The Fourth Industrial Revolution of Healthcare Information Technology: Key Business Components to Unlock the Value of a Blockchain-Enabled Solution

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Section: Discussion

Editor's note: This article is one of an ongoing series covering topics published in conjunction with the Health Information Management and Systems Society (HIMSS) describing the development of blockchain technology and its applicability to healthcare.

As described by the World Economic Forum (WEF),[1] the fourth industrial revolution is here and is changing business models across every industry vertical. This revolution includes digital technology, big data, artificial intelligence, distributed ledger technology (DLT, or blockchain), and analytics, and represents new ways in which technology is being integrated into societies.

This changing interaction with technology will impact business models. Traditional business models are historically based on a centralized framework for delivery of goods and services to the consumer. The new business model is based on the decentralization of the creation and delivery of goods and services. At the core of the new model, organizations must demonstrate value-creation and value-delivery, while ensuring their solutions are secure, scalable, and interoperable to remain competitive. A decentralized business model built on a blockchain framework can provide the decentralization and security needed for this industry shift.

ADVANCEMENTS DRIVING BUSINESS MODELS

Each revolution created shifts in business models. The industrial revolutions of mechanical production (first), science and mass

production (second), and the digital revolution (third) have disrupted how society operated between 1784 to this day. Prior revolutions[1] occurred within 100 years of each other (1784–1870 and 1870–1969); however, the fourth revolution is on an expedited trajectory—occurring about 50 years after the third revolution in 1969. Similar to past revolutions, the fourth revolution requires a shift in business models to ensure growth while maintaining resilience and sustainability.

The WEF argues that we are experiencing the fourth industrial revolution, in which technology and humanity merge as "cyber-physical systems,"[1] and these systems may potentially incorporate distributed ledger technology as part of cryptographically secure, decentralized infrastructure. In the new world of cyber-physical systems, healthcare organizations are not exempt from the need to have a clear definition and understanding of value delivery, and will need to be ready to implement and adopt technology to remain relevant in the new paradigm. In addition, relevance and sustainability require operating within a trusted ethical framework that addresses data governance, access, security, identity management, accountability, and transaction authentication.

THE FOURTH INDUSTRIAL REVOLUTION AND BLOCKCHAIN FOR THE INTERNET OF MEDICAL THINGS

The innovation spurring the fourth industrial revolution in the healthcare industry is centered on the Internet of medical technology (IoMT),[2] which will digitally connect approximately 50 billion[3] medical sensors, devices, and machines to collect and monitor patients' health. Promoting the expansion of IoMT requires an enabling framework of standards and regulations that promote scalable and secure solutions, policies that drive change, interoperable data-enabled

infrastructure, incentives and investments, a skilled and capable workforce, collaborative multi-stakeholders, and continual innovation and entrepreneurship. Blockchain technology can serve as a potential infrastructure to drive these capabilities for the expanded use of IoMT. Blockchain-enabled disruption of the status quo is primed to hit areas such as healthcare supply chains, research, payment, and care delivery systems.

To date, conventional healthcare service models constrain diagnosis and care delivery geographically to the hospital, doctor's office, or community-based clinics. On the contrary, IoMT, enabled by blockchain, allows for an increasing venue from which patients can choose more cost-effective alternatives to monitor and diagnose their health conditions regardless of their geographic location. By converging Bluetooth technology, wearable medical devices, and smartphones, one can enable remote health monitoring in the diagnosis and treatment of health-related conditions, while shifting the power dynamics between the patient and the provider. IoMT also enables increased collaboration between the doctor and the researcher to achieve a better understanding in the treatment of clinical conditions and disease.

PREPARING A BUSINESS FOR NEW TECHNOLOGY AND MODELS

Taking advantage of IoMT business opportunities requires developing a blockchain strategy for implementation, evolution, and sustainability. Organizations seeking to explore this should consider the following steps in the process:

1. Identify the business case or use case to align business priorities
2. Perform a return-on-investment (ROI) analysis

3. Develop a consensus or network of patient-centered services
4. Identify a pilot system, location, program, etc.
5. Develop the implementation framework, which includes plans to:
   a. Establish governance
   b. Conduct assessments
   c. Determine budgets
   d. Design standards and workflows
   e. Ensure compliance with regulations such as Trusted Exchange Framework and Common Agreement (TEFCA), Health Insurance Portability and Accountability Act of 1996 (HIPAA), Family Educational Rights and Privacy Act of 1974 (FERPA), and the Information Blocking rules (or other regulations if non-US based). All new technologies require documented compliance with applicable laws, which drive information governance and information sharing.
   f. Train and educate stakeholders
   g. Conduct operational readiness change management exercises
   h. Implement
   i. Identify key performance indicators (KPIs) to measure and assess impact
   j. Maintain communication with the Executive Leadership and Board of Directors
6. Implement tokenization and token ecosystems
7. Assess the total cost of ownership (TCO), as reflected in the budget. TCO should be clearly understood for all projects, especially understanding when those costs are realized.

ENABLING PROGRESS IN HEALTHCARE

The fourth industrial revolution will leave its mark on global healthcare. In spite of its size, complexity, and regulations, healthcare is poised for rapid change. News stories are published daily about disruptions to traditional industries and businesses because of its advances. Telemedicine evolves into virtual care encounters. Remote patient monitoring is critical to chronic disease management. Artificial intelligence and machine learning supplant call centers and provide key tools in diagnostic radiology. Personal devices collect and disseminate health information and provide real-time monitoring of chronic conditions. The rapid and expansive availability of health data allows for proactive interventions and transfers care into the sphere of wellness, enabled by predictive analytics. The new healthcare delivery system will have new cost modeling, advanced revenue-cycle options, and increased price transparency, all of which empowers the patient and the family to make better choices.

Blockchain can serve as an enabler for all of these disruptive technologies. As discussed in our previous Health Information Management and Systems Society articles, blockchain provides a "transactional framework" that ties together these new processes in healthcare while enabling a new approach to identity and patient control of data and information. Blockchain, through the use of crypto coins and tokens, can even support new ecosystems of value and incentivization that could drive new ways to interact with health and life sciences. As blockchain technology supports this revolution's impact, businesses will need to be prepared to adjust their business models and governance structures to benefit from this revolution.

Conflicts of Interest
The authors state they have no known conflict of interest.

Contributors

Both authors are members of the Health Information Management and Systems Society Blockchain in Healthcare Task Force. Jim St. Clair, Ann Ingraham, Dominic King, Michael B. Marchant, Fletcher Cotesworth McCraw, and David Metcalf were involved in the original draft preparation. Jim St. Clair and Ann Ingraham were responsible for review and editing of the article.

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