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Human Sensing- Bringing Agility to Pharma Value Chain with Business 4.0™

Abstract

Due to the rapid proliferation of digital technologies and advancement in sensing mechanisms based on real time, low power implementation of cost-effective sensors(embedded devices), sensing the human state and context through contact and non-contact methods has evolved significantly. Consequently, one of the promising areas, which have opened up for pharma, is exploiting the capabilities of Human Sensing for next leap in their transformation journey. Human Sensing is a broad integrated terminology, which encompasses both physical and cognitive sensing related to human beings.

Human sensing provides a unique opportunity in enhancing the agility of pharma value chain, which hinges around three large elements: R&D, manufacturing, and marketing & sales. Human Sensing has the potential to transform each of these elements. While R&D can be transformed using physical sensing, cognitive sensing of patient can impact manufacturing and sales & marketing stages, respectively. This will make the value chain more agile, by capturing and utilizing the human sensing data, thereby making the pharma organization more intelligent at each stage. An integrated human sensing platform supported by Business 4.0™ backbone is thus the need of the hour to help pharma take a quantum leap in its digital transformation journey.

The Building Blocks of a Human Sensing System

The non-invasive or minimally invasive nature of human sensing is driving its increasing adoption across the life sciences industry.

The first step of the sensing journey begins with deployment of different physical sensors on a subject using smartphones, wearable devices, 3D cameras, and telematics to record parameters such as heart rate, oxygen level, blood pressure, and temperature. The data is then combined with cognitive sensing like behavioral detection and social interaction using advanced analytics and machine learning. This results in timely insights with real-time processing and qualitative analysis of the subject. With both the physical and cognitive sensing information, sufficient knowledge on the subject's location, mental state, physiological state, general wellness, and behavioral mindset is generated, essentially creating a digital twin of the subject (see Figure 1).
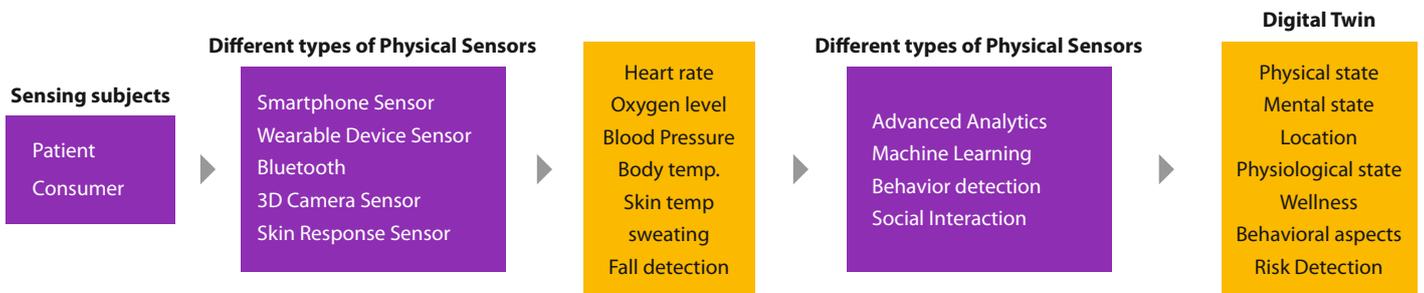
Sensing subjects

Patient
Consumer

Different types of Physical Sensors

Smartphone Sensor
Wearable Device Sensor
Bluetooth
3D Camera Sensor
Skin Response Sensor

Heart rate
Oxygen level
Blood Pressure
Body temp.
Skin temp
sweating
Fall detection

Different types of Physical Sensors

Advanced Analytics
Machine Learning
Behavior detection
Social Interaction

Digital Twin

Physical state
Mental state
Location
Physiological state
Wellness
Behavioral aspects
Risk Detection

Figure 1: The human sensing journey

Tapping into the Potential of Human Sensing Across the Life Sciences Value Chain

The three fundamental processes that form the bed rock of the life sciences value chain are research & development, manufacturing and supply Chain, and sales and marketing. Human sensing holds immense potential in transforming each of these functions for life sciences companies (see Table 1).

Research & Development (R&D)

Top life sciences companies, on an average, spend anywhere between 15 - 25% of their revenue on R&D and are under constant pressure to make clinical trials more efficient in order to enable faster time to market. Human sensing can be applied in two challenging areas of life sciences R&D– multi-site clinical trial data collection and Real-World Evidence (RWE).

Life sciences companies need to present a diverse set of data and experiences for regulatory approval. However, carrying out clinical trials on a wide set of patients, often spread across multiple geographies, is a time and effort consuming process. To provide a faster and more accurate method of gathering patient data, biosensors and wearables can be used to collect the user's physiological information such as pulse, activity levels, body temperature, oxygen levels, and blood pressure.

The challenge related to RWE is to arrive at the best treatment paths in clinical practice based on the data collected from clinical trials. RWE can be gathered using human sensing platforms such as biosensors, wristband, wearables, sensor-based chip-on-a-pill, or ingestible sensors. The collected sensor data can be analyzed to generate the best clinical pathway.

Manufacturing and Supply Chain

It has been reported that, pharmaceutical manufacturers waste USD 25 Billion due to supply chain inefficiencies1. Human sensing can address this issue using sensors and radio frequency identification (RFID) to provide invaluable intelligence to the pharmaceutical supply chain. For example, during transportation, certain medicines need to be maintained at a specific temperature to function properly. A human sensing system enabled by sensors and RFID can ensure continuous

logistics monitoring and report on required parameters. Warehousing and routing of drugs using smart sensors helps in efficient supply chain management reducing wastage cost, minimizing the overall drug cost.

In addition, with advancements in the field of genomics and precision medicine, drug manufacturers are moving from mass to custom manufacturing as response to a specific medicine varies across individuals. Human sensing provides a solution to address the problem by integrating individual patient data collected through bio-sensors and wearable devices with the manufacturing system.

Sales and Marketing (S&M)

This is a strategic function in life sciences organizations who spend anywhere between 30 - 50% of their revenue on S&M. With the proliferation of digital technologies, the business to business (B2B) model of pharma companies is being transformed to a business to customer (B2C) model, as patient-centric S&M functions offer considerable differentiation.

Engaging with the patients to understand their mindset, social media behavior, and general wellness is becoming increasingly important to deliver holistic treatment. Increasing incidences of chronic diseases now require long term patient engagement and management. Further, the medical system is moving towards a future where the bottom line will depend not only on the number of prescription drugs sold, but also on the overall wellness of the patient.

Human Sensing has a crucial role to play in meeting patient treatment requirements by gathering physiological data of patients, as well as data on mental wellness through physical and cognitive sensors. For example, by analyzing patient discussion and interaction on social media, pharma companies can assess and make sense of what is being said, and how to utilize the information for better marketing and customer engagement.

Research & Development	Manufacturing & Supply Chain	Sales & Marketing
Multi-site clinical trial data	Supply Chain Wastage	Patient Engagement
Real world data	Personalized Medicine	Wellness
Real world evidence	Quality Issues	Chronic Disease Management

Table 1: Use cases of human sensing across three major functional areas of the life sciences value chain

Creating an Efficient Human Sensing Model for Pharma with Business 4.0™

Thus far, the life sciences industry has adopted only parts of human sensing within its value chain such as multi-site clinical trial data of patients, or deployment of sensors for supply chain wastage. Programs and initiatives to engage better with patients, focused mainly on patient education, are also in progress. However, most current initiatives relate to physical sensing, and with minimal inclusion of cognitive sensing, do not provide an integrated view of human sensing.

To realize the full value of human sensing, an integrated, seamless, and full spectrum approach to human sensing (see Figure 2), spread across the value chain, must be implemented. The intelligence gathered at one stage can then be fed into the next stage, and as a result, the whole system derives the benefit of increased insights and better efficiencies.
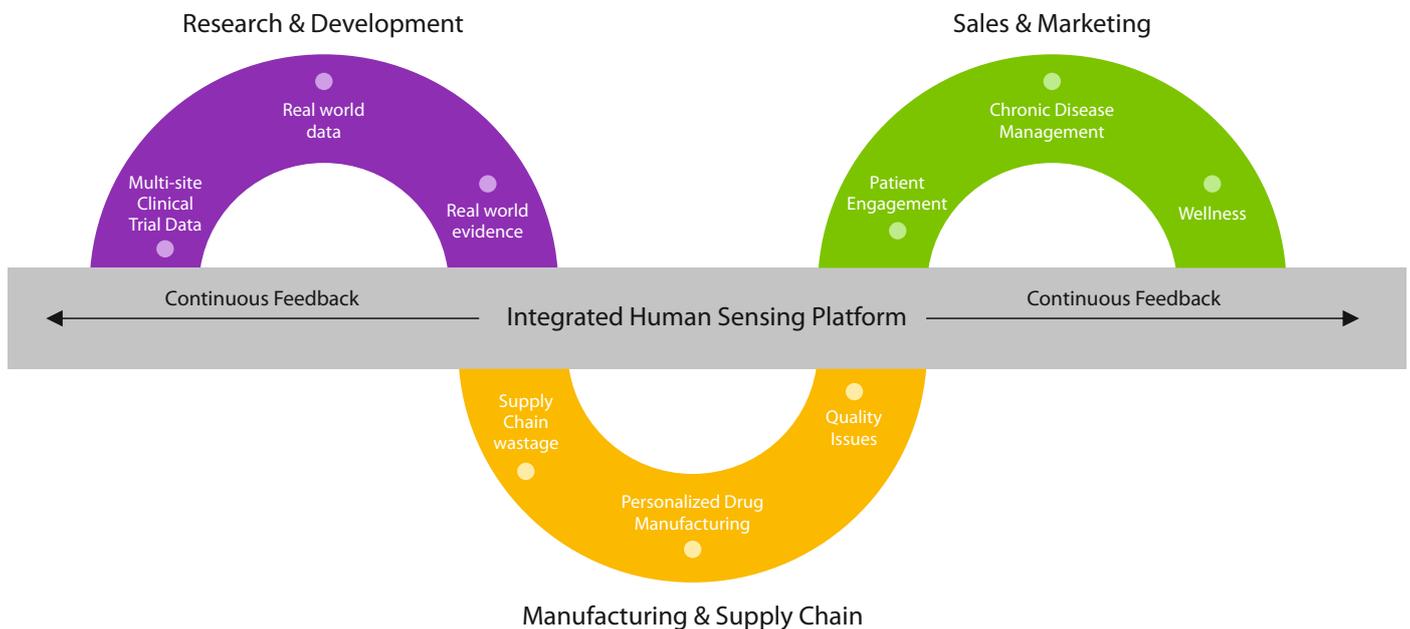

Figure 2: Integrated human sensing model for the pharma value chain

As a next step, life sciences organizations should evaluate their position in the human sensing matrix using the suggested framework provided in Figure 3.
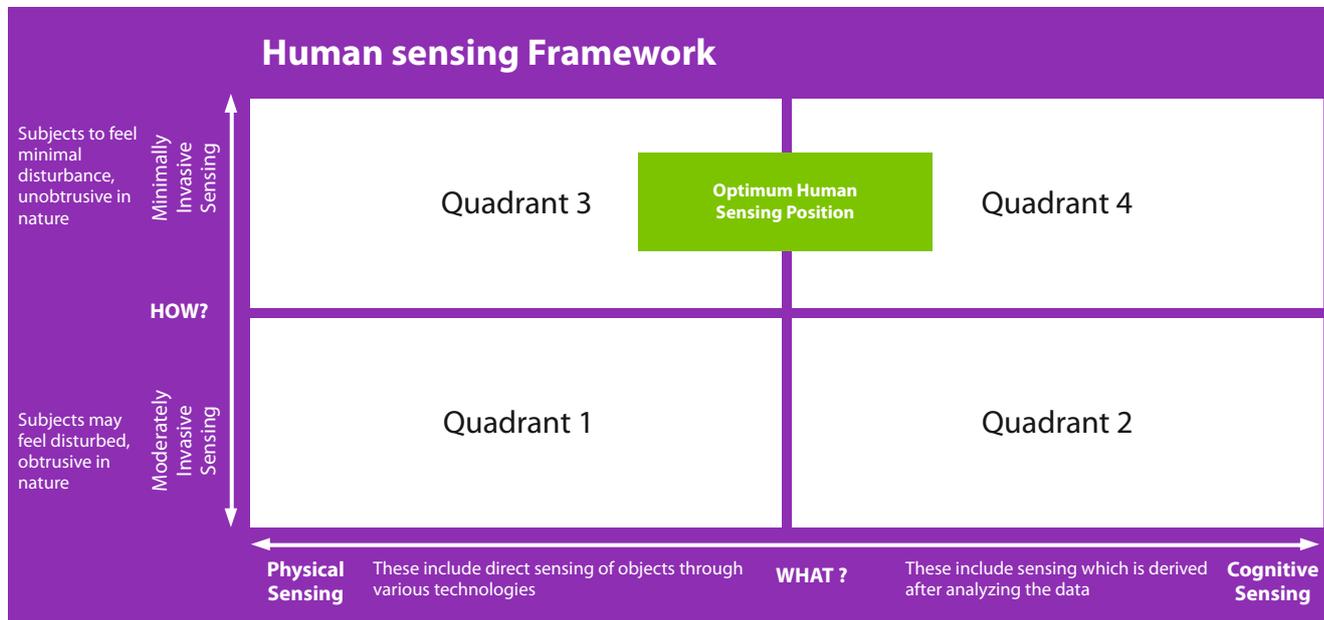

Figure 3: Human Sensing Matrix to evaluate positioning of organizations

Quadrant 1 is the most basic level of human sensing, which comprises mostly physical sensing elements that are moderately invasive. Quadrant 2 comprises cognitive sensing that is still moderately invasive in nature. Quadrant 3 is again physical sensing but is characterized by its minimally invasive nature, while Quadrant 4 is cognitive sensing which is minimally invasive. Most of the current initiatives and pilots underway within pharma companies fall either in Quadrant 1 or 2. An ideal position for pharma companies would be somewhere in between Quadrant 3 and 4, with a mix of minimally invasive physical and cognitive sensing, forming a holistic physical and mental map of the patient.

Human sensing, supported by Business 4.0™ framework, can bring about major breakthroughs in the pharma industry. By leveraging a digital ecosystem of sensors, IoT, RFID, wearables, social media, cloud, analytics among others, it can enable interactive sensor-based data to tailor medicine at an individual level, driving the practice of precision medicine. By making the value chain integrated and holistic in nature, it supports organizations to embrace risk and adopt an experimental approach for better results. The value created in terms of efficiency improvements is exponential in scale, and impacts patient engagement, thereby influencing business outcomes positively.

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Human Sensing – An Imperative for the Pharma of Future

As the winds of change flow across the life sciences industry, there is a spurt in availability of digital tools, impacting consumers' engagements with the larger healthcare system. On the other hand, there is pressure on pharma to deliver better and quicker research outcomes, enable an agile manufacturing and supply chain system that can meet requirements of individualized treatments of the future, and reposition the sales and marketing function to engage with patients meaningfully in their larger wellness journey. A positive development accompanying this is the advancement in the field of electronics, which has brought down the cost of sensor hardware and associated technologies.

All these developments have created a window of opportunity for life sciences companies to take a Business 4.0™ leap in their transformation journey. Forward looking life sciences companies willing to stay ahead of their peers, should make human sensing an integral part of their planning process. And, evaluating current positioning through the suggestive framework discussed above should be the first step of this journey.

References

1. A. Jacques, "The Digital Supply Chain: Seizing Pharma's Untapped Opportunity", supplement to Pharmaceutical Technology 41 (2) February 2017

2. A Survey of Human-Sensing: Methods for Detecting Presence, Count, Location, Track, and Identity, THIAGO TEIXEIRA Yale University, GERSHON DUBLON, Massachusetts Institute of Technology and ANDREAS SAVVIDES, Yale University

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