# Challenges to Global Technology Deployment

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# Challenges to Global Technology Deployment Executive Summary

This report outlines challenges to deploying new technology, specifically a

blockchain Supply-chain management tool, globally. Many of these challenges can also exist in a local context. This report is to provide information to the business leadership team to guide issue identification and resolution by outlining how challenges to global deployments of new technology can be managed. Technological and non-technological challenges to implementation and adoption are discussed. Further, the importance of ethical business decision making and incorporating corporate social responsibility into global business decision making in an age of blockchain SCM technology is touched upon.

This report is not an extensive dive into all possible challenges that might be encountered with a blockchain SCM global implementation. Rather it is an attempt to outline how challenges can arise from multiple arenas, such as technological demands interacting with local infrastructure, sociological and psychological concerns, and regulatory mis-matches. By outlining how such challenges can be met, this report aims to model for management the process of identifying, and planning responses, to challenges early in the project life-cycle.

# Deploying Innovation

Deploying innovative technologies can face many challenges. Some of these challenges are based on psychology and culture, while others are based on technological issues. Still other issues may be regulatory or legal in nature. In considering rolling out a new technology in a global enterprise, it is important to consider how these challenges may impact both local and global costs to deployment, and how they may or may not impact the probability of success. Not all challenges are insurmountable, but some are extremely difficult to overcome, and as such must be recognized early to avoid overly investing in a poor technology strategy.

For the purposes of this paper, we will consider the issues faced by a large, multi-national company based in the United STates wanting to deploy blockchain technology in support of a supply chain operations both locally and globally. For this deployment challenge, not all issues will impact global and local deployments equally. Indeed, some will barely constitute a problem in one context and will be nearly insurmountable in others. However, each issue is one that needs to be considered in the overall deployment effort.

# Technological Factors

From the perspective of technological factors, there are many that can be considered. But in this instance we will focus on just a few. The first issue that must be considered is cloud infrastructure availability. As some of the uses of blockchain is to help ensure sourcing and labor practices to both appease consumer demand and to meet corporate ethical standards (Kouhizadeh et al., [2021;](#_bookmark13) Saberi et al., [2019),](#_bookmark19) it is essential that blockchain technology is supported by the entire supply chain. This end-to-end support is what provides for a transparent supply chain for both the corporate entities involved and the consumer (Gaur & Gaiha, [2020).](#_bookmark6)

For our global corporation, Africa, as well as other less-developed nations in South America and Asia, presents a significant source of resources for our supply chain (Wood & Mayer, [2001).](#_bookmark21) However, Africa and other less developed regions of the world, significantly lags behind industrialized and post-industrial nations in cloud infrastructure and the cost of that infrastructure is significantly more. **mckinseySolvingAfricaInfrastructure** found, for example, that generator-based power costs three to six times that of grid-based power in other locations within Africa. For our use-case, cloud infrastructure is nearly absent. While Africa is the second largest continent, representing more than 20% of all the earth’s landmass, it contains only one Amazon Web Service region, comprised of only 2 availability zones (AZ), both located in the far south (AWS, [n.d.).](#_bookmark0) By way of comparison,

Europe has six regions and at least 16 AZs.

Because one of the easiest ways to solve global deployment challenges is with cloud technology, a point that will be discussed in depth later, this presents an extremely difficult situation for global companies. It is not really possible to locate the needed computing infrastructure within easy reach of the source of materials. This means that anyone wishing to build end-to-end supply-chain blockchain systems in Africa need to invest heavily in private computing facilities to support the computational needs of the blockchain systems.

However, computing power is not the only infrastructure lacking. Blockchain also consumes a large amount of network bandwidth (Litke et al., [2019).](#_bookmark14) This requires modern networking infrastructure. While there is fairly respectable internet penetration into

Sub-Saharan Africa. The quality of service is not comparable to that seen by more modern regions. It suffers from two major problems. The first, is that ownership interests of authoritarian regimes means that internet connectivity can be, and is, shut down for political motivations. Additionally, the quality of service is lower than typically requierd to support the type of high-bandwidth usage that modern blockchains supply-chain systems require (Freyburg & Garbe, [2018).](#_bookmark5) Further, the political nature of communication infrastructure in Africa means that instead of having regional internet providers, there are “scattered islands” of connectivity (Fanou et al., [2017/11/15/November 2017///).](#_bookmark4) This results in a situation where even if adequate connectivity exists at two locations, unless those locations are controlled by the same ISP, under the same regime, there is a good chance that communication between sites will be spotty at best.

As blockchain is fundamentally predicated upon near-real time information sharing between trade partners, the inability of companies to be secure in political environment that protects open communication means that companies face serious difficulties in rolling out these types of new innovations into the global market space. What will work flawlessly in a place like Europe or the United States can be quite hampered by the “digital divide” that separates modern digital nations from less developed ones.

# Cultural and Psychological Issues

Many barriers to technological implementation are not merely technological, or even have much to do with technology at all. Often the barrier to entry is almost purely psychological and cultural. A prime example of this phenomenon with respect to culture is the response of Greek shipping companies to blockchain supply-chain technology. The utilization of blockchain in the shipping industry to increase efficiencies, drive profits, and provide a significant competitive advantage is well documented. Maersk is leading this effort across the globe and their successes have been stellar (Groenfeldt, [2017).](#_bookmark9) Yet, despite the proven success of the world’s largest shipping company in this arena, and a rising demand among shipping customers, Greek shippers collectively own the 22% of the global share of carriers and 33% of the tankers. This collectively is more than 50% of the European Union fleet capacity. The industry is financially stable and successful, with the financial resources to embrace high-tech solutions (Papathanasiou et al., [2020).](#_bookmark17) However, cultural barriers persist that prevent this adoptions. Greek carriers rely on old-fashioned “face-to-face,” or at least “phone-to-phone” conversations and personal relationships to create shipping contracts. Their culture strongly and deeply embraces the roles of middlemen and personal contacts that blockchain is specifically tailored to eliminate as “inefficiencies” (ibid.). But where many see inefficiencies, Greek shippers see a strength.

They believe their deep personal relationships create bonds that ensure continued business,

minimize conflict, and allow for easy resolution of disagreements. Further, where companies like Maersk see sharing of information and transparency as an opportunity to eliminate economic waste, Greek shippers see information transparency as a threat to their way of business.

These deep cultural barriers are not easily overcome. Moreover, they can be an absolute barrier to market entry for new technology if business partners in the supply chain simply refuse to adopt the new and innovative measures because of cultural reasons.

From a psychological perspective, the literature is rife with evaluations of models for

innovation acceptance such as the technology adoption model (TAM) which highlights that perceived utility and perceived ease of use are key factors in determining the rate of technological adoption. When a new, innovative technology is presented, the degree of acceptance and success it sees is strongly correlated to the psychology perception of the managers and workers who are asked to adopt the technology (Gefen et al., [2003).](#_bookmark7) Specific research into blockchain supply-chain systems in under-developed locales (namely India) showed that these psychological factors account for nearly 70% of the behavioral intentions of participants (Kamble et al., [2019).](#_bookmark10) This is a highly significant figure and needs to be taken into account. Of the factors addressed so far, this is the first that applies universally to local and global contexts. There is no particularly context that strongly favors and disfavors consideration of psychological impacts to managers and workers when rolling out new technology.

# Regulatory Misfit

Another area of difficulty for globalization of innovative technology is the impact of disparate regulatory structures in various locations. One easy to understand example of this is the European Union’s General Data PRotection Regulation (GDPR). The GDPR requires several constraints that are not enforced in other areas, such as the United States. Specifically, the GDPR requiers consent of the subjects for data processing, anonymizing collected data to protect privacy, safely handling the transfer of data across borders, and having data officers to oversee data compliance. Of these, the consent for data is the most problematic for blockchain applications. Under Articles 17 & 18 of the GDPR, individuals have, under certain circumstances the right to have their data removed (**Art17GDPR**).

However, one technological function of blockchain is that all data is immutable.

This doesn’t itself present an insurmountable hurdle to corporate-to-corporate blockchain supply-chain management systems. However, it does serve as a barrier to allowing small suppliers who are functioning as sole-proprietorship into blockchain SCM

systems. This is because personal data would not be removable as a result of the technology itself.

Many regulatory incompatabilities exist between nations. Normally, this doesn’t present a significant problem, but with electronic technology, where data collected in one country may be processed and stored in another country out of necessity, it can become a significant burden to ensure compliance with the rules. The complexity of the rules does result in companies with significant legal staff facing massive fines for falling afoul of the laws. Recently Google was fined almost $60M by France for GDPR violations.

# Deployment Strategy

We have seen that cloud capacity, internet capacity and stability, cultural norms, psychological acceptance, and regulatory burden are all potential barriers to a global deployment of innovative technology such as blockchain for SCM. Of course, none of these are in and of themselves an absolute impediment. However, any company that wishes to rise to the challenge must have a strategy for facing each of these challenges in turn.

Let’s start with some observations about the ideal way to deploy technology of the scale of an SCM blockchain system. Such systems inherently benefit from a scalable architecture (Gokalp et al., [2019).](#_bookmark8) SCM is a resource heavy system in the first place, and blockchain capabilities only increase those resource demands. These resources demands are quite expensive but the benefits of SCM and blockchain integration exceed the deployment costs when managed well (Bal & Pawlicka, [2021).](#_bookmark1) The most cost effective method for building large computer systems and deploying them globally is to utilize cloud service systems like Amazon’s AWS, MIcrosoft’s Azure, or others (Carcary et al., [2014).](#_bookmark2) This works quite well in locations that have adequate cloud computing centers either located near the company, or connected to the company with low-latency, high-bandwidth internet connections. However, as we have seen, in locations such as Africa there is a distinct lack of established cloud infrastructure.

This presents two options to the company wishing to address the problem this creates. The first is to mitigate the impact by selecting suppliers who are located near appropriate infrastructure. Most resources are available from multiple suppliers in multiple locations. Very few resources available from Africa are not available from any other continent. So one very real strategy is to simply find a new supplier that is located in a location more amicable to cloud computing. A second strategy is to partner with the other companies in the supply chain to build physical non-cloud infrastructure to serve the supply chain to augment any cloud connectivity that is not locally available.

When it comes to addressing the concerns of network bandwidth, these same two options exist. For network connectivity, satellite network connections can supplant the poor to non-existent network infrastructure. This technology is not inexpensive, but if changing suppliers is not possible it may be the only real option to ensure the needed bandwidth is available in the proper locations. As the advantages of a blockchain enabled SCM system permeate the entire supply chain, if changing suppliers is not an option and the strategy of building the necessary infrastructure must be followed, then forming a limited partnership with other supply-chain participants to fund, staff and operate any locally constructed networking or data center capacity is appropriate.

Addressing cultural norms is not as simply as devising a solution to technical infrastructure limitations. As seen from the discussion about the Greek shipping industry, cultural norms can drive non-adoption. In the case of the Greek shipping companies, the benefits of adoption are well known in the shipping industry (Groenfeldt, [201](#_bookmark9)7), but the Greek shipping companies still resist. In order to address cultural barriers to adoption, a company must engage in a significant communication and information sharing strategy to overcome hesitation to adoption. Research has shown that culturally bound perceptions will change in the face of significant, consistent communication efforts entered into in a good faith effort to inform and empower (Dubey et al., [2019;](#_bookmark3) Gefen et al., [2003;](#_bookmark7) Park et al., [2009).](#_bookmark18)

These same techniques are necessary to address psychological barriers to adoption.

Indeed, cultural barriers are, essentially, simply shared psychological barriers. So, in addressing one, it is possible to address the other. However, there is a slight difference in that psychological barriers tend to be tied more to individual perceptions around complexity and ease of use rather than perceptions around relational constructs. The Greek shippers avoid blockchain not only because of perceptions about difficulty in using it but because of a shared commitment to the cultural norms of doing business in person. To address psychological barriers to adoption, companies need to develop targeted training for participants in the system to demonstrate both ease of use of the product developed and the utility of the system for them in their particular tasks (Lou & Li, [2017).](#_bookmark15)

Regulatory differences between countries, regions, and local areas can present an even greater challenge than any of the above options. For companies that are already engaged in global business operations, this means starting early to work with the various legal departments in each country and region to ensure that requirements and potential areas of conflict can be identified early and addressed in the system design. For example, if since personal identifying information can not be removed from the blockchain as the blockchain is immutable, one plausible solution to avoid privacy issues in the future is to design the blockchain to carry not personal identifying information, but a key to the database that stores personal identifying information (PII) separate from the blockchain ledger. This will allow the PII to be treated differently depending on the regulations which apply, will allow for PII anonymization, and other steps to address potential regulatory concerns. But it is necessary that the system architects are aware of the legal and regulatory demands early so that solutions can be devised.

# Considerations When Deploying Technology

Obviously deploying a technology like blockchain SCM systems globally presents challenges, but it provides for great benefits as well. These benefits are not all related to

costs. This is a technology that can be used to reduce environmental and human rights impacts across the supply chain (Mukherjee et al., [2021).](#_bookmark16) As companies are coming to realize that there is real benefit to being concerned with sustainability (Kolk, [2016),](#_bookmark12) striving to make corporate social responsibility a factor in global business decision making is moving from being a nice-to-have, but not necessary, advertising point to a central strategic business consideration. Kolk points out that issues that drive consumer and business decisions include ecosystem health, sanitation, education, energy consumption, prosperity, inclusion, justice, peace, and human dignity.

With new technologies such as blockchain SCM being specifically targeted to bring informational transparency to corporate practices, failing to take these issues into consideration for any global technology deployment demonstrates significant short-term thinking. Consumers are demanding that companies provide the information they need to make ethical purchasing decisions, and that extends to nearly all global operations (Kim, [2019;](#_bookmark11) Saberi et al., [2019;](#_bookmark19) Sahai et al., [2020).](#_bookmark20) It simply is no longer realistic to think that ethics can be segregated from business strategy for long-term success. Therefore global business decisions need to be made with a clear understanding of the ethical implications of the proposed activities: be the activity the rolling out of new technology or the building of a new manufacturing plant.

One of the real advantages of cloud computing with respect to this particular point is that many cloud providers have specific documented plans to become carbon neutral, and publish data about their carbon footprint. This allows companies that are addressing technology deployments not only the convenience of being able to release technology globally, but also the ability to do so with minimal environmental impacts. A feat that is not nearly as simple to do with corporate owned computing centers.

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