Information School
UNIVERSITY of WASHINGTON

How can IOT be applied in Healthcare?

IMT 580 - GROUP 8

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Agenda

01 Topic Introduction & Market Analysis

02 Task Environment & Current Practices

03 SWOT Analysis

04 Recommendations & Expected Results

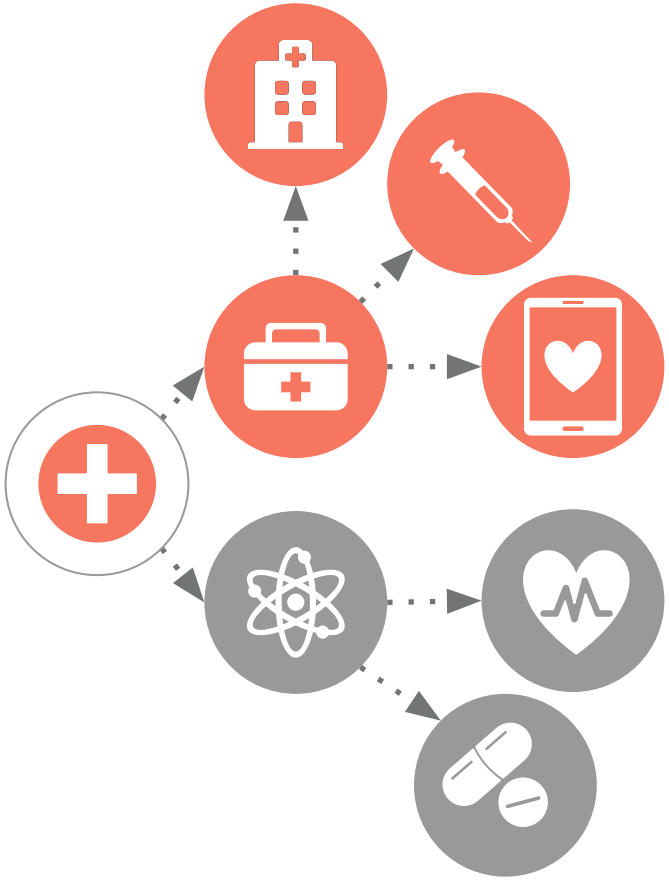
01 Topic Introduction & Market Analysis

+ Healthcare and IoT
+ Why Healthcare Leaders Should Consider IoT
+ Current Market State

Healthcare Sector

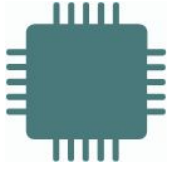
As per Global Industry Classification Standards, Healthcare Industry (MSCI, 2018) is grouped into

- Healthcare Equipment and Services
  - Medical Instruments and Supplies
  - Providers and Services
  - Healthcare Technology
- Life Sciences
  - Pharmaceuticals
  - Biotechnology
  - Life Sciences Tools and Services



What is IOT ?

The Internet of Things (IoT) is the **network** of physical objects that contain **embedded** technology to **communicate** and sense or interact with their internal states or the external **environment**. (Gartner, 2017)

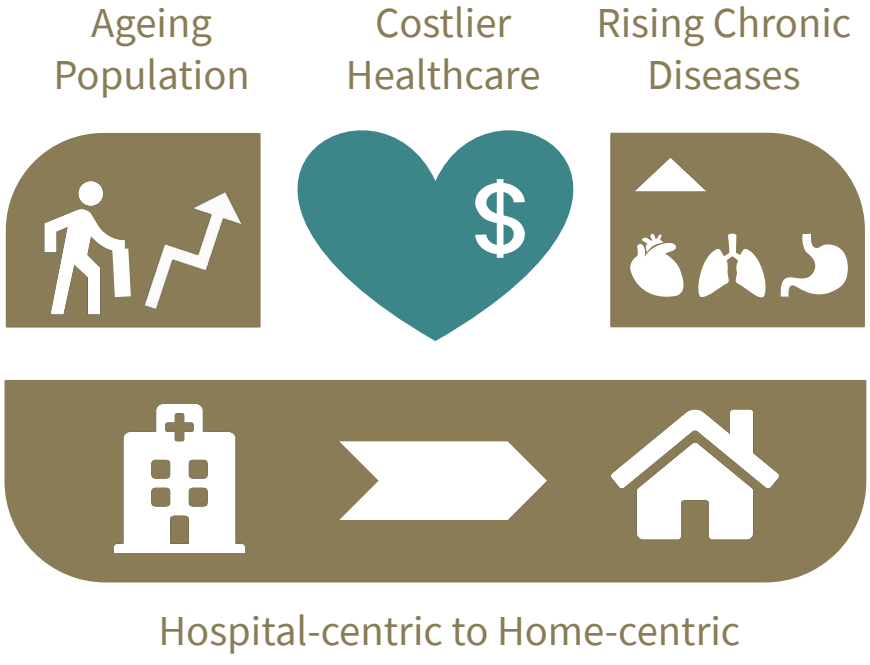
Why should Healthcare leaders consider IoT?

Current scenario of Healthcare:

- Population of age 60 & over:
  0.6Bn in 2015 to >2Bn in 2050 (UN, 2015)
- Cost: $7,233 per person per year in 2006
  to $10,348 in 2016 (Amadeo, 2018)
- Chronic Diseases Rising (WHO, 2007)

What can technology do?

- Increase Accessibility
- Decrease Cost
- Improve Efficiency



Current State of Market

- The Global IoT Healthcare market is immature but growing
- Expected growth: From $41.22 billion in 2017 to $405.65 billion by 2026 with a CAGR of 28.9% (ResearchAndMarkets.com, 2018)

Drivers • Technological Innovations - AI, Data Science, Edge Computing	**Opportunities** • High potential in emerging markets
Restraints • Lack of competence in deploying IoT solutions	**Challenges** • Lack of awareness among consumers in developing countries

02 Task Environment & Current Practices

+ Task Environment
+ Recent Practices

Task Environment

Other hospitals that have implemented IoT healthcare solutions

Cloud services and infrastructure vendors such as Microsoft Azure, Amazon AWS

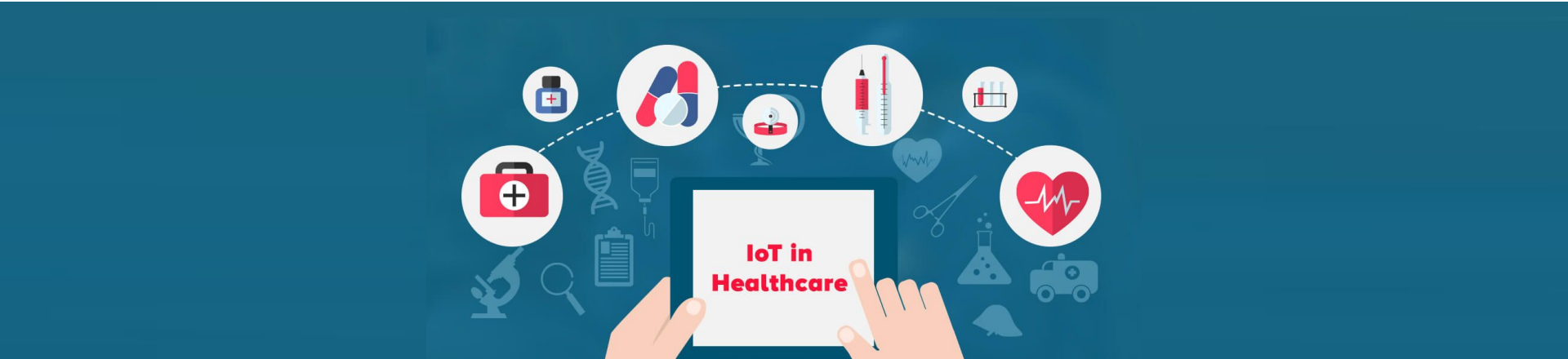
Patients

IoT in Healthcare

Applications & Benefits

IoMT (Internet of medical things) has various applications mainly including:

1) Smart Hospitals (Boston Medical Center)
2) Home centric healthcare
    - Remote health monitoring at home (KAA IoT platform)



Traditional healthcare organization

Boston Medical Center

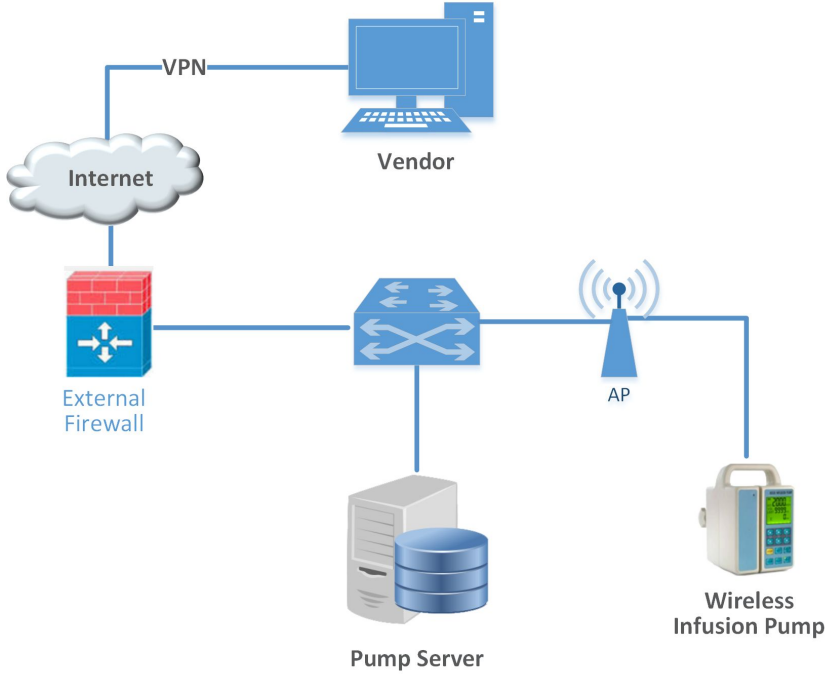
(www.bempu.com)

- "We used to have someone manually walk around and chart the temperatures and document that," says Jim Piepenbrink, director of clinical engineering at Boston Medical Center (BMC). "The ability to **have wireless alerts is a great time saver for the staff.**"
- RTLS - Newborn babies are given wristbands, allowing a **wireless network to locate** them at any time.

Boston Medical center

IOT enabled infusion pumps

- Hospital has more than 600 infusion pumps which are IoT enabled. (Gerdeman, 2016)
- BMC staff members can now dispense and change medications automatically through the wireless network, rather than having to physically touch each pump to load it up or make changes



www.nccoe.nist.gov

Boston Medical center

IoT Monitored Biodigester

- Sustainability Efforts

- BMC uses a "biodigester" that composts food scraps from the kitchen.
- This machine is monitored with IoT technology to make sure it's working properly, to measure how much waste is running through it, and to determine whether enough water is being used.

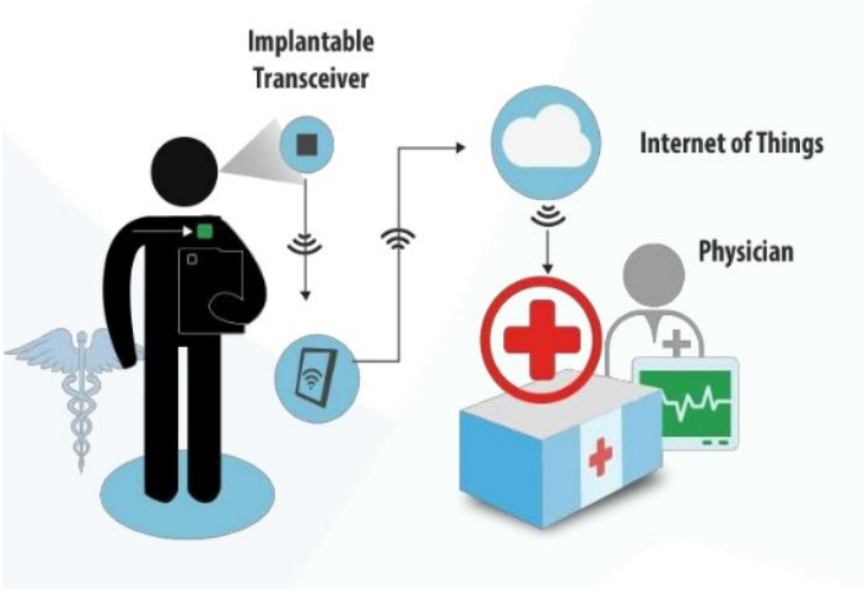
Remote patient health monitoring - Wearables

Kaa - a leading IoT platform

- As per Centers for Disease Control and Prevention, around half of the American elderly population suffer from one or more chronic health conditions. IoT in healthcare wearables including implantable devices is evolving rapidly, so as to help doctors receive real-time data in a fizzy effective chronic disease management

Kaa — a leading IoT platform

- The Health Insurance Portability and Accountability Act(HIPAA) sets standards to protect patient health information and the Security Rules which sets standards for securing patient data
- KAA has HIPAA-compliant data security



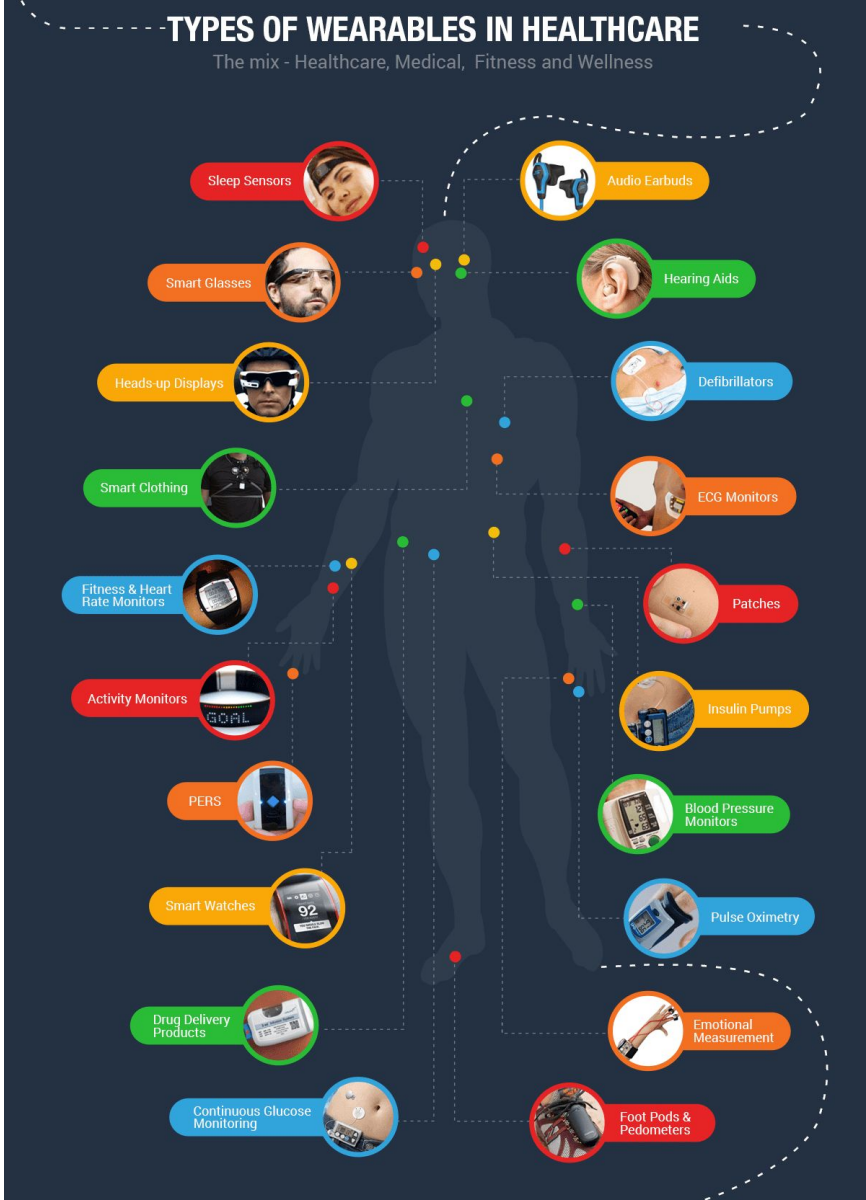
Remote patient health monitoring - Wearables

Wearable Tech market

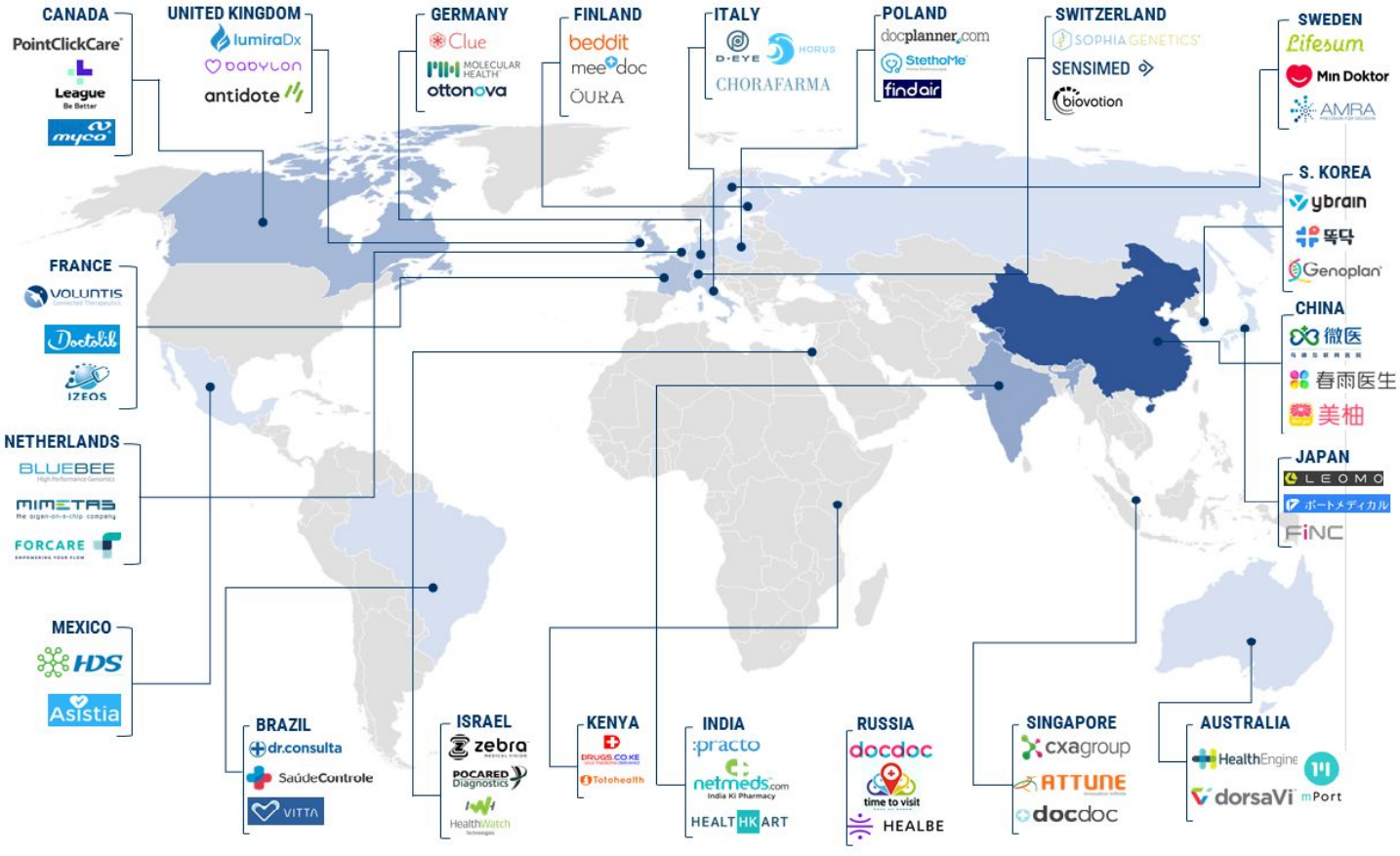
Through remote monitoring, patients can significantly reduces length of hospital stay and perhaps, even hospital re-admission.

Healthcare Internet of Things Market is predicted to **Reach $163B by 2020.**

(hitconsultant.net)



Healthcare IoT vendors outside the USA



www.cbinsights.com

Benefits

1. High level of patient engagement
2. Decreased Costs
3. Improved Disease Management and Drug Management
4. Reduced Errors - Highly accurate data collection
5. Enhanced Patient Care

www.softograph.com

03 SWOT Analysis

+ The Current Strengths & Weakness
+ The Future Opportunities & Threats

The Current

Strengths & Weakness

The Future

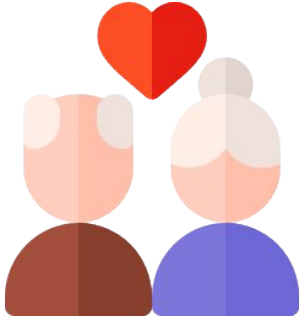
Opportunities & Threats

	STRENGTHS	WEAKNESSES
Technology	• **Remote Patient Monitoring & Telehealth** • **Healthcare Automation & Robotics**	• **Privacy & Data Security** • **Dependency on the Internet & System Interoperability**
Market / Management	• **Data-Driven Practices** • Increase in Investment for Healthcare IoT Solutions	• Lack of Governance Standard
Politics / Ethics	• Innovation & Strategic Leadership	• **Slow Adoption Rate**

Strength #1

Remote Patient Monitoring & Telehealth

Real Time Monitoring



Elderly Care

convenient & user-friendly

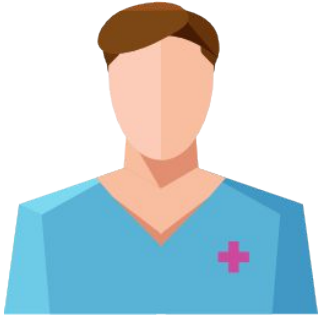
Decreased Operating Costs

Strength #2

Healthcare Automation & Robotics

Reduced Errors & Waste

Administration of Drugs



Decreased Labor Costs

Data-Driven Practices

“Everything is recorded”

Disease Management

Improved Patient Experience & Outcomes of Treatment

Weaknesses #1

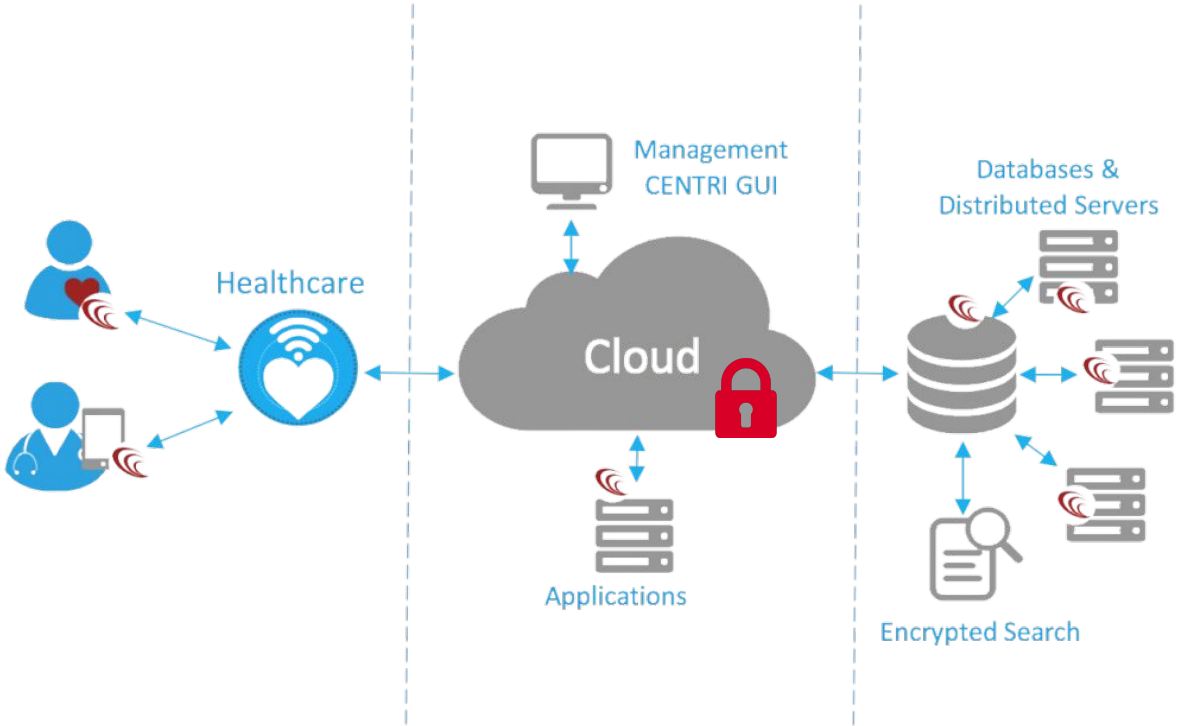
Privacy & Data Security

Access management

Protected Health Information (PHI)

Data breaches

Dependency on the Internet and System Interoperability



Dropped connections

Version control

Data sharing

Weaknesses #3

Slow Adoption Rate

The FDA regulatory & device certification process

Internal resistance to change

Digital talent recruitment


The Current
Strengths & Weakness
The Future
Opportunities & Threats

	OPPORTUNITIES	THREATS
Technology	• Growing popularity of healthcare wearables	• Data Security-Related Challenges & Cybercrime
Market / Management	• Higher demand for remote health monitoring of an aging population • Strategic market alliances by creating those new business models	• Lack of Contingency Planning & Risk Management
Politics / Ethics	• Increased consumer health consciousness	• Bodily injury risk (defective design, manufacturing defects, product misuse, etc.)

OPPORTUNITIES

Technology

- Growing popularity of healthcare wearables.

Market / Management

- Higher demand for remote health monitoring of an aging population.
- Strategic market alliances by creating those new business models.

Politics / Ethics

- Increased consumer health consciousness.

Wearables & Devices

Elder Remote Monitoring

Business Models

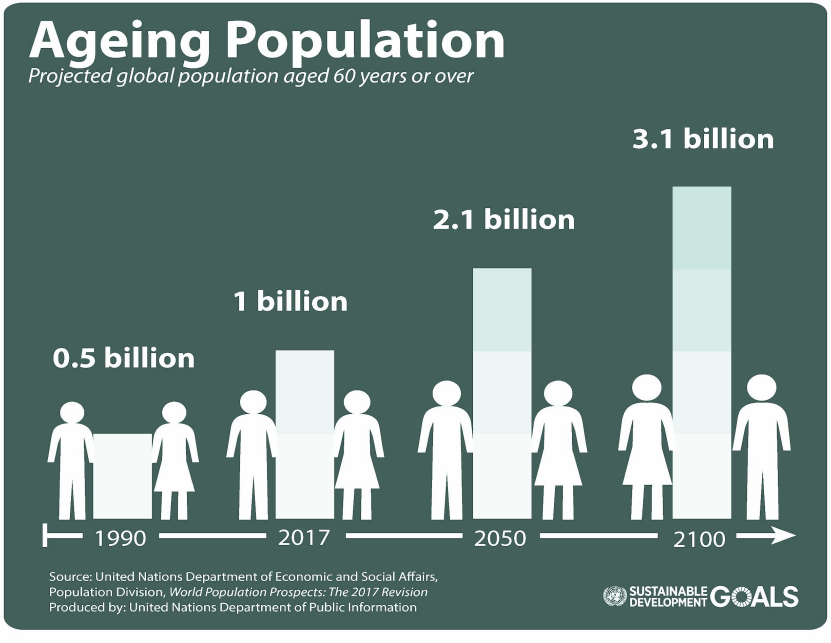
Health Consciousness

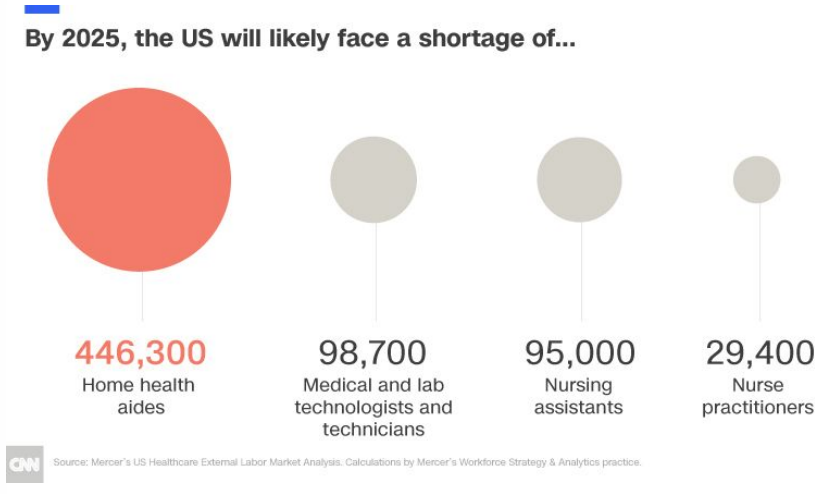
STRATEGIC OPPORTUNITIES

Technology + Market Trend	 Wearables & Devices	+	 Elder Remote Monitoring	=	**Elder Care**
Technology + User Needs	 Wearables	+	 Health Consciousness	=	**Trend Monitoring**
Technology + Business Strategy	 Safe Iot	+	 Business Models	=	**Smart Systems & Services**

1. Elder Care: Remote Medical Assistance and Monitoring

The sharp demographic shift to **an aging society & the shortage of medical staff** will make many countries struggle with elder in-person care.





↑ The shortage of medical staff

← The aging society

Opportunities - Elder Care - Remote Medi

Robotic Healthcare Assistants (Advanced Sensor & AI)

Medication Adherence & Tracking

Management Thoughts

As a leader or manager, to deal with this crisis, they have to fulfil several tasks, and one main of them is **Managing in the General & Global Environment Combining**

- Economic Forces
- Technological Forces
- Sociocultural Forces
- Demographic Forces

2.Trend Monitoring: Real-Time Reporting and Monitoring

- Report medical emergencies
- Connect doctors and patients
- Monitor body health information

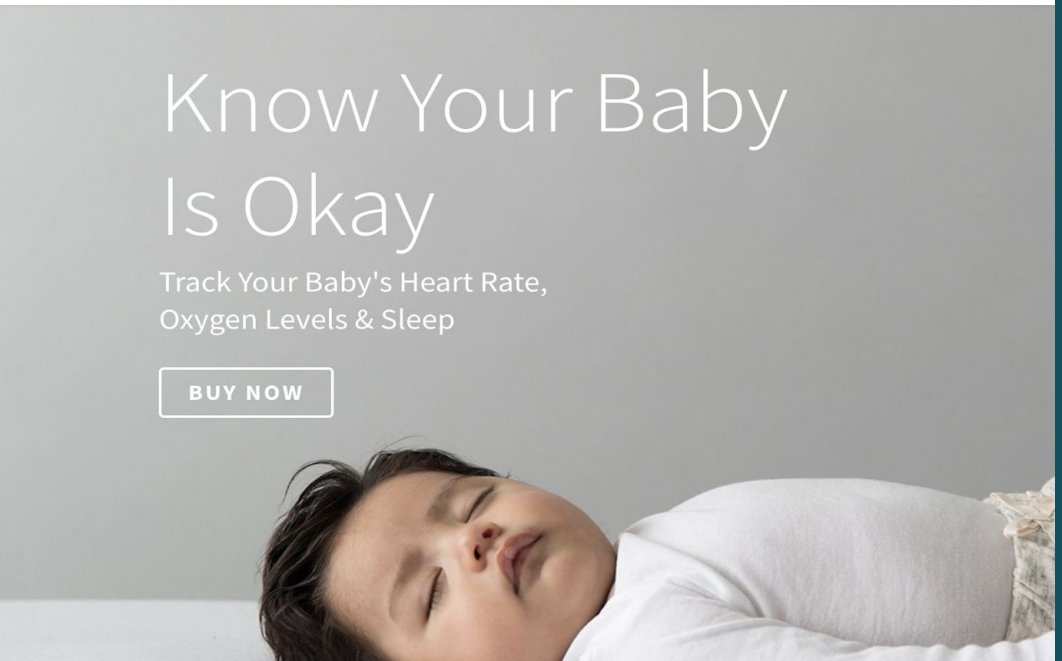
All possible solutions for common people

2.Trend Monitoring: Real-Time Reporting and Monitoring

Watch	Eyeglasses	Hearing Aid	Activity Tracker	Detection
				
				
Pebble Smart Watch	Google Smart Glasses	Sonitus in the Mouth Hearing Aid	Fit Bit Activity Monitor	Scanadu Tricorder

Trend Monitoring: Baby Care

Many other use cases for IoT in healthcare
auto-monitoring body temperature for fami
your weight and body fat composition, hea
baby's vitals.



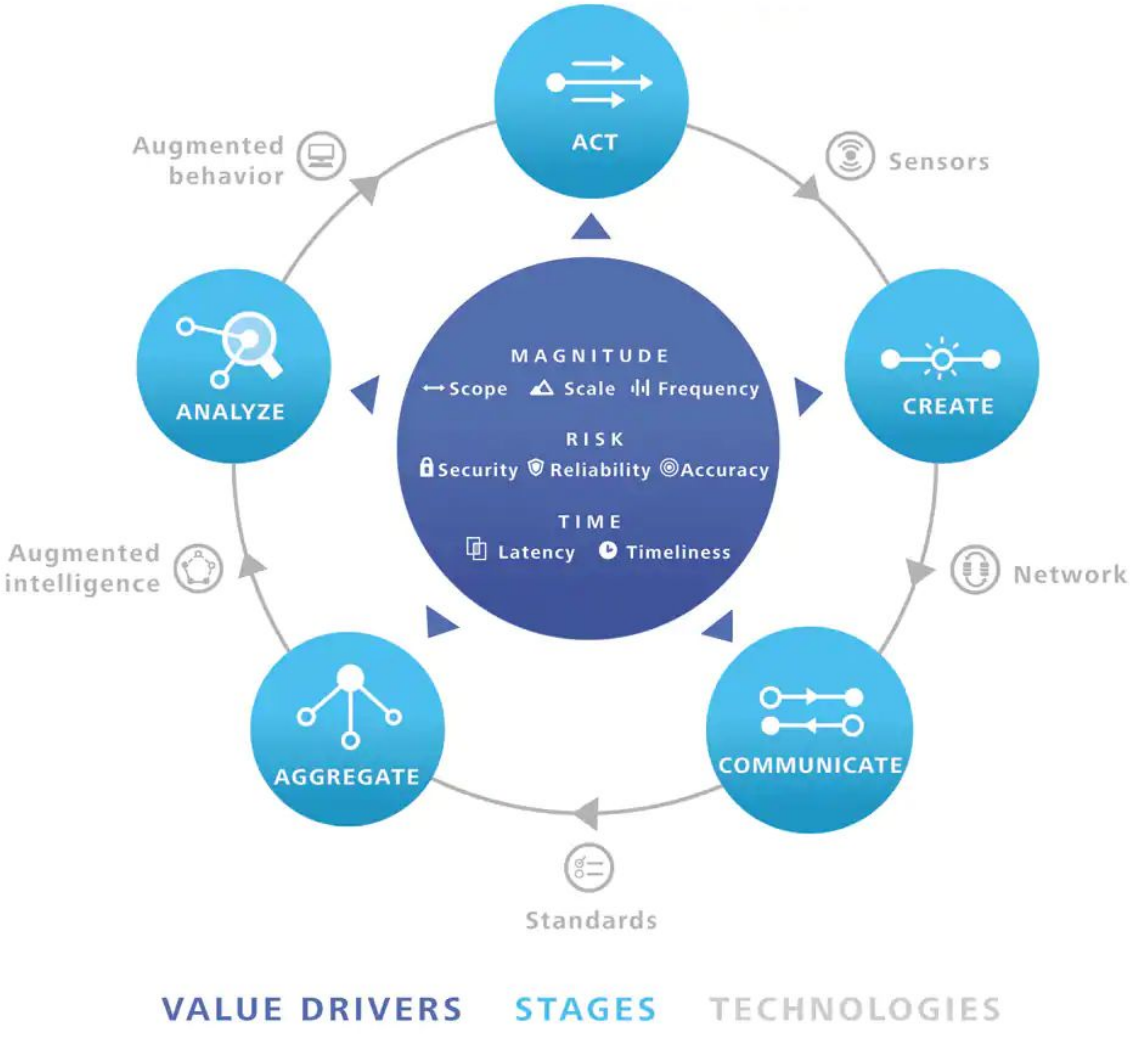
Management Thoughts

As a leader or manager, it's essential to develop those **competitive advantages** quickly by holding a good responsiveness towards the current market needs always.

It is the key to produce desired goods or services more efficiently and effectively than its competitors.

3. Smart Systems & Services:

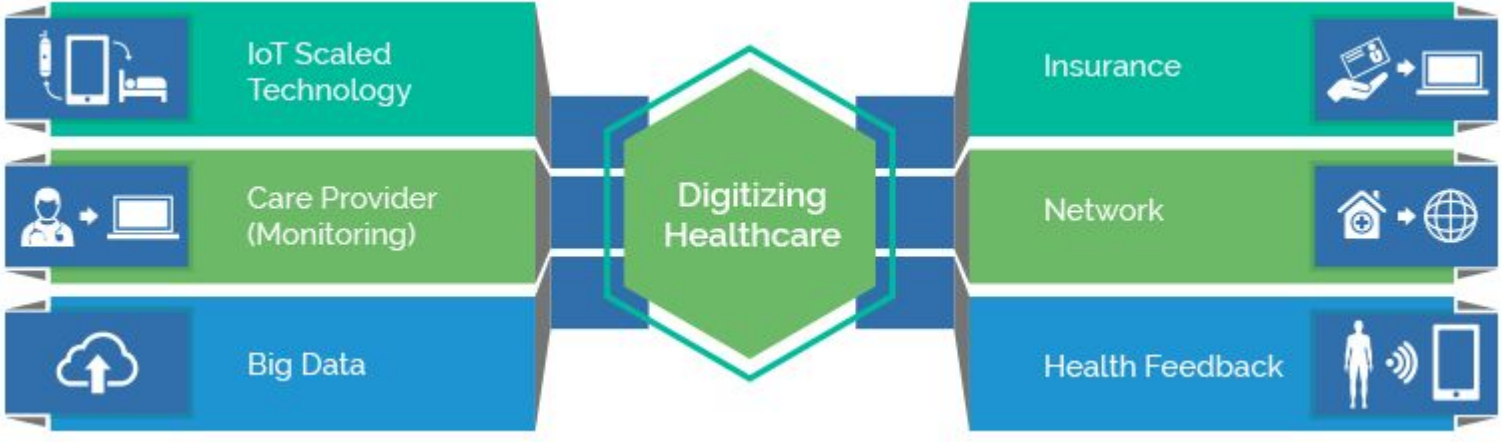
- Information Value Loop
- Business Strategies



Graphic: Deloitte University Press | DUPress.com

Develop Smart Systems & Services as a Leader

- The Manager's Planning, Strategies and Mission Statement
- Value Chain Management:
  1) Functional Strategies for Competitive Advantage,
  2) Improving responsiveness to customers



THREATS

Technology

Access Control

Plan, Strategy & Vision

Market / Management

Ethic Standards

Politics / Ethics

Policy Regulation

- Data Security-Related Challenges
- Lack of Contingency Planning & Risk Management
- Bodily injury risk (defective design, manufacturing defects, product misuse, etc.)
- Hacking Attempts(Cybercrime)

Threats to be Managed

Refined Iot + Policy

Access Control + Policy Regulation = **Build Trust for Users By More Competitive Advantages**

Social Duties + Management

Ethic Standards + Policy Regulation + Plan, Strategy & Vision = **Build A Safe Market**

04 Recommendations & Conclusions

+ Our Attitudes based on PEST Analysis
+ Recommendations & Solutions

Political

- Lack of **Governance Standard**
- Lack of **Contingency Planning** & **Risk Management**
- Slow **Adoption Rate**

Economical

- **Increase in Investment** for Healthcare IoT Solutions
- **Strategic Market Alliances** by Creating New Business Models

Social

- **Privacy** & **Data Security**
- Higher Demand for Remote Health Monitoring of an **Aging Population**
- Increased Consumer **Health Consciousness**

Technological

- Growing Popularity of **Healthcare Wearables**
- **Data-Driven** Practices
- Dependency on **the Internet** & **System Interoperability**

Problems	General Recommendations	Specific solutions
	For **vendors**:	
	● Invest in new technologies (Hitt et al., 2010)	● Mutual Authentication
● **Data security issues & Cybercrime**	● Emphasize on human capital (Hitt et al., 2010)	● Build effective company culture (Deloitte, 2013) ○ Loyalty ○ Satisfaction ○ Performance
	● Build efficient organizational structure (Jones & George, 2016)	● Horizontal management platform ● Communication & Innovation

Problems	General Recommendations	Specific solutions
• **Data security issues & Cybercrime**	For **Organizations**: • Taking proactive steps to maintain a secure environment	• Deploying intrusion detection • Educating risks to patients and staff
• **Data Privacy**	• Behavioral control - bureaucratic control (Jones & George, 2016)	• SOPs
	• Clan control (Jones & George, 2016)	• Values & norms

Problems	General Recommendations	Specific solutions
Lack of Governance and standard	Navigating regulatory change	Provision for IoT devices
System Interoperability	Development of unified platforms (Deloitte, 2018)	Develop open platforms based on open-data standards Develop a consensus for interoperability standards

Current Policies and Regulations

Policies and regulations for the Internet of Healthcare Things

The Health Insurance Portability and Accountability Act (HIPAA) covers data privacy and security provisions for safeguarding health information, but does not specifically govern IoT devices.

The U.S. Food and Drug Administration (FDA) works closely with the U.S. Department of Homeland Security (DHS), private sector organizations, medical device manufacturers, health care delivery organizations, security researchers and end users to improve the cybersecurity of medical devices.

Problems	General Recommendations	Specific solutions
Lack of Contingency Planning & Risk Management	Develop effective risk management strategies	ERM Risk culture Risk assessment
Bodily injury risk (defective design, manufacturing defects, product misuse, etc.)	Training	Develop training plans to prevent misuse of products
	Revise product liability regulations	Revise the product liability law to incorporate issues with IoT healthcare devices

Conclusion


HEALTHCARE
PREVENTION
ASSISTANCE
DOCTORS
ONLINE
DIAGNOSIS
TREATMENT

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Thank you!

Questions?