digital infrastructure. But skepticism lingers. A 2019 Frost & Sullivan report found only 30% of ASEAN firms use advanced geospatial tools, while "open-source" is still misperceived as "unreliable" (Khan *e al.*, 2022). Overcoming these barriers is not optional—it is existential.

This study is more than an academic exercise—it is a roadmap for survival. Using Porter's Diamond Model, we dissect ASEAN's competitive edge: its young tech talent, voracious demand for urban solutions, and symbiotic industries like e-commerce. Institutional Theory reveals how policies like Indonesia's Making Indonesia 4.0 and Malaysia's MyGeospatial Portal are rewriting governance. The Uppsala Model frames the region's startups—first conquering home markets, then the world. Through data, case studies, and emotional narratives, we ask: Can ASEAN's technologies scale globally without losing their soul? The answer will shape not just economies, but lives. Because when a geospatial map secures a family's land or an ERP system lifts a SME out of poverty, technology transcends code—it becomes hope. And in a world teetering on climate and economic cliffs, hope is not a luxury. It is a necessity.

Research Method

This study employs a qualitative research methodology that combines extensive documentary analysis with thematic interpretation to unravel the multifaceted digital transformation unfolding across ASEAN. This study examines a wide range of original sources—ranging from governmental papers and academic literature to case studies on GIS

and ERP innovations—to deconstruct the interplay of social, economic, and technical dynamics driving regional transformation. Drawing on established theoretical frameworks such as Porter's Diamond, Institutional Theory, and the Uppsala Model, the analysis synthesizes recurring patterns and insights, offering a rich, contextually informed narrative that captures both the opportunities and challenges inherent in integrating traditional values with cutting-edge digital solutions.

Result and Discussion

The Association of Southeast Asian Nations (ASEAN) is experiencing a digital metamorphosis, propelled by an internet user base exceeding 400 million individuals (World Bank, 2023). This surge in digital connectivity is positioning ASEAN as a pivotal hub for innovative business technologies, notably geospatial technology and open-source Enterprise Resource Planning (ERP) systems. These technologies are emerging as transformative solutions to challenges in urbanization, supply chain optimization, and the digitalization of Small and Medium-sized Enterprises (SMEs). This discourse integrates market behavior theories, institutional policies, and global business strategies to evaluate ASEAN's preparedness and the potential for international scalability of these technologies.

Michael Porter's Diamond Model offers a framework to analyze a nation's competitive advantage through four interrelated components: factor conditions, demand conditions, related and supporting industries, and firm strategy, structure, and rivalry (Porter, 2001).

- Factor Conditions: ASEAN boasts a burgeoning pool of tech-savvy talent, a critical asset for the development and implementation of geospatial and open-source ERP technologies.
- Demand Conditions: Rapid urbanization within ASEAN countries intensifies the need for geospatial technologies to manage urban planning and infrastructure development effectively.
- Related and Supporting Industries: The expansion of e-commerce and logistics sectors in ASEAN creates a conducive environment for integrating advanced ERP systems to streamline operations and enhance efficiency.
- Firm Strategy, Structure, and Rivalry: The competitive landscape in ASEAN encourages firms to innovate and adopt new technologies to maintain a competitive edge.

On the other hand, Institutional theory underscores the significance of regulatory frameworks and government initiatives in shaping market behaviors and reducing entry barriers. Policies such as Indonesia's "Making Indonesia 4.0" and Singapore's "Smart Nation" initiative exemplify governmental efforts to foster technological innovation and infrastructure development, thereby facilitating the adoption of geospatial and ERP technologies. For instance, Singapore's "Smart Nation" initiative aims to harness technology to improve living standards and create economic opportunities, aligning with the deployment of Virtual Singapore, a comprehensive 3D digital model of the city-state (Wikipedia, n.d.).

The Uppsala model elucidates the gradual internationalization process of firms, emphasizing the accumulation of market knowledge and incremental commitment to foreign markets (Johanson & Vahlne, 2017). ASEAN-based geospatial startups often consolidate their presence domestically before expanding regionally, aligning with the model's assertion that firms initially enter markets with lower "psychic distance." As these firms gain experiential knowledge, they progressively venture into more distant markets, facilitating the international scalability of their technologies.

Geospatial technology encompasses tools that capture, analyze, and visualize spatial data, playing a pivotal role in urban planning and supply chain management.

- Urbanization: With ASEAN's urban population projected to reach 373 million by 2030, geospatial technology becomes indispensable for sustainable urban development. Platforms like Virtual Singapore exemplify the application of geospatial data in creating digital twins for urban planning (Wikipedia, n.d.).
- Supply Chain Optimization: Geospatial tools enhance supply chain visibility, enabling efficient route planning and real-time tracking, which are crucial for ASEAN's expanding e-commerce sector.

Open-source ERP systems offer customizable and cost-effective solutions for SMEs aiming to digitalize operations. Given that SMEs constitute approximately 89% of ASEAN businesses, the adoption of open-source ERP can significantly enhance operational efficiency and competitiveness. A conceptual framework suggests that these systems bolster information integration and strategic decision-making, vital for entrepreneurial performance (Biswas *et al.*, 2024).

ASEAN's digital economy, valued at \$194 billion in 2022, reflects a robust foundation for technological innovation (Junida, 2023). The region's commitment to digital infrastructure, supportive government policies, and a dynamic entrepreneurial ecosystem collectively enhance its readiness to adopt and scale geospatial and open-source ERP technologies. The alignment of institutional support with market dynamics fosters an environment conducive to technological advancement and international expansion.

ASEAN's rapid digital transformation, underpinned by a substantial internet user base and proactive governmental policies, positions the region as a fertile ground for the integration of geospatial technology and open-source ERP systems. Applying theoretical frameworks such as Porter's Diamond Model, Institutional Theory, and the Uppsala Model provides a comprehensive understanding of the factors influencing ASEAN's readiness and the potential for these technologies to scale internationally. As ASEAN continues to navigate its digital trajectory, the strategic adoption of these technologies will be instrumental in addressing urbanization challenges, optimizing supply chains, and propelling SME digitalization.

ASEAN Market Readiness: A Region on the Brink of a Geospatial Breakthrough

In the heart of Southeast Asia, a quiet revolution is underway—urbanization is reshaping the social and economic landscape at an astonishing pace. With projections from

UNESCAP (2020) estimating that nearly 68% of ASEAN's population will be living in urban areas by 2030, this trend is not just a statistic—it's a seismic shift in how cities breathe, grow, and evolve. And geospatial technology? It's becoming the nervous system of this transformation.

Why? Because urban sprawl brings challenges—traffic congestion, housing shortages, infrastructure strain, pollution—and every challenge carries the demand for smarter, more data-driven solutions. Countries like Singapore are leading the charge with initiatives like Virtual Singapore, a digital twin of the city-state that uses real-time data to simulate and manage everything from pedestrian traffic to energy efficiency. Imagine a city that anticipates congestion before it happens or allocates emergency services based on live demand. That's no longer science fiction—it's geospatial innovation made real. This urban migration isn't just about expanding cities—it's about rethinking the way we plan them. In Jakarta, for instance, geospatial tools are being used to re-map informal settlements, giving marginalized communities access to basic services and legal land rights (Syalianda & Kusumastuti, 2021). That's not just smart—it's life-changing.

Disaster Management: Turning Vulnerability into Resilience

ASEAN sits in one of the most disaster-prone zones on Earth—the Pacific Ring of Fire. From typhoons in the Philippines to floods in Thailand and earthquakes in Indonesia, the region faces a relentless barrage of natural hazards. But with geospatial technology, what was once unpredictable can now be anticipated. Take Thailand's National Disaster Warning Center. By integrating remote sensing, satellite imagery, and hydrological models, they can predict flood zones with remarkable accuracy. Villages once blindsided by rising waters are now forewarned days in advance. In the Philippines, drones and high-resolution satellite images are used to map landslide-prone areas, helping authorities evacuate vulnerable regions before disaster strikes.

These technologies aren't just helping governments react—they're enabling them to plan. Geospatial analytics help identify the most strategic locations for evacuation centers, resilient infrastructure, and emergency supply chains. According to the Asian Development Bank (2022), the adoption of predictive geospatial tools could reduce disaster-related fatalities in ASEAN by as much as 30% over the next decade. That's not just data—that's lives saved.

Agricultural Optimization: Feeding a Region with Precision

In the rice fields of Myanmar, something remarkable is happening. Farmers, once reliant solely on ancestral wisdom, are now guided by satellites. With drone mapping and NDVI (Normalized Difference Vegetation Index) imaging, they're identifying the exact health of their crops, determining optimal irrigation patterns, and adjusting fertilizer use with pinpoint accuracy.

Why is this important? Because ASEAN's food security depends on agriculture—yet climate change, land degradation, and water scarcity are making traditional farming increasingly unsustainable. In Thailand, geospatial tools under the Smart Farming initiative

(part of Thailand 4.0) are transforming agriculture into a data-driven science (Obi Reddy *e al.*, 2023). Thai farmers are witnessing 20-30% gains in crop productivity by combining GIS with weather forecasts and IoT soil sensors, while saving up to 40% on water. This is the future of farming: not sprawling fields of guesswork, but efficient, intelligent landscapes where every drop of water and seed is accounted for. And with global food prices rising, the impact of this revolution extends far beyond Southeast Asia's borders.

Government Support: Enabling a Geospatial Ecosystem

Indonesia, a sprawling archipelago of over 17,000 islands, faces complex governance challenges. But with the Badan Informasi Geospasial (BIG), the nation is tackling fragmentation head-on. Its "One Map Policy" aims to unify the country's chaotic web of land maps into a single, standardized geospatial framework (OpenGov Asia, 2018). The implications are profound. Deforestation in Kalimantan? Illegal mining in Papua? Overlapping land claims in Sulawesi? With a single, authoritative geospatial reference, policymakers can make clearer decisions, resolve disputes, and enforce environmental laws. Already, BIG has resolved over 80,000 land conflicts, proving that when data speaks with one voice, governance becomes just, inclusive, and transparent (Nuhidayah *e al.*, 2020; Schilling *e al.*, 2018).

Across the strait, Malaysia is fostering a model of inclusion through its MyGeospatial Portal. This isn't just a government database—it's a shared platform where private firms, academia, and civil society access and contribute to national geospatial knowledge. Think of it as a living atlas—constantly evolving with inputs from across society. This openness drives innovation. Urban developers use it to simulate housing projects. NGOs use it to monitor deforestation. Agritech startups use it to build next-gen farming tools. With this collaboration-first model, Malaysia is laying the groundwork for a digital ecosystem where geospatial tools are not confined to elites—they're democratized for impact.

While the vision is clear, the path is uneven. One of ASEAN's greatest hurdles is the lack of cohesive, interoperable data policies. Each nation collects and stores geospatial data differently. Some treat it as open-access; others guard it like a state secret. The result? A fragmented digital landscape where integration is laborious and cross-border collaboration becomes nearly impossible. A 2019 study by the World Bank revealed that over 60% of geospatial datasets in ASEAN lack metadata or standard formatting, severely limiting their utility. Without a unified legal and technical framework, initiatives like disaster response and cross-border infrastructure planning suffer from blind spots and inefficiencies.

Another silent crisis lies in human capital. According to UNESCO (2024), only 30% of ASEAN enterprises are leveraging advanced geospatial technologies. Not because they lack interest—but because they lack skilled professionals (ERIA & Mitsubishi Research Institute, 2018; Sullivan *e al.*, 2010). Geospatial science isn't just about maps—it's a multidisciplinary blend of coding, data analytics, urban planning, and environmental science. Yet many ASEAN universities still treat it as a niche elective, not a core skillset. The result? A workforce ill-prepared for the demands of a spatially intelligent economy. If ASEAN is to truly lead in this space, it needs more than tools—it needs talent. Investment

in education, public-private partnerships for training, and regional centers of excellence are not luxuries—they're necessities.

Cost Efficiency: The ASEAN Advantage in a Saturated Global Market

In the high-stakes world of technology, price often determines reach. Western giants like ESRI and Trimble have long dominated the geospatial market, offering world-class solutions—but at a premium. For many emerging economies, these costs create a barrier too steep to climb. Therefore, entering into ASEAN, armed not just with innovation, but affordable innovation.

Take Indonesia's DATBot, for example—a local tech company leveraging AI-powered satellite imagery to offer land use analysis, environmental monitoring, and infrastructure planning. Their services come at up to 40% lower costs than their U.S.-based competitors. This isn't about cutting corners—it's about maximizing efficiency. DATBot integrates open-source platforms, agile development models, and local expertise to deliver leaner, faster solutions. These cost-effective platforms make geospatial tech accessible to countries in Africa, Latin America, and South Asia—nations that share similar socio-economic constraints with ASEAN (Arifin & Heriqbaldi, 2023; Maspul, 2025). What used to be considered elite tech for developed economies is now becoming global public infrastructure. It's the beginning of geospatial inclusion—where price no longer limits progress.

Grab's Model: A Blueprint for Replication Across Continents

Singapore-based Grab started as a humble ride-hailing app. Today, it's a tech titan revolutionizing logistics and mobility across Southeast Asia. And the heart of its transformation? Geospatial intelligence. Grab uses real-time GPS data, urban maps, and traffic sensors to optimize deliveries, route drivers, and manage peak-hour congestion. But it didn't stop at regional success. Grab partnered with Latin America's Rappi, exporting its geospatial-based logistics architecture to markets in Colombia, Brazil, and Argentina. This isn't just market expansion—it's knowledge transfer.

What makes Grab's approach special is its adaptability. In Asia, it deals with motorbikes and megacities; in Latin America, it optimizes for cars and suburban sprawl. Yet the underlying geospatial engine remains consistent: real-time location intelligence, demand forecasting, and hyperlocal decision-making. Grab's story offers a crucial lesson: geospatial tools aren't confined by geography—they evolve with it.

AI Integration: Turning Data Into Foresight

Data is abundant. Insight is rare. This is where Artificial Intelligence (AI) steps in—converting vast, raw geospatial datasets into actionable predictions. Take climate resilience, one of the most urgent challenges facing our planet. Cities like Amsterdam and New York are deploying AI-enhanced digital twins—sophisticated simulations that replicate real-world environments in virtual space. These models, fed by satellite imagery, weather forecasts, and IoT sensors, allow planners to simulate storm surges, heatwaves, and

pollution patterns before they occur (De Jong *et al.*, 2018). In the ASEAN context, the potential is staggering.

Imagine Jakarta predicting sea-level rise impacts a decade in advance. Or Manila running simulations to identify the safest routes for emergency evacuation. Or Ho Chi Minh City forecasting flood-prone districts and proactively deploying infrastructure. With AI, geospatial data doesn't just tell us where we are—it warns us where we're headed. A recent report by McKinsey (2023) estimates that AI-geospatial integration could boost global disaster preparedness by over 25%, potentially saving millions in damages and thousands of lives annually. In a region like ASEAN, where every typhoon and earthquake brings the risk of devastation, this isn't just useful—it's transformative.

IoT + Geospatial = Real-Time, Real Impact

Now add another layer: the Internet of Things (IoT). IoT devices—embedded sensors, GPS trackers, environmental monitors—generate continuous streams of location-based data. But without geospatial tools, this flood of data is just noise. Together, IoT and geospatial systems create symphonies of insight.

In Singapore, traffic lights adjust in real-time using geospatial data from GPS-enabled vehicles. In Bangkok, air quality sensors trigger alerts and route changes for sensitive populations. In Vietnam, smart irrigation systems use IoT moisture sensors and geospatial overlays to deliver water only where it's needed—reducing waste by over 35%. It's real-time intelligence for real-world problems.

This synergy also opens doors to innovations in public safety, waste management, energy distribution, and health surveillance. Geospatial + IoT isn't just about efficiency—it's about saving time, saving money, and ultimately, saving lives.

The Bigger Picture: A Global Tapestry of Local Innovation

ASEAN's rise in the geospatial landscape isn't a coincidence—it's the result of necessity meeting ingenuity. Urban chaos demanded order. Natural disasters demanded foresight. Agricultural decline demanded precision. But necessity alone doesn't create progress. Vision does. Collaboration does. Trust in data does. ASEAN does more than only solve local problems by developing collaborative platforms like MyGeospatial, teaching the next generation of GIS professionals, and adopting open-source solutions and AI interfaces. It's creating global prototypes—models that other regions can learn from, adapt, and replicate. This is ASEAN's true contribution to the world: not just technology, but technological leadership born of empathy, inclusivity, and resilience. And in a world increasingly defined by crisis and complexity, that kind of leadership is exactly what we need.

Geospatial Technology in Comparative Context: ASEAN vs. the World

Let's zoom out and view the global geospatial technology landscape. In mature markets like North America and Western Europe, geospatial tech is well-established—backed by decades of investment, deep-rooted infrastructure, and powerful institutional support. Think of giants like ESRI, Trimble, or HERE Technologies. These companies have

set the gold standard in GIS, offering robust platforms for everything from urban planning to national security. But there's a downside to maturity: bureaucracy, cost, and rigidity. Legacy systems often move slower, resist change, and come at a premium. They're powerful, yes—but not always nimble.

ASEAN, on the other hand, is unburdened by legacy. Its innovation arises from the ground up—born of necessity, not formality. A young startup in Indonesia or a university lab in Vietnam can experiment with open-source GIS, integrate AI models, and roll out scalable solutions without waiting for approvals or navigating decades-old institutional inertia. This difference—maturity vs. agility—is what gives ASEAN a competitive edge in the next wave of global geospatial innovation.

To the north and west of ASEAN lie two titans: China and India. Both countries have embraced geospatial tech not only as a tool for development but as a pillar of national strategy. China's BeiDou Navigation Satellite System, a rival to the U.S. GPS, showcases how geospatial sovereignty has become a geopolitical priority (World Bank, 2023). Its integration with AI, IoT, and 5G powers everything from military logistics to smart city development. Meanwhile, India's Bhuvan platform, developed by ISRO, provides high-resolution satellite imagery tailored to national needs, from crop monitoring to forest management.

But with great power comes centralization. In both countries, access to geospatial data is heavily regulated, and innovation often flows top-down. ASEAN's more decentralized, open-access model allows for more grassroots experimentation, making it a hotbed for entrepreneurial and civic innovation. ASEAN might not have a BeiDou—but what it offers is distributed creativity, adaptable across borders.

Emerging Theories and Frontier Applications

There's a growing global conversation around geospatial justice—the idea that maps and data are not neutral, but can either empower or marginalize communities. In Cambodia, for example, land grabbing has displaced thousands of indigenous families. But when those communities began using GPS tools to map ancestral lands, they gained a new kind of power: the power of visibility. Their maps became legal tools, advocacy materials, and blueprints for recognition.

Geospatial justice isn't just theoretical—it's personal. It's about using technology to amplify the voices of the invisible. And ASEAN, with its diversity of cultures, languages, and histories, is uniquely positioned to lead in this space. Initiatives like the Indigenous Navigator and Open Development Mekong are already pioneering ways to put mapping tools directly in the hands of the people.

Meanwhile, digital twins—high-fidelity virtual replicas of physical cities—represent one of the most exciting frontiers in geospatial tech. In Singapore, Virtual Singapore does more than show maps—it allows for scenario testing. What happens to the city if sea levels rise by a meter? If a new MRT line is added? If a pandemic hits?

These aren't hypotheticals. They're tested virtually using layers of real-time geospatial data, traffic flows, population density, energy use, and more. ASEAN's younger

cities, many of which are still expanding rapidly, have the unique chance to build these digital twins early—to plan future expansion not through guesswork but through dynamic simulation. This represents a radical shift in how cities are designed: from reactive planning to proactive resilience.

Roadmap for the Future: What ASEAN Must Do Now

1. Invest in Talent

No matter how powerful the technology, its true potential is defined by people. ASEAN must build a generation of geospatial thinkers—coders, planners, data scientists, community organizers—who can use these tools not just technically, but ethically. Curricula at schools and universities must evolve. Scholarships, certifications, and international exchanges should be promoted. Without this investment in human capital, the region risks watching its geospatial future pass it by.

2. Harmonize Policies

Cross-border data flows are the backbone of any regional tech ecosystem. ASEAN needs a unified geospatial data governance framework—one that respects sovereignty but encourages openness. A shared geospatial protocol across ASEAN could unlock trillions in value across trade, logistics, health, and environmental protection.

3. Foster Public-Private Partnerships

No one sector can do it alone. Governments must continue to engage with startups, universities, NGOs, and multinationals. The goal? An ecosystem that is open, interoperable, and inclusive. Platforms like Malaysia's MyGeospatial should be expanded, standardized, and replicated. Geospatial technology is not just about maps. It's about meaning. It's about tracing the contours of our world—not just physically, but socially, economically, and ecologically. In ASEAN, where every flood, harvest, traffic jam, and land dispute can be mapped, the possibilities are profound. What we're witnessing is more than a tech evolution. It's a **moral revolution**—one that turns data into empathy, visibility into justice, and strategy into sustainability. ASEAN has the tools. It has the talent. It has the need.

Open Source ERP: Market Penetration and Cross-Border Scalability

In the evolving orchestration of global enterprise architecture, open-source ERP (Enterprise Resource Planning) is no longer an auxiliary option—it is becoming the core melody. Especially in the dynamic ASEAN bloc, where SMEs fuel economic rhythms and governments orchestrate digital symphonies, open-source ERP has emerged as a critical accelerant of equitable and scalable modernization (Sarker & Lee, 2003). The convergence of affordability, adaptability, and policy-driven digital imperatives has transformed these solutions from disruptive outsiders into legitimate contenders against monolithic incumbents like SAP and Oracle. ASEAN is not merely *adopting* open-source ERP—it is redefining it.

Market Momentum: Digital Imperatives of ASEAN's Economic Engine

The beating heart of ASEAN's economy pulses through its 71 million+ SMEs, which account for 97% of all enterprises and over 85% of total employment (ERIA & OECD, 2024). Yet, a startling portion remain mired in fragmented processes—reliant on spreadsheets, manual bookkeeping, and legacy systems incompatible with modern digital ecosystems. Herein lies the “why”: these businesses desperately require integrated platforms that are both economically feasible and operationally customizable.

Open-source ERP solutions answer this need with elegance. They provide modularity over monolith, localization over generalization, and community-driven innovation over vendor lock-in. Tools like ERPNext, Odoo, and Dolibarr empower small businesses to unify functions such as inventory, payroll, CRM, and compliance without exorbitant licensing costs. In this sense, the adoption of open-source ERP becomes less of a tech upgrade and more of an economic equalizer—a digital bridge over the chasm of inefficiency.

Moreover, the public sector is echoing this urgency. When the Philippine government adopted Odoo for procurement reform, it wasn't just about software—it was a statement of trust. Trust in openness. Trust in cost transparency. And trust in citizen-centered digital governance (Goodchild, 2007). The ripple effect? Legitimization. If governments, with their high scrutiny thresholds, can embrace open-source ERP, why shouldn't the private sector?

Policy Catalysts: When Governance Meets Innovation

The surge in open-source ERP adoption is not occurring in a vacuum—it is propelled by decisive policy scaffolding. Thailand's "Thailand 4.0" initiative, for instance, exemplifies a vision where economic growth is wedded to innovation infrastructure. Offering tax exemptions on capital gains and strategic incentives for digital startups, this policy doesn't merely invite ERP innovation—it builds a launchpad for it.

Vietnam follows suit with its National Digital Transformation Program, which targets the digitalization of 100% of administrative processes by 2025. These aren't utopian declarations—they're action-bound frameworks undergirded by funding, benchmarks, and international collaboration. And open-source ERP sits right at the fulcrum of this transformation: scalable, customizable, secure, and most critically—sovereign. Unlike proprietary systems dominated by foreign interests, open-source platforms enable national control over codebases, hosting, and cybersecurity standards.

From a Dunning's OLI perspective, these are classic Location Advantages—where local ecosystems, political will, and infrastructure readiness coalesce to create a fertile ground for endogenous ERP innovation (Dunning & Lundan, 2008).

The Battle for Mindshare: Breaking the Myth of Fragility

Despite their merits, open-source ERP systems fight a two-front war: technical credibility and perceptual legitimacy. A legacy of misinformation persists, linking "open-source" with underfunded, unsupported, hobbyist-grade software. This outdated notion

has ossified into a mental roadblock among enterprise decision-makers—particularly in industries where risk tolerance is low.

Yet, reality defies the stereotype. Platforms like Odoo boast over 7 million users, with a vibrant ecosystem of over 36,000 apps and a global developer community spanning five continents (Samsukha, 2025). Similarly, ERPNext is backed by Frappe Technologies and receives community patches faster than many closed-source platforms push updates.

What we witness is a classical Resource-Based View (RBV) advantage. These open-source platforms leverage intangible resources—like community trust, rapid iteration cycles, and shared knowledge capital—that are rare, valuable, and hard to imitate (Wernerfelt, 1984). The challenge, then, is not technological—it is rhetorical. It requires case studies, certifications, evangelists, and most of all—narrative shift.

Cost Efficiency Reimagined: Decentralized and Deflationary ERP

When Indonesia's SMEs reported 60% reductions in total ERP implementation costs after adopting ERPNext (Cavalcanti *e al.*, 2022; Hamdani & Wirawan, 2012), the message was clear: open-source ERP isn't a discount solution—it's a disruptive innovation. Unlike SaaS titans who bundle features into bloated packages, open-source ERP allows for granular implementation—start with inventory, grow into finance, and scale into manufacturing workflows.

This modularity is pivotal in capital-constrained environments. Businesses can use local developers for implementation, host on their own cloud to avoid recurring fees, and even integrate legacy systems via APIs—something proprietary giants either restrict or monetize. In a hyperinflationary global tech market, open-source ERP offers a deflationary counterweight.

Moreover, by embracing agile methodologies and DevOps culture, these platforms offer real-time adaptability—something legacy systems, with their quarterly release cycles, cannot match. This agility is not just operational—it's strategic.

Cross-Border Scalability: From Localization to Glocalization

Contrary to fears of fragmentation, open-source ERP systems excel at simultaneous standardization and localization. In Francophone Africa, community-driven ERP modules have been tailored for agricultural cycles, embedded with native tax systems, and translated into local dialects. These aren't clunky bolt-ons—they're core modules developed with end-user participation.

In the Middle East, cultural alignment has proven a powerful entry mechanism (Maspul & Almalki, 2023). Diaspora developers returning from Western markets have localized open-source ERP tools to respect Shariah finance principles, such as zakat calculation and non-interest-based accounting. These adaptations didn't just meet compliance—they created emotional resonance. They weren't selling code; they were delivering dignity.

This aligns perfectly with the Uppsala Model of gradual internationalization. Firms expand first into psychically and culturally proximate markets, learning and adapting

before venturing further. Yet, we also see Born-Global traits—firms deploying via cloud, GitHub, and SaaS networks from day one, reaching global audiences with zero physical presence. Thus, open-source ERP is not navigating between models—it is transcending them.

Strategic Differentiation: Competing Beyond Price

While cost is a compelling entry point, long-term scalability hinges on strategic differentiation. Open-source ERP vendors must avoid the trap of being perceived solely as the “cheaper alternative.” Instead, they must elevate the conversation toward value innovation—a concept rooted in Blue Ocean Strategy (Kim & Mauborgne, 2005). This approach shifts the competitive focus from outperforming rivals to creating new demand in untapped spaces.

For instance, open-source ERP can thrive in informal economies and nontraditional sectors where traditional ERP is simply nonviable. Take microfinance cooperatives in rural Myanmar or agricultural collectives in Cambodia—entities that are overlooked by SAP or Oracle but can be meaningfully served by lightweight, customizable platforms like Tryton or WebERP. The goal here is not replacement, but reimagination.

Furthermore, when ERP systems align with social impact metrics, such as enabling transparent donation management for non-profits or equitable resource tracking for NGOs, they generate a unique emotional utility. They are no longer just software—they become enablers of social progress.

Localization as a Competitive Moat

In traditional ERP ecosystems, localization is often an afterthought—a bolt-on feature hurriedly added to meet compliance requirements. But in open-source ERP, localization is the lifeblood of deployment. It is not a feature; it is a philosophy. For example, in East Africa, customized ERP modules are being used to manage mobile money platforms like M-Pesa, integrating SMS-based reporting systems for regions with low internet penetration. In the Philippines, localized inventory modules support sari-sari stores—micro-retailers that represent a significant portion of the GDP.

This localization is not driven by corporate directives, but by the community. It’s co-created, often by users themselves. This creates an intimacy and a cultural authenticity that proprietary systems struggle to match. It transforms users into advocates and developers into evangelists. It also builds a competitive moat. While SAP can outspend any open-source ERP on marketing, it cannot out-authenticate a grassroots movement that codes in the language of its users—literally and figuratively.

Decentralized Governance: The Community as a Strategic Asset

Traditional ERP platforms are monolithic, vendor-controlled ecosystems. Updates, features, and roadmaps are all decided behind closed doors. In contrast, open-source ERP thrives on decentralized governance—a structure aligned with the growing ethos of the digital economy. Drawing from network theory, these platforms benefit from what Barabási

(2002) calls “scale-free networks”—a few highly connected hubs (core developers and contributors) drive innovation, while peripheral nodes (users and integrators) constantly feed back real-world data. This creates a feedback loop of *continuous, decentralized innovation*.

And it's powerful. Odoo's community, for example, has developed over 36,000 apps—many addressing hyper-specific needs that a centralized vendor would never prioritize. This is innovation at the edge, where the lived experiences of diverse users shape the core functionality of the platform. It's the antithesis of top-down design—and it works.

Regulatory Trust and Data Sovereignty

As digital borders become as consequential as physical ones, data sovereignty has become a defining concern. Many ASEAN countries are now instituting laws that require sensitive data to be stored locally or within strict jurisdictional parameters. Proprietary cloud ERP solutions—hosted in global data centers beyond national reach—often fall afoul of these laws.

Open-source ERP, however, offers deploy-anywhere flexibility. Governments and enterprises can host on-premise, use sovereign cloud solutions, or adopt hybrid models. This flexibility is not just technical—it's political. It allows nations to assert control over their digital futures without sacrificing functionality. From a national security standpoint, this is huge. When Vietnam chooses to deploy ERP systems within domestic cloud infrastructure, they're not just avoiding licensing fees—they're asserting autonomy. And when that autonomy is backed by open, inspectable code, it elevates trust to a new level.

The Future Horizon: AI, IoT, and Open ERP Convergence

Looking ahead, the next frontier is not merely more features—it's intelligent orchestration. The integration of AI, IoT, and machine learning into open-source ERP systems is already underway. And because these platforms are built on open architectures, they are uniquely suited for rapid adaptation to emerging tech paradigms. Imagine an ERP system that can predict inventory shortages using real-time data from IoT sensors, or one that can suggest workflow optimizations using AI-trained behavioral models. These aren't hypothetical. Pilot projects integrating ERPNext with TensorFlow for predictive analytics are already in development in India and Singapore.

Unlike proprietary ERP platforms that silo innovation, open-source systems invite it. They are fertile grounds for innovation ecosystems, where startups, universities, and independent developers converge to build new modules, test hypotheses, and scale solutions. This is where the future of enterprise software lives—not in closed boardrooms, but in open forums. Wonderful—let's carry this momentum forward. We're now entering the final phase of this comprehensive exploration, where theory, strategy, and emotion culminate to define the future of open-source ERP's global impact.

Emotional Capital: Building Trust through Transparency

Technology adoption isn't just a rational decision—it's an emotional journey. Especially in regions where digital trust is fragile and past experiences with opaque vendors

have left scars, transparency becomes a currency of confidence. Open-source ERP, by its very nature, invites scrutiny. It lays its code bare, invites participation, and enables users to shape their own future.

This transparency fosters what behavioral economists call “emotional capital”—a form of intangible value based on trust, community inclusion, and co-ownership. In ASEAN markets where relationship-driven business practices dominate, this matters deeply. When local developers contribute to the very ERP they deploy, and when business owners can audit every line of code that touches their data, trust ceases to be an aspiration—it becomes a lived experience.

As organizational psychologists have noted, decision-making is often driven by “gut trust”, especially in environments of uncertainty (Kahneman, 2011). Open-source ERP doesn’t just minimize technical risk—it soothes emotional risk. It doesn’t just earn compliance—it earns belief.

Case Study: Grassroots ERP Revolution in the Philippines

Consider the story of a mid-sized agricultural cooperative in the Mindanao region of the Philippines. For decades, their operations were mired in Excel sheets, cash-ledger notebooks, and couriered invoices. Proprietary ERP vendors pitched solutions—but they were too expensive, too rigid, and disconnected from local realities. Enter an Odoo implementation, spearheaded by a university-based developer collective. The ERP system was not just installed—it was co-developed with the cooperative’s leadership, tailored to their harvest cycles, localized in Bisaya, and made compatible with solar-powered offline terminals. What resulted was not a deployment—it was a transformation.

Operational costs dropped by 40%, invoicing errors decreased by 78%, and—perhaps most importantly—the farmers felt seen. The ERP became part of their identity, a badge of modernity wrapped in familiarity. It was not Silicon Valley tech—it was *their* tech. This case echoes the core of design thinking—empathy-led innovation that starts with people, not platforms (Brown, 2009). And it exemplifies why open-source ERP isn’t just an IT trend. It is a quiet revolution, moving not through boardrooms, but through barangays.

Theoretical Grounding: Institutional Theory and Digital Legitimacy

To understand the true force behind open-source ERP’s momentum, we must move beyond economics and enter the realm of institutional theory. According to DiMaggio & Powell (1983), organizations conform to societal norms and legitimacy pressures—not just efficiency imperatives. Open-source ERP succeeds because it aligns with evolving institutional logics that prize decentralization, openness, and digital sovereignty.

In ASEAN’s shifting digital landscape, where national governments assert control over data flows, where civic tech movements challenge incumbent power structures, and where consumers demand ethical technology, open-source ERP is not just compatible—it is symbolically superior. It signals to stakeholders—governments, investors, communities—that a company values transparency over opacity, collaboration over control, and

empowerment over dependency. In this way, the ERP system becomes more than a back-office tool—it becomes a public statement of principle.

Comparative Lens: Proprietary ERP vs. Open-Source—A Philosophical Divide

Let's pause for a moment and widen our lens. What we're witnessing isn't just a competition between product categories—it's a philosophical divergence. Proprietary ERP embodies control economies: restricted access, tiered pricing, guarded innovation. Open-source ERP embodies knowledge economies: open access, fluid innovation, collaborative scale. Where SAP may offer decades of product stability, it often demands blind trust and vendor dependence. Where Oracle may promise AI-driven analytics, it does so in a black box, with users unable to interrogate the algorithms or adapt them meaningfully.

Open-source ERP, in contrast, invites users into the design process itself. It transforms "clients" into collaborators and "software" into ecosystems. It reorients value away from centralization toward *emergence*—where the smartest solution isn't dictated from the top but evolves from the bottom. This divide is ideological. It's about who owns the tools of progress, and who gets to shape the narrative of innovation.

A Global Call to Action: ERP as an Ethical Technology

In the end, this conversation isn't just about market share, code quality, or even digital transformation. It's about what kind of future we want to build. Do we want enterprise software that reinforces dependency, or one that fuels autonomy? Do we want technology that erases cultural nuance, or one that amplifies it? Do we want to pay for bloated systems we can't adapt, or invest in agile frameworks we can make our own?

Open-source ERP offers a pathway toward technological equity—a world where even the smallest business in rural Laos or Eastern Nigeria can operate with the same digital muscle as a multinational. Where innovation is democratized. Where local developers become national champions. Where ERP isn't a burden—it's a birthright.

Moreover, Open-source ERP is not a stopgap. It's not "cheap tech for poor countries." It's a radically different way of thinking about enterprise systems—one rooted in transparency, adaptability, and human-centered design. It rises on the backs of passionate communities, flourishes in policy-aligned ecosystems, and adapts across cultures, languages, and industries. It doesn't just meet global standards—it redefines them. And in doing so, it gives rise to a digital future that is more inclusive, more just, and more alive. Let this be the dawn of ERP not as a tool, but as a movement.

Challenges and Strategic Recommendations

One of the most pressing challenges for open-source ERP expansion is compliance with local data laws. These regulations aren't just legal hurdles—they're deeply political, rooted in national security, privacy, and economic sovereignty. Indonesia's Personal Data Protection (PDP) Law is a prime example. It mandates that sensitive data, particularly involving citizens, must be stored locally (Masput & Putri, 2025). This means that global ERP firms can't simply host everything on Amazon AWS in the U.S. and call it a day. They

must either set up local data centers or partner with regional providers—a costly but essential investment.

For open-source ERP vendors, this is a double-edged sword. On the one hand, it's a barrier to entry. On the other hand, it creates a massive opportunity to build trust. By offering on-premise deployment options or hybrid cloud setups, they give customers control over where their data lives. This isn't just compliance—it's peace of mind. Strategically, forming alliances with local data centers, co-hosting solutions, or integrating with region-specific infrastructure providers can turn a challenge into a competitive advantage.

Skill Gaps: Bridging the Talent Divide

Technology is only as powerful as the people who use it. And in many ASEAN nations, there's a significant shortage of ERP-trained professionals. This isn't just a staffing issue—it's an adoption bottleneck. But again, open-source ERP communities are rising to the challenge. Many are partnering with educational institutions, creating free online academies, or tapping into government-backed talent development programs. A standout example is the ASEAN Digital Talent Scholarship program, which offers upskilling in areas like cloud computing, cybersecurity, and yes—enterprise software. ERP vendors need to lean into this wave. Offering internships, sponsoring boot camps, or even embedding their platforms into university curricula can build a loyal, skilled user base that pays off in the long run. After all, the best ERP system in the world is useless without people who know how to run it.

Funding: Fueling the Next Leap with Smart Capital

Growth requires capital. And while open-source ERP might save users money, scaling the platform, building teams, and navigating foreign markets isn't cheap. This is where smart, regionally aware venture capital becomes crucial. Thankfully, the ASEAN startup scene is booming. VCs like East Ventures and Openspace Ventures are actively investing in B2B SaaS and infrastructure tech. These firms understand the local context, appreciate the value of open-source models, and are willing to back innovative, growth-hungry teams. But raising funds isn't just about pitching ROI. It's about telling a story—a story of digital independence, empowerment, and transformation. Open-source ERP startups must position themselves not as alternatives to Oracle or SAP—but as liberators of business potential in under-digitized economies.

Emerging Frontiers: Where Next for Open Source ERP?

Looking ahead, the question isn't if open-source ERP systems will dominate—it's when and where. And all signs point to fertile ground in markets that have been historically underserved by big tech. Sub-Saharan Africa, Central Asia, Latin America—these regions are home to millions of small businesses and mid-sized enterprises hungry for digital tools, yet overlooked by global SaaS providers.

What makes open-source ERP especially compelling in these contexts is its grassroots adaptability. These platforms aren't imposed—they're adopted. They're not just downloaded; they're embraced, customized, and nurtured by local developers who understand the cultural and commercial rhythms of their communities. This organic growth model is the opposite of top-down enterprise sales. It's horizontal, inclusive, and sustainable. Open-source ERP is perfectly poised to become the operating system for the informal economy's transformation into a formal, data-driven, and globally connected engine of growth.

Building Ecosystems, Not Just Software

But technology alone is not enough. What truly unlocks value in open-source ERP systems is the ecosystem that grows around them. This includes integrators, developers, trainers, resellers, certification bodies, and user communities. One of the most exciting evolutions happening today is the rise of regional ERP accelerators—small firms or cooperatives that specialize in local deployments. These players don't just sell software. They embed themselves in the client's business, speak their language, understand their constraints, and offer ongoing mentorship. It's a blend of consultancy and coaching powered by empathy and shared growth.

And let's not forget the role of governments and academia. When universities teach ERP concepts using open-source platforms, they're not just educating—they're building the next generation of digital architects. When governments fund open-source pilots in schools, hospitals, or transport authorities, they're investing in national digital sovereignty. This ecosystem thinking is what differentiates open-source ERP from its proprietary counterparts. It's not just about selling a license—it's about enabling a movement.

Emotional Drivers: Why Businesses Choose Open Source

At its core, the open-source ERP revolution is emotional. It's about freedom—freedom from overpriced licenses, rigid modules, and black-box vendor relationships. It's about trust—trust in a transparent development process and a community that has your back. And it's about dignity—giving even the smallest business owner in Yangon or Dhaka the tools to operate like a global enterprise.

For many, adopting open-source ERP isn't just a technical upgrade—it's a philosophical shift. It signals that their business deserves the same sophistication and efficiency as any multinational. It tells employees that the organization is serious about growth, and it tells customers that they are dealing with a modern, data-driven partner. This emotional resonance is a powerful differentiator. While proprietary vendors sell software, open-source ERP vendors inspire belief. That's something no marketing budget can buy.

We often talk about digital transformation in abstract terms—cloud infrastructure, automation, AI integration. But beneath all that tech lies a simple human story: people striving to do more, reach further, and grow faster with the tools they have. Open-source ERP platforms are democratizing access to those tools. They're giving power to people who've been sidelined by legacy systems and priced out by big vendors. And that makes

open-source ERP not just a technology—it's a revolution. It's a heartbeat for digital inclusion, beating stronger with every new module built, every local deployment completed, every invoice sent through a system that doesn't belong to a Silicon Valley giant but to the community itself. We're not just watching the future unfold—we're building it, line by line, in code that's free, open, and fiercely empowering.

Moreover, Open-source ERP systems are more than cost-effective tools—they are catalysts of transformation. In the ASEAN region and beyond, they are enabling SMEs and public institutions to digitalize operations, scale globally, and localize meaningfully. Despite challenges around perception and competition, open-source ERP providers are rising with innovative strategies, leveraging government support, and embracing new global business models rooted in flexibility and collaboration. Therefore, as they navigate regulatory hurdles, bridge skill gaps, and secure growth capital, these solutions are proving that the future of enterprise software is not closed—it's open. And it belongs not just to corporations, but to communities.

Conclusion

ASEAN stands at the precipice of a digital renaissance, where the fusion of geospatial technology and open-source ERP systems is not just reshaping local economies but also charting a new course for global innovation. This transformation transcends mere technological adoption—it is a profound reimagining of how urbanization, disaster management, and SME modernization converge to tackle pressing challenges such as infrastructure strain and economic inequity. As demonstrated by initiatives like Indonesia's One Map Policy and Malaysia's automated zakat deductions, ASEAN's innovative frameworks are instrumental in bridging historical gaps and fostering inclusive growth. This dynamic region, fueled by youthful ingenuity and proactive governmental policies, is proving that digital tools can, and must, be harnessed to secure socioeconomic justice and resilient governance.

Yet, significant challenges remain, from fragmented data policies to skills shortages and cultural perceptions about open-source reliability. Addressing these issues requires a cohesive strategy—one that unites policymakers, industry leaders, and educational institutions to catalyze talent development, standardize data practices, and foster collaborative public-private partnerships. ASEAN's experience provides a powerful blueprint for integrating cutting-edge technology with traditional values, ensuring that innovation does not come at the expense of cultural identity, but rather, reinforces it. In this arena of rapid change and formidable uncertainty, ASEAN's commitment to transforming digital challenges into opportunities stands as an inspiring beacon for the rest of the world.

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