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Chapter 4: Transforming procurement through automated sourcing and smart contract negotiations

4.1. Introduction

Drastic liquidity shortages dovetailing with geopolitical uncertainties have led many organizations to expedite their digital transformation initiatives, making the reinvention of the pivot of business activities — supply chains — a priority. The use of modern IT tools to automate, augment, and reinvent procurement, coupled with the trend to outsource more and more ancillary activities to third parties has led to increased interest in the automation of enablers of procurement activities. However, the answer to the question of how far this automation will go remains uncertain, leading to diverging opinions, from the expected complete commoditization of "spend categories" to the carry-over of the entirely bookable unavailability of procurement professionals. In this chapter we concentrate on the first side of the automation debate, using a specific enabler — sourcing — and a generalization of its application to show the promise of more advanced automation techniques, where the sourcing procedure takes place inside a smart contract negotiating automatically on behalf of a business participant using a variety of available agent negotiating engines (Omar et al., 2021; Özkan et al., 2021; Agrawal et al., 2023).

Following an explanation of how the current state of automatic sourcing is the meme of "A" icon, a deep learning model that predicts the outcome after a negotiation without performing it and sense-checking it, and of its business implications, we will discuss some further unexpected implications of the wide-spread adoption of automatic sourcing: its local and global externalities, and a model for its timing, supported by the establishment of strong patents, the avoidance of externalities, and the possibility of technology licensing and "spend category" parameterization. We conclude by discussing the establishment of external loads, and spending capabilities that give credibility to the establishment of a smart contract, through a disintermediation space blockchain, as prerequisites for automatic sourcing (Sigalov et al., 2021; Sinha & Roy Chowdhury, 2021).

4.2. The Evolution of Procurement

Historical Overview The history of procurement can be traced back to as early as 3000 BC when the Babylonians developed a form of a centralized economy based on a centralized government that appropriated goods created by craftspeople.

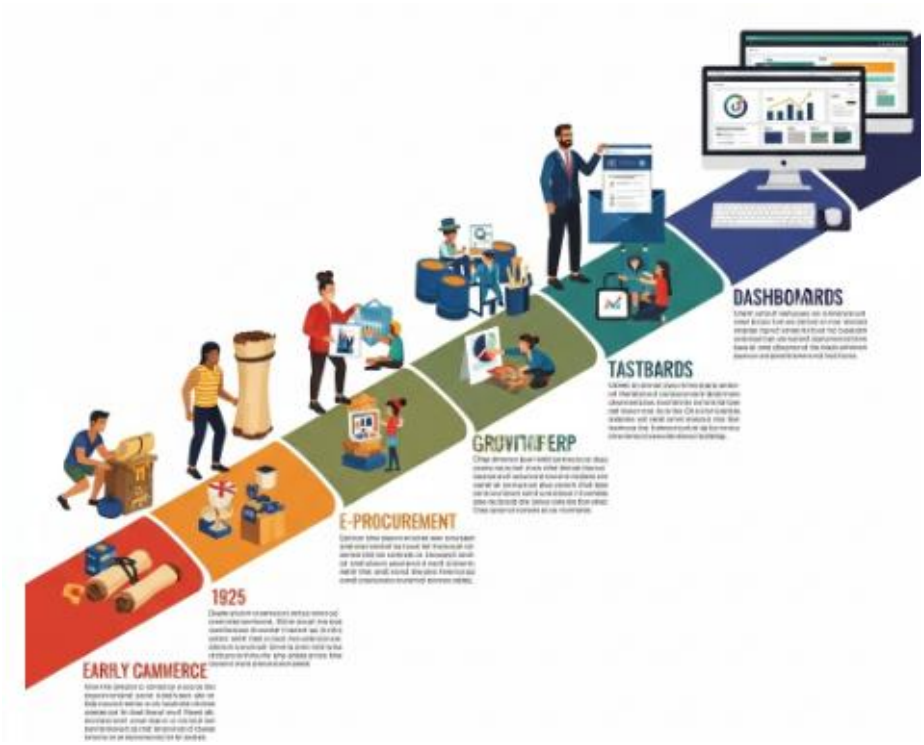

Fig 2 : The Evolution of Procurement

During this period, the ability to efficiently acquire the necessary resources became increasingly pervasive. A few hundred years later, public works projects became an important function of government, and the capture, delivery, and use of resources for large projects gave birth to the first models of contracting for services. Interestingly, the best-known code of ancient history detailing a collection of transaction rules is that of the Babylonians, known as "the code of Hammurabi," which dates to around 1750 BC. Hammurabi's code included laws about prices for known goods and services, protection against bribes, misrepresentation, and guarantees accounting for construction projects. Although procurement and contract negotiations had existed for thousands of years, the ability to record transactions, and the growth of early empires resulted in the establishment of a form of power created by the ability to acquire goods and services. The concept of a procurement process and business cycle that is fortuitously introduced by these early examples has similarities to those developed much later during the

Renaissance, the Industrial Revolution, and into our modern global information economy.

With the development of early empires and economies came the first recorded rules regarding the buying and/or leasing of goods and services. The Egyptians, Greeks, and Romans all recorded rules and procedures for their procurement activities. The government and economy of ancient Egypt were indeed the predecessors of all economic systems that we are familiar with today. As in the early Babylonian economy, the Egyptian economy laid claim to being the first; the ability to acquire the right resources at the right time and the right place, in the right condition, in the right quantity, at the right quality, at the right price was a necessity for the Egyptians.

4.2.1. Historical Overview

The procurement process in large corporations has been active for over a century – its common practices and techniques have developed and changed with the development of good collaborative partnerships with suppliers, commodity market volatility, and awareness of risk. Over the past twenty years, companies have transformed internal business management toward increased efficiency and lower production and transaction costs, particularly in the area of information technology development and implementation. The impact of the Internet and the possibilities it opens for business-to-business transaction efficiencies, using up-to-date electronic tools, have encouraged speed and transparency in procurement practices. In addition, the explanations of supplier behavior offered by behavioral economics have led to a new understanding of the role of the procurement function in terms of market power and risk sharing.

As a separate managerial function, procurement is relatively recent and has emerged as a specialized, strategic area of activity at the intersection of a corporation's market position and its core production capability. Corporations have increasingly transferred responsibility for supplier negotiations and management from the production area to specialized centralized groups with the expertise, power, and information resources necessary to exploit fully the procurement process. Centralization also allows for an internal specialization that permits the company to cope more efficiently with the demands of global business. Multi-site production using a limited number of preferred suppliers has made the transfer of responsibility from the production function more efficient, with corporate-wide agreements and sourcing agreements that take cost factors into account throughout the product life cycle, as well as exploiting supplier capabilities in research and, increasingly, redesign.

The recent development of corporate Supply Chain Management and collaborative supplier relations is an expansion of the procuring function but increasingly requires a

controlling strategic vision from the corporate peak. Supplier capabilities in low-cost production and inventory management, marketing, and rapid identification of changing demand signals or sudden changes in commodity cost or availability support the corporation's response to short-term variations in demand and customer response times. The development of managing, collaborative supplier relations on a long-term basis and the decreased use of international market procurement for low-value items only occur at the price of increased levels of security through reduced supplier options in the local economy.

4.2.2. Current Trends in Procurement

Procurement is increasingly focused on quality instead of price over the recent years. Although price is still a concern, the supply chain is under immense pressure to deliver high-quality products on time. Companies are increasingly experiencing product recalls due to poor quality of supply chain products or services. Data and information security is becoming another area of focus in the procurement supply chain decisions. With the emphasis on digital and providing technology resources for a competitive advantage, companies are facing the risk of intellectual property theft and sensitive client data breaches. Therefore, evaluating suppliers for their security practices, implementing security checks at appropriate times, and monitoring supplier performance are critical.

Modern procurement is also facing the challenge of supplier diversity. Organizations have diversity goals, and although the realization of that goal and the corresponding benefits may require higher costs during a regime of constrained budgets, forward-focused businesses are determined to be conscious of the need of broadening their sourcing options. In fact, companies can experience unforeseen benefits of diversifying their supplier base including reduction in risks, faster realization of company objectives, and embracing the culture of their customers among others. Staying aware of current events is critical to assessing risks within the supply chain. Events such as armed conflict, disease outbreaks, regulatory reform, and environmental issues can impact supply chain processes at any time.

Finally, as consumers are demanding sustainability from businesses, Procurement is becoming the strong proponent of the adoption of sustainable practices, and to an extent, being held accountable for the same. With the increased focus on for-profit organizations to embrace sustainability and economic and social impacts associated with their operations, the role of Procurement is quickly evolving to publicize the organization's mission of doing good for the environment and for the communities residing within its supply chain footprint.

4.3. Automated Sourcing

The remarkable advancements in Artificial Intelligence have fundamentally transformed various aspects of business operations, and procurement is no exception. The automation of the sourcing function, often considered part of a company's back office, greatly enhances efficiency, lowers costs, and reduces management effort. This, in turn, allows decision-makers to focus on more strategic collaboration activities with suppliers. Additionally, categorizing spend data drives automation opportunities, ensuring that pricing on approved items is consistently in line with budgets, and directing maverick spend to automated processes that control it. Autofill capabilities in procurement systems streamline the process of creating requisitions for frequently purchased items. Shifting all purchases of a particular commodity or service to one or two preferred suppliers, who have agreed to terms established through a sourcing event, can also facilitate sourcing automation. However, not all spend categories are open to automation.

Automated sourcing includes the establishment of standardized templates for Requests for Quotes (RFQs), and the automated generation of those RFQs which can be sent to multiple suppliers, their completion by the suppliers, and the automated negotiation of adjustments to the quotes received. With the exception of the Spend Classification tools described earlier, the majority of the tools and products that enable automated sourcing are guided by Artificial Intelligence algorithms. Automated sourcing tools use simple decision trees, rules engines, or scripts to automate the RFQ template, RFQ generation and delivery, and quote reception processes. The results of the RFQs and negotiations are then reviewed by a buyer for final decision approval.

4.3.1. Definition and Importance

The increasing dematerialization of the economy through digital technologies is leading to a transformation of the nature of goods and services, moving from an economy fundamentally based on tangible goods to a digitalized economy based on intangible and experience goods. As a consequence, not only are traditional tangible-related supply chains evolving, but also new supply networks are emerging, based on the provision of intangible goods and services that complement physical supply. The new supply network ecosystem is characterized both by the transformation of traditional suppliers, who are increasingly organizing themselves around networks of collaborating enterprises, emphasizing the relationships with their customers, and by the emergence of new players that add value around the intangibles. In this challenging environment, procurement departments of organizations are increasingly required to operate as value-adding strategic partners. To offset their functional nature where activities are planned, organized, directed, and controlled according to pre-set policies and procedures, some procurement departments are working to incorporate key elements to enhance their

strategic role, including strategic training of their personnel, introduction of performance evaluation systems, alignment to the strategic objectives of the enterprise, establishment of relationships with suppliers based on dialog and trust, differentiated category management. These new challenges introduce greater complexities to procurement departments but at the same time also offer opportunities to become sources of more value added in the business. Automated sourcing can support procurement departments to achieve both objectives through a digital procurement and sourcing strategy.

4.3.2. Technologies Driving Automation

The principles driving Intelligent Procurement on intelligent automation emerged from advanced technology capabilities: Artificial Intelligence applied to data and complex algorithms; Supply Chain Technologies like electronic Invitations to Tender, eRFx and Electronic Auctioning Platforms, Transactional cloud Platforms, Global Data Infrastructures, and Digitalization Solutions for accounting document and tax invoice verification, technologies for Tax Compliance, Optical Character Recognition and Electronic Payment Control and Monitoring.

Advanced technology combined with the emergence of disruptive new Supply Chain Process start-ups disrupted Supply Chain Process into New Intelligent Supply Chain Process – Solutions, Channels, Platforms, Decisions, Information and Infrastructure focused on Yield Growth, Cost Control, Margin, Revenues and Profits Yield Growth, On-Chain Solutions that leverage Smart Contracts for Insurance and Rental solutions, Decentralized Finance, NFTs and tokenization, and Metaverse Solutions for gaming, gamification and Simulation & Modeling using development platforms. Interoperable Blockchain Technology emerged as a foundational technology leverageable for the Decentralized Intelligent Supply Chain Process Infrastructure.

The technological disruptions that are making Intelligent Procurement with Smart Contracts and Automated Procurement possible are technological innovation breakthroughs in Blockchain technology, specifically Interoperable Blockchains for Tokenization and Smart Contract use Solutions, Advanced Robotic Process Automation, Advanced Intelligent Optical Character Recognition, and Advanced AI Algorithms and Techniques applied to network blockchain aggregators for NLP or computer vision.

4.3.3. Benefits of Automated Sourcing

Most large organizations receive thousands of proposals in response to requests for proposals annually, making the evaluation of these proposals resource-intensive and difficult. AI-based automated sourcing eliminates the manual work involved in

processing and analyzing proposals and contract terms. Using Natural Language Processing and semantic analysis, automated sourcing solutions create a digital overview of proposals by summarizing the terms and conditions included in the bids. This is beneficial in fine-tuning the proposals to compare them against the needs of the organization. These solutions classify proposals into high-level categories according to customers' needs, compliance, and ease of evaluation of technical specifications. Automated sourcing can recommend weighted criteria selection, enabling the concerned teams to concentrate on identifying the best available options from a results' shortlist generated by the system.

Additionally, too many choices and massive data can lead organizations to make poor decisions and trade-offs when answering sourcing questions. With such complex aggregation of unpredictable combinations, automated sourcing can spot and suggest alternatives that chief sourcing officers can consider. Automated sourcing is still in its infancy and dominated by few niche technology vendors. Because it is the starting point of an increasingly technical-driven operational model, improvements of digital tools can overcome the reluctance of forward-thinking, technology-driven sourcing managers and decision-makers in investing in these digital solutions. In this new economic environment, technology must play a key role in transforming failures into successes. Automated sourcing can help achieve this goal, enabling organizations to become faster, better at managing core competencies, and offer higher quality goods and services.

4.3.4. Challenges and Limitations

Automated sourcing offers many advantages, but there are also challenges and limitations. For one, the creation of a comprehensive complete dataset of supplier dynamics can be hard to achieve, simply because past key relationships among suppliers cannot be easily derived from the available datasets. There can also be high costs in obtaining data on suppliers, such as pricing or quality data. Second, production and service content templates often depend on customizations that can be specific to a buyer and require human expertise to gather and define in advance. Third, long-term relationships with suppliers can be hard to achieve and may be under attack from the increasing power of buyers as procurement becomes more data-driven. The challenge is to develop an automated sourcing process yet offer sufficient flexibility to establish a long-term partnership with important suppliers. Fourth, vagaries in machine-training data can lead to some unexpected results. For example, problems might arise if for any specific product category, a given algorithm has been trained using only historical templates from a small number of buyers.

The risk is that this lack of data sufficiency can bias the process such that specific suppliers are chosen repeatedly. Moreover, if procurement as a function moves

completely to an automated data-driven process, minority or small volume suppliers may become irrelevant as human procurement practitioners would prefer to work with suppliers providing higher levels of services at better pricing. In fact, automation poses grave risk to their existence, as well as to their higher-volume competitors, as they may not be viable with a pure play automated selection, in particular large material or service packages having long-term potential, are still best done collaboratively with traditional sourcing expertise, when buyer-specific requirements are co-developed with suppliers.

4.4. Smart Contracts

Smart contracts are self-operative bits of code embedded within a contract that run when invoked by the execution conditions specified in the contract, requiring no intermediary to enforce. The contract is the basis for the transfer of value over a blockchain. This value could be money, a property title, a bond, a vote, or anything else of value that can be represented as a digital token. When the smart contract code is executed, it updates the ledger state accordingly and any events dictated by the contract code execution are triggered, such as triggering a payment or transferring an asset token.

To illustrate, if Mary wants to bet that it will rain in New York on a given date, she creates a new smart contract and deposits the money with it, specifying a weather service that will decide if it indeed rained. Her friend John can then deposit a matching amount into the contract, and if it does rain on the specified day, the smart contract will pay the total amount to Mary. Otherwise, if it doesn't rain, the money goes to John. No third party is needed to enforce this transaction; it is guaranteed by the smart contract code, and everyone can check the public register of smart contracts to make sure every smart contract has enough funds and that the rules prevent collusion between John and Mary.

While smart contracts provide an attractive solution for automating many functions currently performed by third-party intermediaries, they also pose serious security risks if proper care is not taken. A smart contract is at risk of loss of funds due to bugs or loopholes in its code or its security and in the fashion hackable web pages or other computer code are vulnerable to cracking. Furthermore, since smart contracts can be very complex, the costs of uncovering loopholes can be very high. Also, on the blockchain, users have limited recourse if any problems arise, since there is no legal protection, unlike that associated with a bank or other intermediary.

4.4.1. Understanding Smart Contracts

Smart contracts are lines of code that automatically execute transactions of value when specific conditions are fulfilled, meaning that two parties in a transaction save both time

and money needed to assure conditions are true. Smart contracts have the huge strategic advantage of automating transactions and digitally codifying, replicating, enforcing, and executing processes that are traditionally manual.

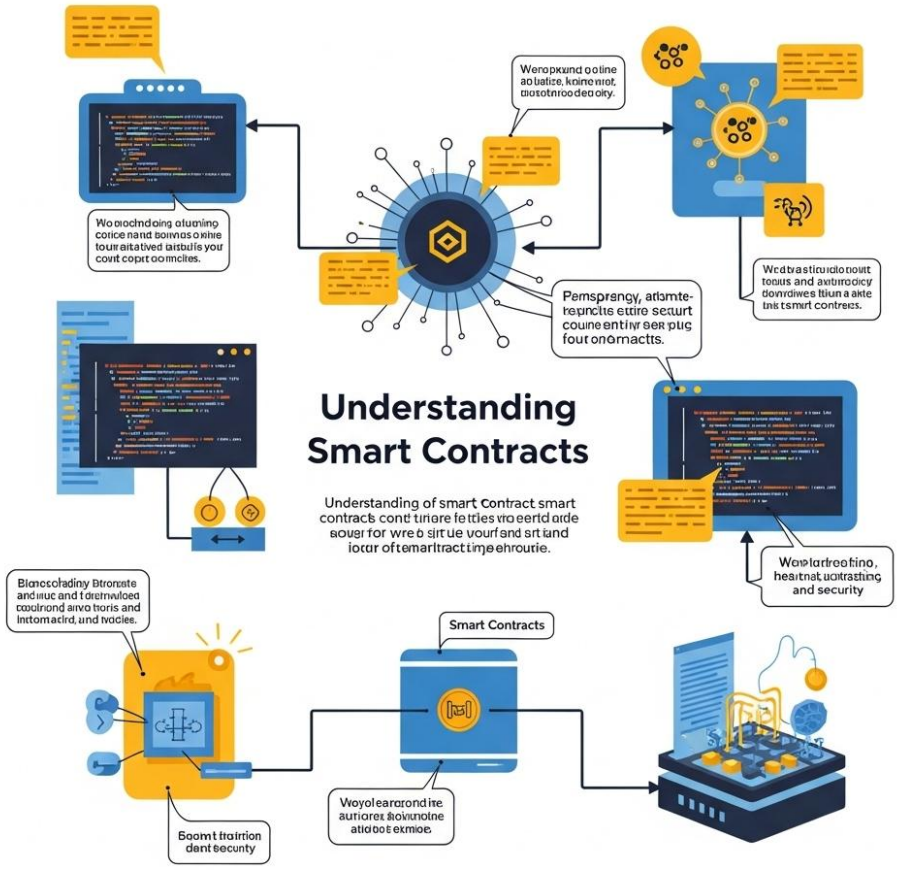

Fig 2 : Understanding Smart Contracts

Smart contract functionality is built on advances in Cloud Computing, Blockchain Technology, Artificial Intelligence, and Internet of Things Technology. A smart contract automatically executes when pre-defined conditions are met. Smart contracts are at the center of DeFi because they create a trustless environment allowing any two participants in an agreement to create and automate the agreed-upon transaction between them with no need for trusted intermediaries. The parties and their agreement terms are recorded on the Blockchain, and when conditions are fulfilled, the transaction is automatically executed. Smart contracts use Blockchain technology to create a permanent public record of the terms of the agreement and its performance. This publicly-verifiable record

creates accountability. All involved parties can monitor the performance of the automated functions of the smart contract from within the Blockchain. Monitoring is enabled by oracles, also called 'Data feeds', which are third parties that relay the data in and out of the Blockchain from off-chain. Since smart contracts involve digital assets, which are lured by hackers, security is important. A 'Security Audit' is a process involving an objective analysis of the smart contract code by an independent expert.

4.4.2. How Smart Contracts Work

Smart contracts integrate the digital asset to the execution control logic to create the autonomous execution capability of a smart contract. These contracts have a different handling from traditional contracts not only for the reasons discussed, but also because of their execution mode. A traditional contract contains an IOU disposition written by the buyer who expresses his willingness to pay in exchange for future provision of goods and/or services by the seller. Only when the buyer pays, the seller has the possibility to honour the contract. The smart contract, in contrast, transfers ownership/title of the goods and/or services provided by the seller to the buyer when the buyer outputs the right, and retains up to that moment ownership/title of the goods and/or services provided by the seller.

Moreover, while a handshake exchange is at the centre of the traditional contract, smart contracts function in a pre-programmed conditional form. They provide ex-ante assurance as they are executed only if pre-established conditions are met. This ensures the integrity of a smart contract through features that are managed directly by the protocol. A smart contract can operate without need for an intermediary only if it is executed on a public ledger. If the smart contract execution is constrained to a private chain, or if the execution is supported by a private ledger that investigates the code for malicious security holes, then the intermediary functions are only partially obviated.

4.4.3. Applications in Procurement

The use cases of smart contracts in the context of procurement are tremendously diverse and practical. Auctions and marketplaces are pretty much the most evident use case of smart contracts. Using an online auction, a buyer can find sellers offering goods and services without the assistance of a central authority or intermediary. Smart contracts will enforce the contract stipulated on-chain. For example, anyone can create an auction smart contract for a specific item, in which the seller's private key is linked to the transaction at the end of the auction period. If the highest bidder is the only person who has sent money to the smart contract, the smart contract will automatically transfer the

item to the highest bidder and will send the payment to the seller. If no one has paid, the transaction is invalid.

Smart contracts could also be used to track supply chains, ensuring that goods ordered have been delivered in accordance with the terms of the purchase. The blockchain-based supply chain traceability improves the safety of deliveries and the enforcement of terms and conditions required by parties when buying and selling products. Furthermore, the safe exchange of payments for products can be done through smart contracts. Finally, smart contracts can tokenize any asset defined in a digital format and transfer it with a cryptocurrency-based payment, which is an interesting use case for specific goods exchanges. Indeed, if goods are in an NFT format, contracts would easily allow the exchange of goods such as clothes of a specific brand, artwork, and vintage watch.

4.5. Integration of Automated Sourcing and Smart Contracts

Synergies and Benefits The areas of automated sourcing and smart contracts are as of now separate and distinct. However, we believe that the automation of requests for proposal (RFP) processing in sourcing services develop synergies and benefits, increasing the opportunities for more automated negotiation processes and the use of smart contracts. For example, companies that have mastered the "art of RFP" using intelligent and automated sourcing services can translate this into data feeds that can provide more data to automate contract negotiations. Advanced intelligent negotiation engines can incorporate the proposals and optimize the desktop negotiation process. Once a contract has been awarded to an AI agent and terms negotiated, incorporating those explicit negotiation terms into a self-executing smart contract means that the process has moved from a computer based sourcing platform to an AI agent negotiating a contract and moving it to the "chain." The agent will want to negotiate smart contract terms in areas where behavior and scoring can easily be monitored and performance can readily be observed. Smart contracts may not be useful for all events subject to contract, particularly contingent events. However, they offer major advantages for a series of transactions where performance can be readily monitored.

4.5.2. Case Studies The success of smart contracts relies on accurate and reliable input data from the physical world. They describe two smart shipping cases in the logistics industry, Smart Shipping for Auditing and Smart Shipping for Service Level Agreements, and discuss related technologies. A system for the automated negotiation of business contracts, where the negotiation process transforms contract proposals into a tree, with contract proposals ranked according to the stage of the process. The system can be extended to enable the negotiation of smart contracts. There is also an electronic auction house for complex contracts that are self-executing, and in which the contract

terms are also executed. The auction house uses moderation to speed the execution of smart contracts.

4.5.1. Synergies and Benefits

Sourcing activities can greatly benefit from the deployment of smart contract technology. Smart contract execution settings allow for automated decision enforcement. In other words, an infrastructure is made available to automatically apply the "smart" part of the contract, meaning that no trusted intermediary is necessary. The obvious extensions of this idea would be if the conditions of the contract enforcement would also change. For instance, the intelligent part would also be able to automatically verify the state of the world as soon as the product/service is provided. In this way, parameters such as quality and timeliness of delivery would play a fundamental role.

Assuming that the previous two steps are done, sourcing activities can benefit from the combination of intelligent negotiations approaching solution space representation and smart contract delivery setting capabilities. For nowadays markets, sourcing decisions are complex. Prices are not the only parameters that influence supplier choice; moreover, the supplier reputation and the characteristics of delivery are fundamental. In proximity markets, advisors and specialized sources' experience are very relevant to set proposal characteristics. These features of offers can be embedded in a kind of "negotiating request", including quality validations, max delivery time, etc. On the other side, intelligent agent market procedures satisfaction is a way to simulate proposals and all their characteristics–again on the basis of suppliers' reputation–without the need to submit their costs.

4.5.2. Case Studies

This section presents several ideas for the integration of automated sourcing and smart contracts with the goal of directing attention to the possible practical applications for the proposed novel procedure in the case of Mexico, framed within the existing legal scheme. The second case study presents a thought experiment for the integration of automated sourcing and smart contracts in the public procurement space.

The first case study presented below is based on an existing e-commerce store. We present here the integration proposal for the preparation and acceptance of electronic offers by suppliers of common goods and services, as well as for the execution of contracts in simple public procurement processes, with only one supplier invited. In this proposal, there are two possible and simple sales processes. The first highlights the central role of automated sourcing and returns the supplier to a state like that of the pre-

internet era. The other incorporates the electronic functions of catalog selling and makes the supplier more functional, at least at first glance. The second thought experiment shows a more complicated case, illustrated in the diagram, for the integration of automated sourcing and smart contracts in public procurement. The gray areas highlight a hypothetical description for public procurement processes of more complexity and length, with three stages: invitation, evaluation, and decision. In addition to the areas already described in the first case study, there are two new areas that address other processes present in most public procurement systems: those processes related to the publication of the invitation, the possible answer, and the economic offer evaluation.

4.6. Impact on Stakeholders

Sourcing projects must bear in mind the interests of every stakeholder involved in a procurement project. Those parties affected by the concerns or interests regarding a sourcing decision such as suppliers, procurement teams and end users represent a small number of parties. In time, we argue how parties outside the actual sourcing project such as taxpayers or the general public at large will need to be also considered as stakeholders from the very beginning in order to achieve the intended political objectives. As procurement teams automate sourcing projects, they also decide how many resources are needed to make manual and individual sourcing decisions. If construction was instead procured on a project by project basis, like is currently the case, how would the additional cost of designing and executing each detailed sourcing project factor into the procurement decision. Would these additional costs lead the office to avoid actually having a specialized office staffed by experts?

Suppliers

Automating sourcing decisions will initially disrupt supplier's resources in the first stage of market entry. Agencies with attractive products such as construction, infrastructure or logistic assets will receive a pipeline with near or out of the money costs on most of its sourcings; suppliers will develop comprehensive risks management strategies to avoid the project from being a utility plant. However, we consider this effect temporary as new entrants will flush the market, together with traditional providers of these services.

Sourcing projects will in addition reduce the obstacles for suppliers from less developed areas such as laborers in emerging economies to enter advanced markets; new suppliers will take a notable share of the sourcing. Agencies will benefit, since they will realize additional cost with little negotiation skill involved. The period of gathering and storing different supplier credentials will reduce, allowing agencies to open multiple relationships and follow the best.

Procurement Teams

Advanced algorithms will perform fact gathering tasks such as writing sourcing documents with the help of digital assistants and opening notifications to notify interested parties against qualification tasks. Agencies will only be asked to tender on simple projects. Air tickets for city representatives visiting the supplier with the most attractive offers would have to pay local taxes. The procurement team will see its role evolve: from getting and analyzing parameters set from others, to synthesizing results from the automated system while verifying that the right parameters have been incorporated.

End Users

Civil society is demanding for governments to ensure that public services procurements such as public transport, social buildings and back office assistance achieves the level of quality from value adding activities.

4.6.1. Suppliers

The greatest impact on operating costs is to the suppliers: the time spent before a transaction is executed will virtually remove their profit margin on low dollar business. They will also potentially spend less time working each order. The transaction cost to them will consist of handling of the paper trail internationally, combined with a small service fee to the transaction agent. A similar scenario exists for suppliers to consumers. These new roles of suppliers as invigilators, supported by technological advances in delivery, will lead to new forms of B2B transactions. Unlike the consumer products industry, which has some informal structures for dealing with business to business transactions, a worldwide market does not yet exist for B2B in the microcosm. The tools have been there for a long time, but no digital brand exists that can gain common acceptance and sponsorship. In line with other technologies, once a marketplace becomes popular, there will no longer exist an opportunity for smaller brands to capitalize through superior concepts. The fundamental problem facing SME's in the future is how to compete against suppliers that accept no markup and have achieved the economies of scale that allow them to drive pricing almost to the cost. With opaque pricing, there is greater opportunity for direct sales with better margins than the retained markup structure of the distributor. The tools and marketplace are in place that allow even retail shops to buy products directly from the manufacturer, thanks to the low overhead of maintaining a website. They will be able to sell at almost cost level, but at the same time, through reducing overhead and knowing that a small turnaround is all that is needed, they are capable of more efficient supply than the distribution houses.

4.6.2. Procurement Teams

Introduction We discuss the impact on the procurement function in this section. The efficiency gains thanks to time savings as well as the decision support in negotiations will raise the efficiency of the procurement team and help them to shift their attention from operational to strategic tasks. We also discuss some new tasks for procurement teams that come with the implementation of the technologies. Impact on Procurement Teams The new way to approach sourcing will have important implications for procurement teams. Automated sourcing and smart contract negotiations will create new efficiencies, primarily time savings. Implementing automated sourcing and smart contract negotiations can provide significant time savings, leading to a significant efficiency increase in making sourcing decisions. This efficiency increase can free personnel for higher-value, strategic sourcing decisions. It allows non-strategic sourcing decisions at lower organizational levels to be made while more strategic decisions can still be made by procurement teams. Developing sourcing strategies and working with suppliers to improve their performance over the longer term provides greater leverage in negotiations. An emphasized focus on supplier collaboration and relationships means that companies will have better information with which to negotiate.

4.6.3. End Users

Over the years, the end users' perspective seems to have been sidelined in most, if not all, procurement efforts. Probably, the only exception seems to be the efforts dedicated to creating supplier catalogs. With PeCs revolutionizing the way we place orders, end users may again be challenged to redefine the concepts of ease and speed. Well executed, PeCs have built-in approvals and alerts that prevent the order of items outside of the defined guidelines.

Automated sourcing and smart contract negotiations empower the Category Managers and the end users who use the PeCs. As smart authoring combined with AI Catalogs will make this decentralized, empowered way of working more impactful, perhaps we will not call them contracts anymore. Term levels would be defined based on corporate policies, customer requirements, and supplier innovation, operational capabilities around account management, credit, risk. AI tools would be used for ratings and risk alerts. The clients would be mapped at Term level by Account type and effort needed – e.g., strategic, transactional, supplier enabled.

End users will be empowered with self-serve tools and will help collate the right data as the PeCs will auto-populate with the right supplier ecosystem and established Term levels. Specialized terms in areas such as consulting, professional services with technology dependencies, project focus for travel, specialized skill level of temporary labor will allow experts in these categories to explore the right networks and help collate responses to help with screening and recommendation. With AI and advanced analytics,

the Power of the Network is on the side of the end user and stakeholder. This allows with the right prompts for the end user to do market cooling/collation to define what expect are term level economic conditions to the Term definition, confirmation, and management to the supplier, if required, and collaboratively solve the issue if required.

4.7. Regulatory and Compliance Considerations

Because of the evolving character of the developed technologies and its impact on regulations that oversee them, comprehensive, in-depth and bidding approaches to compliance must be carefully considered. Achieving this would ensure that buyers and suppliers can fully leverage the abilities enabled by state-of-the-art technologies and maximize value extraction. Non-compliance with local regulations could bear substantial risks in this regard, specifically in the realm of privacy and data protection, antitrust laws, trade sanctions, and export control; although opportunistic behavior by suppliers could arise in the absence of well-defined contracts and regulation.

Legal Framework. Operators of large language models are not in all jurisdictions equally liable for users of their models, whether they are buyers or suppliers utilizing the technologies for their specific purposes. Some models may provide the ability for buyers to draft requests for proposal or specific proposals in an unlimited fashion, creating substantial risks for all operators attached to intellectual property ownership, whether it be copyrights or patents, as users could utilize the automatic generation abilities for harmful content. This could create reputational or punitive damages for either the buyer or the supplier in case model prompts lead to discriminatory behavior.

Data Privacy and Security. Complying with data privacy and security measures laid out by local treaties, laws, guidelines, and governance codes is essential. All parties must ensure that tokens or data uploaded for purposes of contract creation or evaluation are not used as training data, as this could expose sensitive data from both the private and corporate sectors. The implications of exposing tokens range from minor inconveniences to damages that can amount to the millions, deprecating the significance of well-established templates that contain business-sensitive data.

4.7.1. Legal Framework

Blockchain technology and smart contracts have transformed the creation of agreements. Defined as immutable, timestamped records of transactions that are linked securely together through a network of computers, blockchains have emerged as trusted resources

for many types of data. Immutable records create trust in the data, and the combination of automation and tokenization creates the capacity for reliable, autonomous actions to be taken against those records. Smart contracts build on that concept, effectively enabling trusted, secure automation of activities and business processes in a way that has never been previously possible. Yet this technology is new and largely unregulated. While innovators in other industries look to blockchain technology to support a myriad of activities, from establishing long-term energy contracts between consumers and producers to tracking expensive wine collections to verifying credentials for employees, the legal language in traditional contracts was designed to operate in a physical, evolutionary world. There are no specifications about how data inputs have to be input into the smart contract engine, nor any definitions about what happens if the wrong information is entered. Lacking are related concepts about the legal responsibility of data entry into the smart contracts, nor the warranties about accuracy, coverage, and consistency of the data. Absent are the qualifying statements regarding the nature of the hire on the ledger system, the nature of the parties utilizing the ledger, nor the governing supply parameters that then allow the system to generate automatic messages and transactions. However, with the right iteration values input at the right time by the right parties, the ledger uses automated scripts to initiate processes. It requires no intermediaries, nor does it incur the considerable transaction costs usually associated with executing financialized collateralization activities.

4.7.2. Data Privacy and Security

As a result of the treatment and storage of possibly sensitive personal data related to patients, providers and payers, conduct of public procurement has been subject to special regulations related to data privacy and security considerations. However, this is not an isolated event. The public administration is often faced with somewhat conflicting needs. On the one hand, the body has interest in the highest transparency possible to grant proper control by all the interested public, making accessible online all the information considered relevant. Public procurement related to high hospital budgets and the selection processes considered to generate higher ethical risk are often made publicly available in special tax paying portals. On the other hand, there are relevant privacy related concerns associated with excess of information placed publicly available. One of the main critical issues in that area is related to the disclosures done by the public procurement offices regarding contracts content. Legal uncertainties regarding ethical limitations on disclosures of the contracts negotiated in automated modes often create issues to make these conditions publicly available online.

In order to cope with data privacy concerns, the most usual procedure is to implement decisions designed to remove sensitive elements, described as redaction or expurgation,

from the publicly accessible versions of documents provided to the general public in order to avoid any possible identification of the parties and disclose sensitive information from the contracts. As a result of that limitation, the exposed conditions are mostly those regarding the contract value. In that sense, continuing with the tax-market analogy, a possible role model in that perspective is to take comparative insights from the general data protection regulation, which also provides for legal bases that allow further processing of personal data in publicly available registries, provided that a framework is in place that is based on legitimate processing purposes and implement mechanisms to avoid propriety and privacy risks.

4.8. Future Trends in Procurement

Technological disruption in procurement is emerging through automated sourcing using supplier marketplaces and negotiation through smart contracts on digital infrastructure platforms. With trusted intermediaries such as suppliers and service operators eliminated in lieu of a digital infrastructure platform, services can be provided on-demand at lower prices through automated sourcing and facilitate cost savings for organizational buyers. With the increasing prominence of Blockchain technology and Open Book Accounting Services, we predict that on-demand supplier marketplaces will emerge in multiple industries fueled by technology providers, resulting in zero service support costs for slow moving expensive suppliers. We, therefore, predict that a movement towards Dynamic Pricing and Smart Contracting will take on greater urgency in the next decade across all industries, resulting in sharply increased productivity improvements.

For example, service-based industries like hospitality affected by huge pricing discrepancies that hurt brand integrity and customer satisfaction are already moving towards a hybrid of demand-based pricing and Dynamic Pricing to enforce pricing integrity and smart contracts where low cost service customers found through flexible travel and hospitality websites are smart contracted to outservice brand integrity customers paying high prices through a smart contract, and low cost service customers are opportunistically moved into high costs service customer slots whenever the demand environment is generous. The service industry sage believes that this pricing business and brand integrity balancing act is being taken to the next level as companies, too, face increased scrutiny over how they do business as well as what business they are in. Healthcare, said to be one of the most antiquated industries as far as pricing is concerned, is emerging into the 21st century and entering the Digital Infrastructure Economy, fueled by the increasing amount of digitally native health companies being formed and Digital Infrastructure platforms specifically designed for Healthcare being newly created.

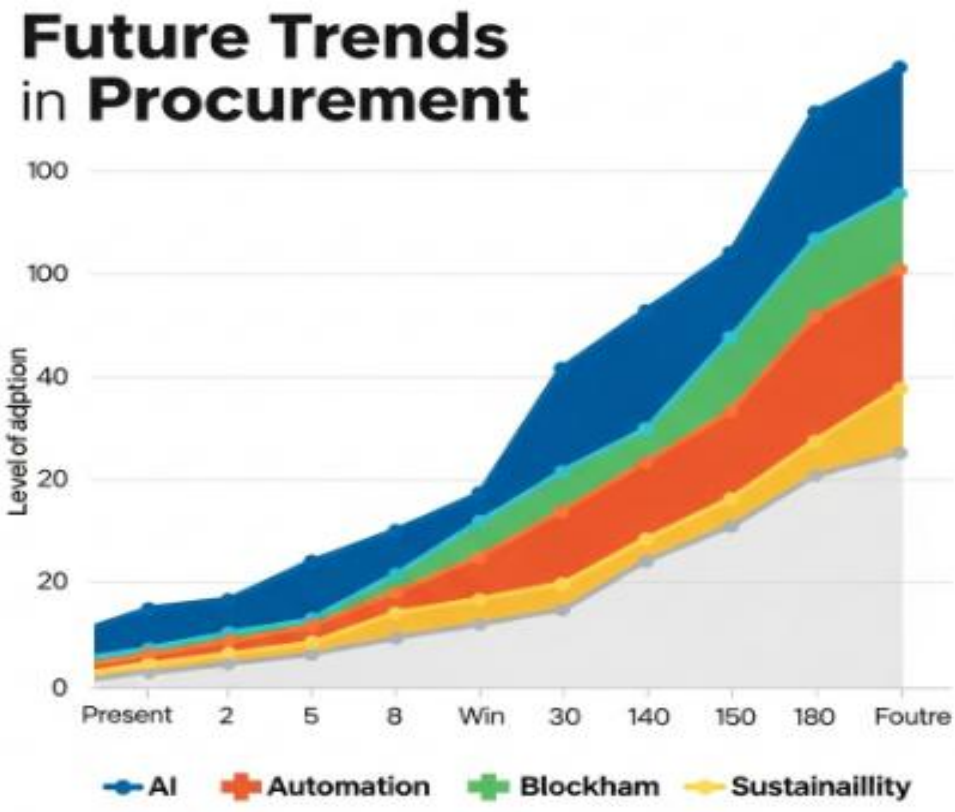

Fig : Future Trends in Procurement

4.8.1. Emerging Technologies

Over the next decade, it is expected that we will see the increased adoption of Artificial Intelligence, Blockchain, and the Internet of Things across the procurement function. Though adoption rates are currently low, these technologies will automate work like forecasting demand, finding sources, managing supply chain risk, and negotiating contractual terms in order to improve organizational efficiencies. AI refers to the capacity of computers to undertake tasks usually associated with human expertise, including skill, reasoning, learning, linguistics, and perceptual abilities. Machine learning is a subset of AI with technology that can self-learn and improve over time without the need for constant human supervision. AI combines vast amounts of data along with cloud computing, and machine learning technology programs that enable deep learning.

The application of AI in sourcing decisions will lead to a huge increase in savings and efficiency. It will allow for smarter decisions, determine incentives for suppliers to hold inventory, model transportation flows, calculate total landed costs, identify patterns in

sourcing decisions over time for better planning, provide near real-time cost analysis of buying one product from one supplier vs. alternatives by region, and more. Automated sourcing will analyze complex pricing structures and will provide companies with contract recommendations for the highest savings. Companies may at some point choose not to negotiate their contracts with a supplier at all, letting the technology do it for the best price. Data agreements may be negotiated between systems of suppliers and buyers with the help of AI technology predicting the best decision. There are already examples of primitive types of this technology taking steps towards this vision.

4.8.2. Predictions for the Next Decade

In the past twenty years, procurement organizations have streamlined their internal processes, created efficient systems to manage relationships with their suppliers, implemented electronic catalogs, and identified KPIs to measure their performance. These changes have made procurement an efficient operation, usually within the context of a very business-centralized organization. Over the next decade, however, we predict that procurement organizations will go through a metamorphosis. The seamless use of emerging technologies will have a significant impact on the way in which business is conducted, which will necessitate changes in procurement's role, capabilities, and responsibilities. Outsourcing, once the province of strategic sourcing professionals, will be the norm for almost any special business capability that can be hired. All personnel involved in the performance of the corporate function will become more aware of what capabilities are available externally. Because this knowledge is ubiquitous, procurement must enhance its capability to create value by managing external resources, rather than assume a controlling and primary role in all external relationships.

Over the next decade, the procurement function must engender a true partnership by adding business capability on demand, thus enhancing overall value. This is a difficult shift for many procurement organizations, but with the increasing emergence of online clearinghouses, it is inevitable and necessary. Indeed, in the next years, procurement must compete with these entities for the business of other corporate specialties if they are to survive. The concept of shared standards for all user departments, global supply chain management that encompasses multiple buyers and suppliers, and the concept of outsourced value chain capability is new for many corporations. But is there any other option for business? The turbulent times will force everyone to re-think the vision of their enterprise, and for procurement, new technologies, new exciting challenges, and new responsibilities await us in the next technology-driven decade.

4.9. Conclusion

Contents

This essay has highlighted the benefits of procurement automation, specifically in the area of supplier negotiations through sourcing optimization and smart contract incentives. We have presented a multifaceted framework for exploring the problems and their technical solution. Our conclusion is that there are sufficient potential solution advantages and business synergies attractive enough to interest large corporate and governmental buyers, resulting in a commercially viable new product that stands to benefit buyers, suppliers, and society as a whole. Our hope is to motivate large buyers to support commercial product development and initiate pilot projects.

It is clear that the described research and development effort requires close collaboration between academics specializing in the relevant technical areas and private sector companies, from start-ups to established corporations. Indeed, developing automated sourcing through joint decision optimization has the characteristics of "science-inspired business" with high risk and uncertainty, as well as the potential for high rewards. Will-wise companies recognize this opportunity and take determined steps to become first movers in applying generated products to enhance their sourcing capabilities? By leveraging their domain knowledge and by applying cutting-edge knowledge in artificial intelligence, optimization, simulation, and data analytics, they stand to enhance performance, cost efficiency, and shareholder value from this strategic corporate function. They also gain the satisfaction of having catalyzed the transformation of negotiations into a problem that can be solely addressed through scientific advancement.

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