Salud 4.0: Lecciones aprendidas de la pandemia COVID 19

Eldon Caldwell, Ph.D., Sc.D.
Full Professor/Cathedraticus, University of Costa Rica, Costa Rica
Outstanding Service Award and member of Academy of Fellows, IEOM, USA

13 de mayo 2021

Eldon Caldwell, Ph.D., Sc.D.

Full Professor/Cathedraticus, Department of Industrial Engineering, School of Engineering, University of Costa Rica
Chair of Industrial Engineering Department, Engineering School, University of Costa Rica
Global Outstanding Service Award, IEOM Society, USA
Member of the IEOM Academy of Fellows
Member of the IEOM Global Council, USA
Member of the Distinguished Professors Program, IEEE Computer Society, USA

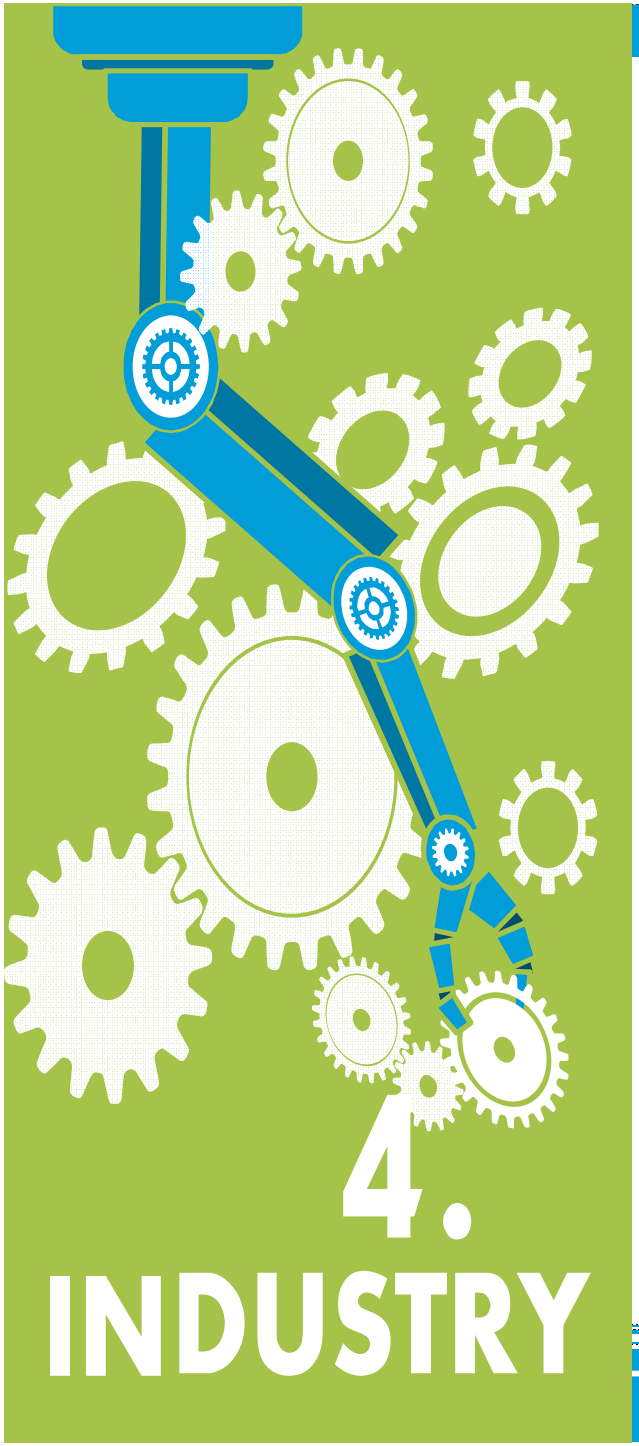
Sc.D. Informatics / Automation and Robotics, University of Alicante, Spain
Ph.D. CS / Industrial Engineering, University of Nevada, LV, USA /Autonomus University of Central America, CR
Ph.D. (in fieri) Education, Universtiy of Costa Rica (defense of doctoral thesis scheduled for May 2021)
M.I.E. Industrial Engineering, University of Costa Rica
M.Sc. Sustainable Health Systems Management, State Distance University, Costa Rica
M.Sc. Marketing Services, Interamerican University of Puerto Rico, Costa Rica
M.B.A. Financial Analysis, Interamerican University of Puerto Rico, Costa Rica
M.Sc. Operations Management, ITESM, Mexico
Bch. Sc. Industrial Engineering, University of Costa Rica, Costa Rica

Specialization Degree in Statistical Quality Analysis, University of Veracruz, Mexico.
Lean Systems Certified Specialist, APICS-MAPV-University of Nevada, USA.
ASQ-Six Sigma Black Belt Certified Trainer, MAPV-University of Nevada, USA.
ISO 9001-2008 Lead Auditor Certified, Quality Assurance of North America.
Belbin Team Work Certified Specialist , Belbin Spain.

<u>Professional experience serving as international manager and senior consultant</u>
Operations Manager at MASECA Group. (1991-1995); Project Manager at Eaton Corp.(1995-1997); General Manager at Bandag Inc. (Quirós & Cía.) Costa Rica (2004-2007); more than 25 years of consulting and advisoring experience for World Wide Bank, World Wide Health Organization, Interamerican Bank for Develop, Plan International, RTC Peru, Panama Ministry of Health, Honduras Ministry of Health, Costa Rica Ministry of Health, Young Electrical Signs USA, National Resources Center for Inclusive Education/Costa Rica, Banco Popular y Desarrollo Comunal, DOLE Latin America and many others.

Contact information: eldon.caldwell@ucr.ac.cr; phone: (506) 8380-0949
LinkedIn: https://www.linkedin.com/pub/eldon-glen-caldwell/4a/81b/433
ORCID: https://orcid.org/0000-0003-0853-2469

https://www.computer.org /profiles/eldon-caldwell



Agenda

01 CONTEXTO

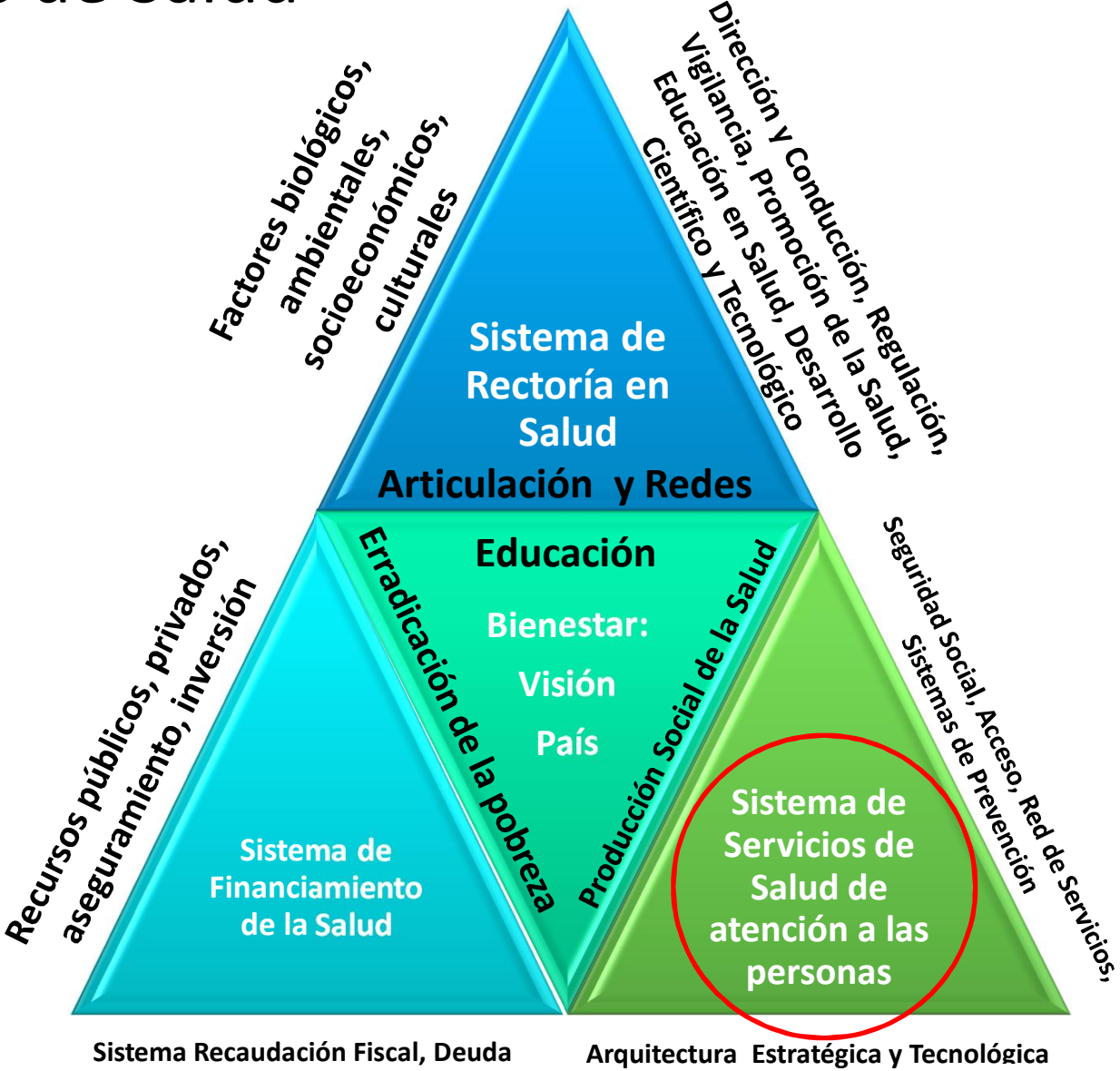
02 SALUD 4.0

03 ALGUNAS LECCIONES APRENDIDAS

04 CONCLUSIONES

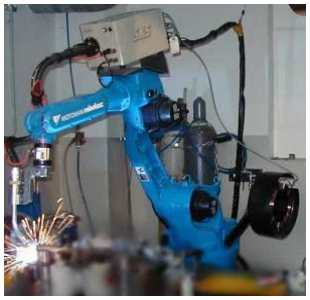
Sistemas de Salud y Sistemas Ciberfísicos

Sistemas de Salud

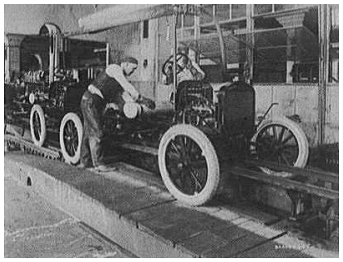


Fuente:
E. Caldwell, Ph.D., Sc.D., 2015

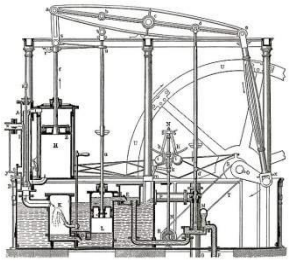
Cuarta Revolución Industrial



Cuarta Revolución Industrial
Basada en sistemas Ciber-físicos



3ra Revolución Industrial
Impulso de la producción Autónoma basada en la Electrónica y TIC´s



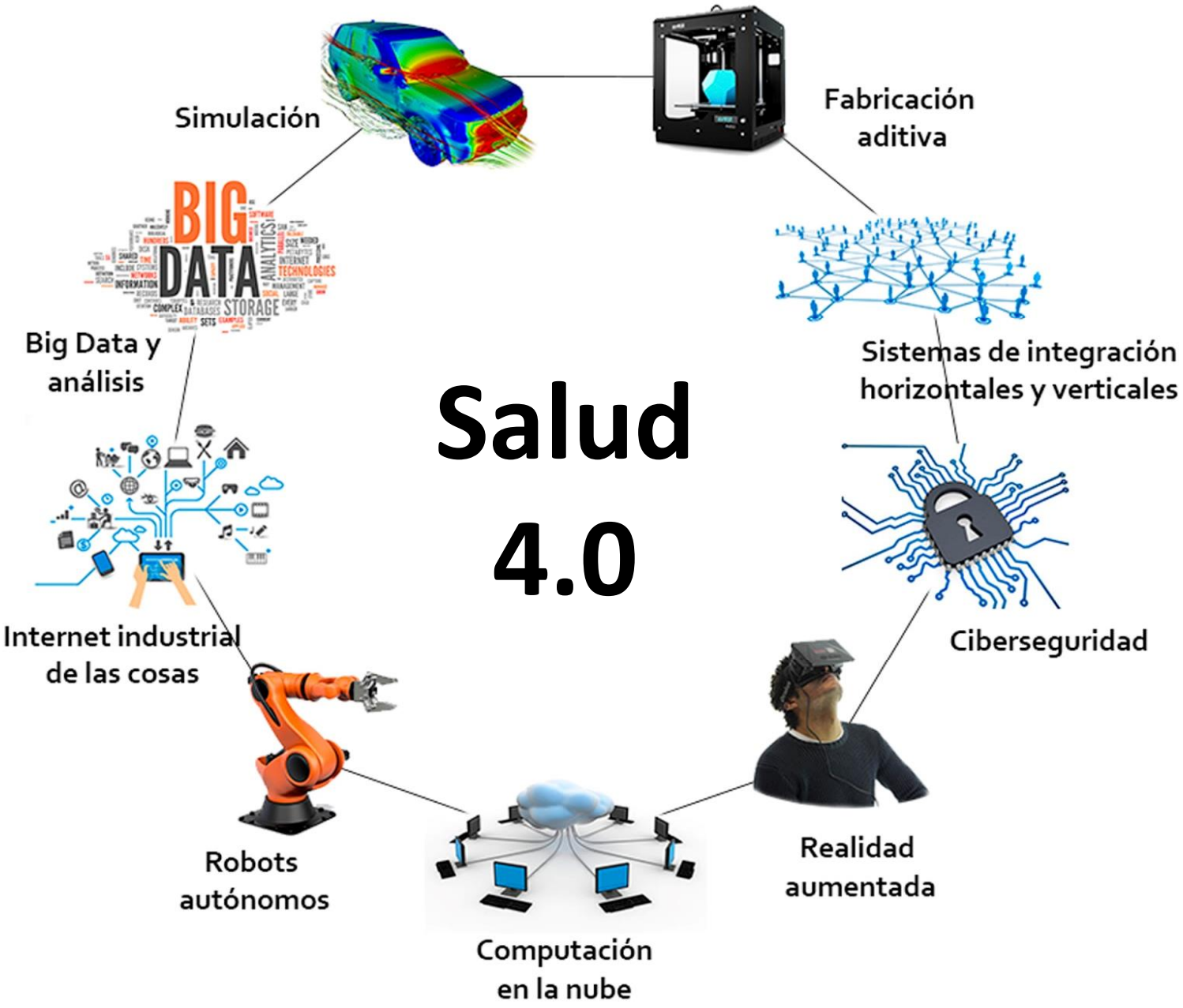
2da Revolución Industrial
Líneas de producción masiva basadas en energía eléctrica

1ra Revolución Industrial
Producción con máquinas mecánicas basadas en agua y vapor

Nivel de complejidad

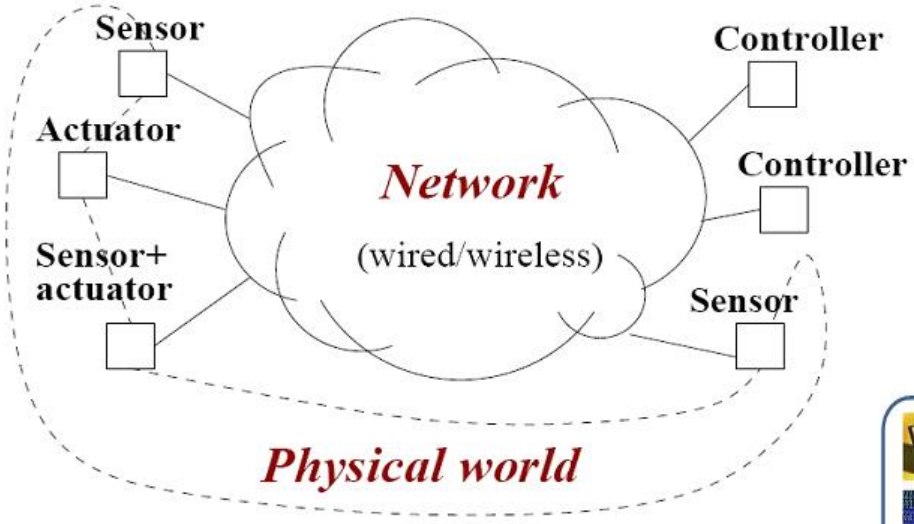
Industry 1.0	Industry 2.0	Industry 3.0	Industry 4.0
Finales del Siglo XVIII	Inicios del Siglo XX	Inicios de los años 70	Hoy

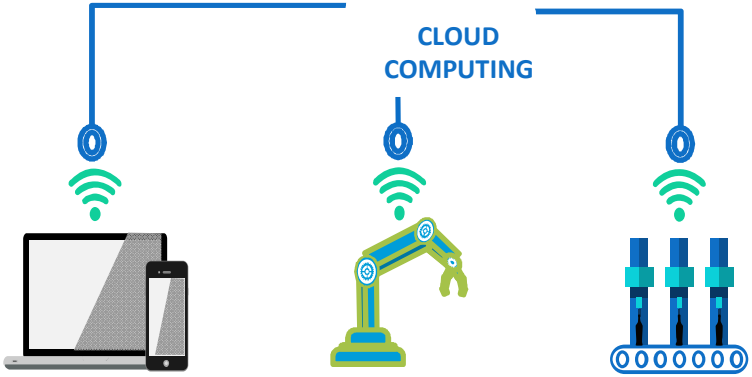
Source: DFKI/Bauer IAO,2020

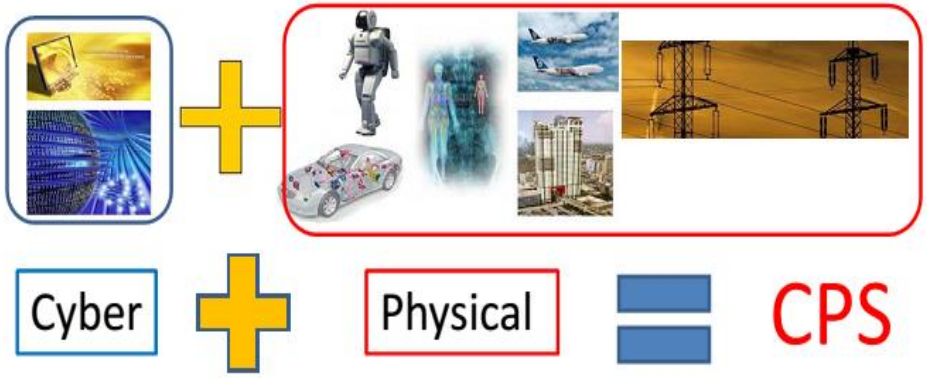


Fuente: Rogelio Garza, Sub-Secretaría de Industria y Comercio, Mexico, 2018

Sistemas Ciber-físicos:
CP Systems







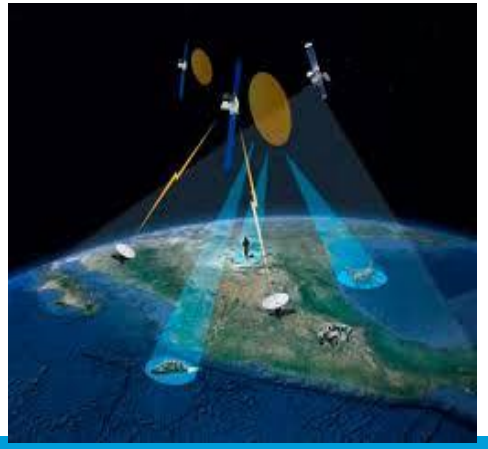
Source: University of Oslo, 2018

Salud 4.0 /CPHS: Tecnologías potenciadoras

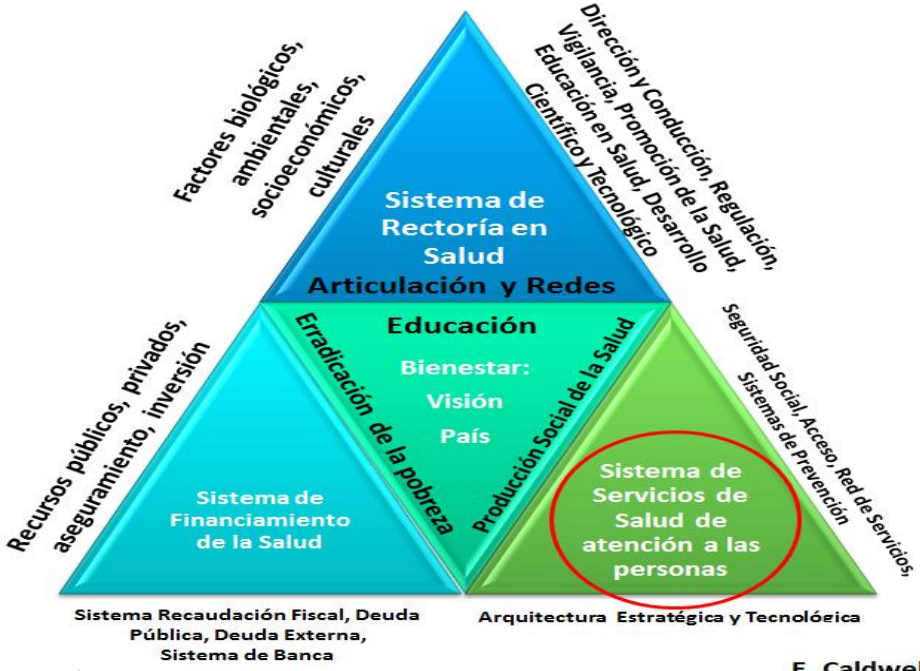
- **Interconectividad (IoT/ IoRT)**

- **Visibilidad (VRS/Dtwins)**

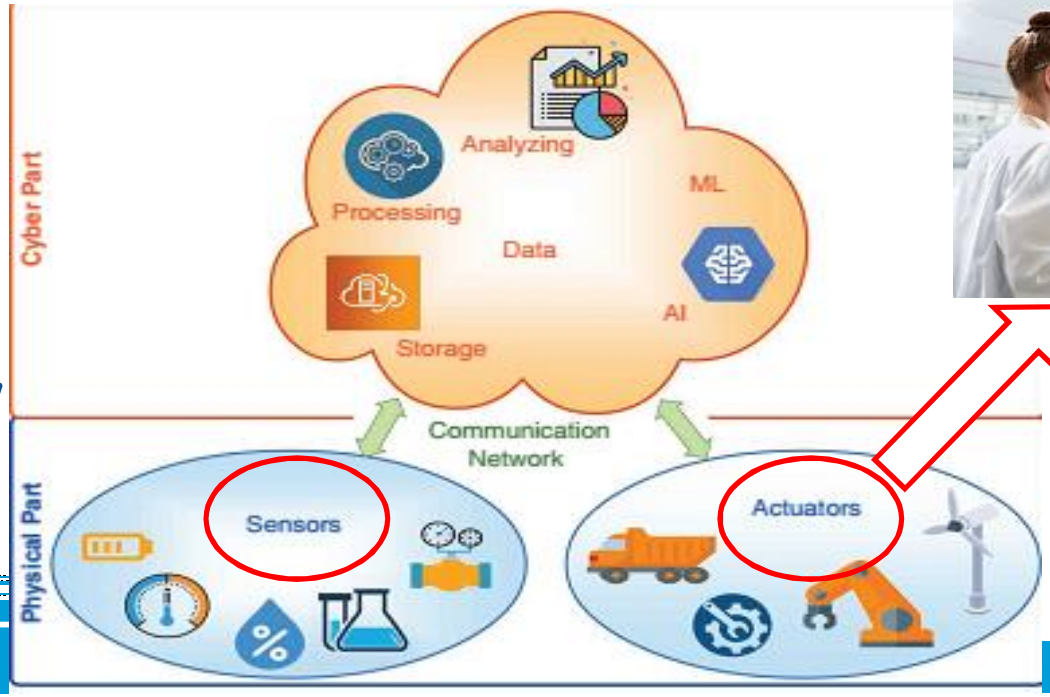
- **Interoperabilidad (Blockchain)**



Sistema de Salud Ciber-físicos (CP Heath Systems): Arquitectura básica



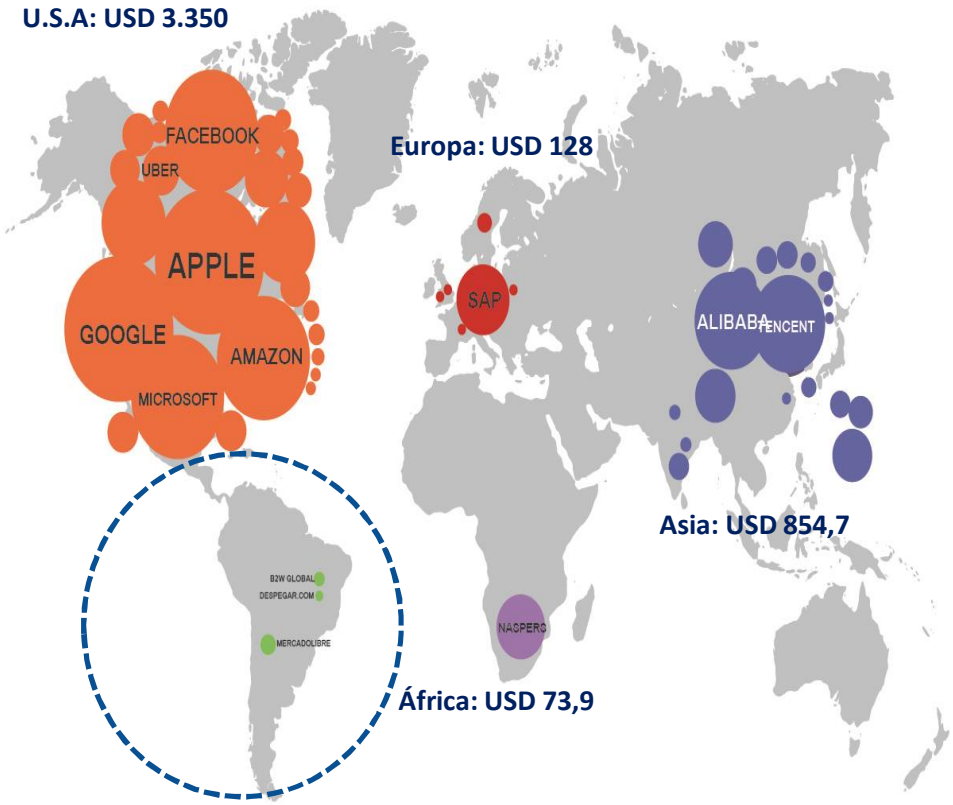
Fuente:
E. Caldwell, Ph.D., Sc.D., 2018



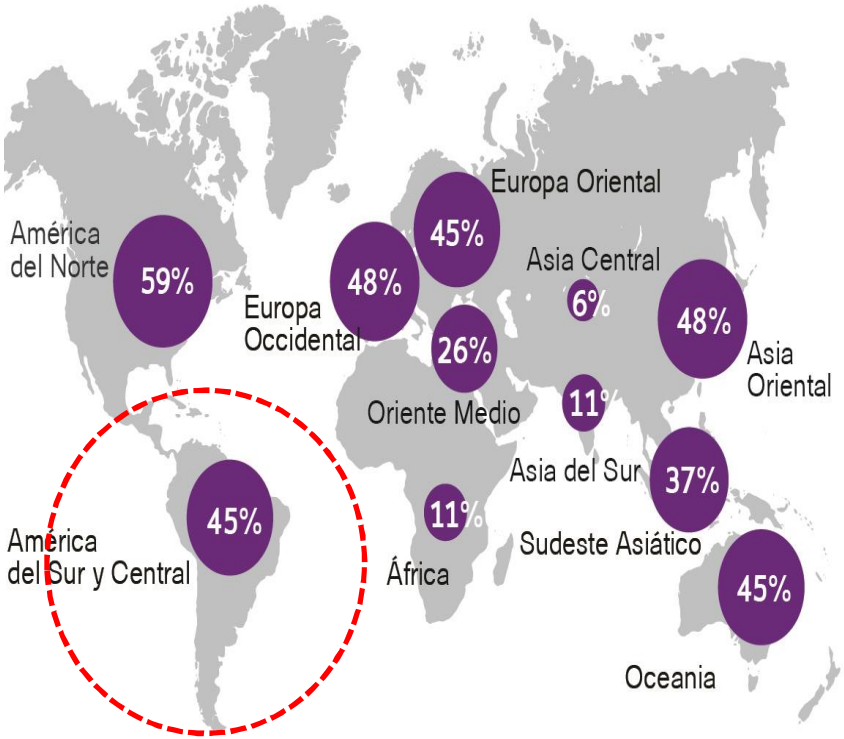
Servicios Digitales

OFERTA

(en miles de millones)



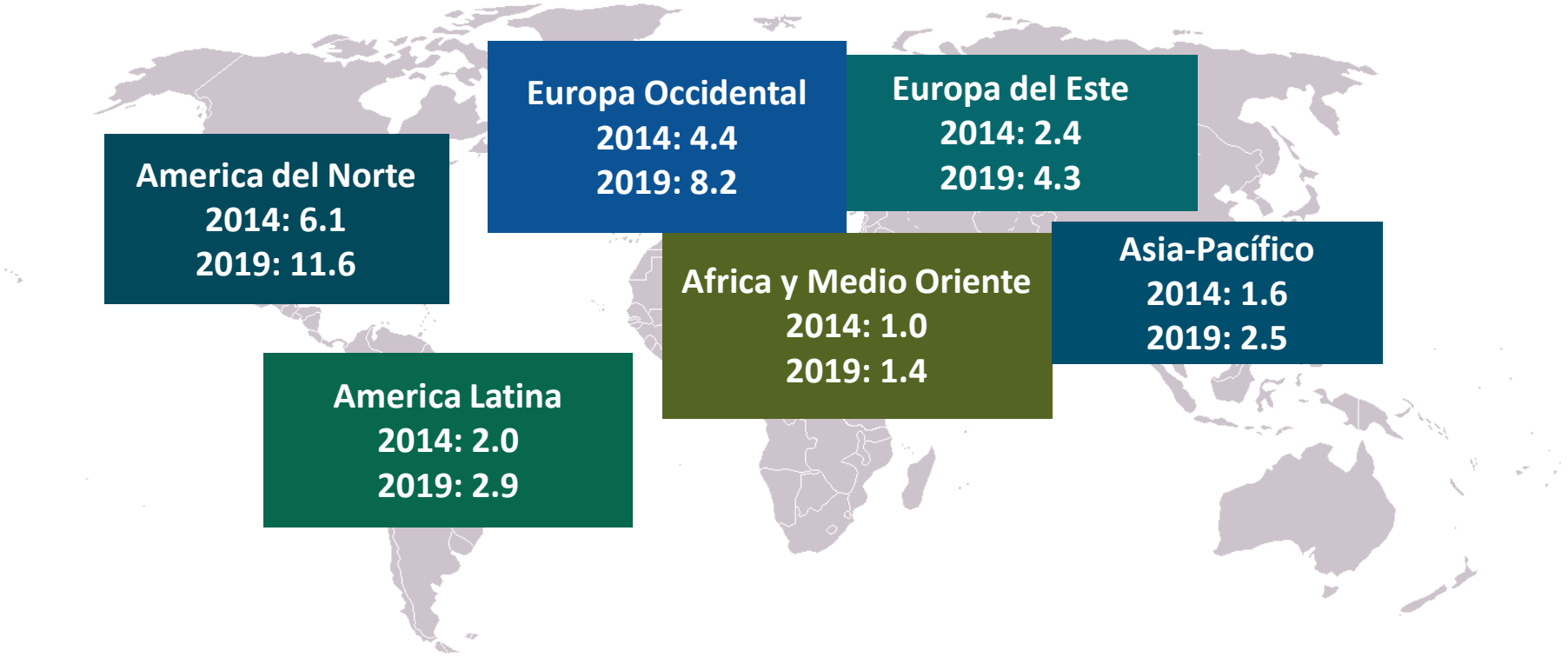
DEMANDA



Fuente: CEPAL,2017

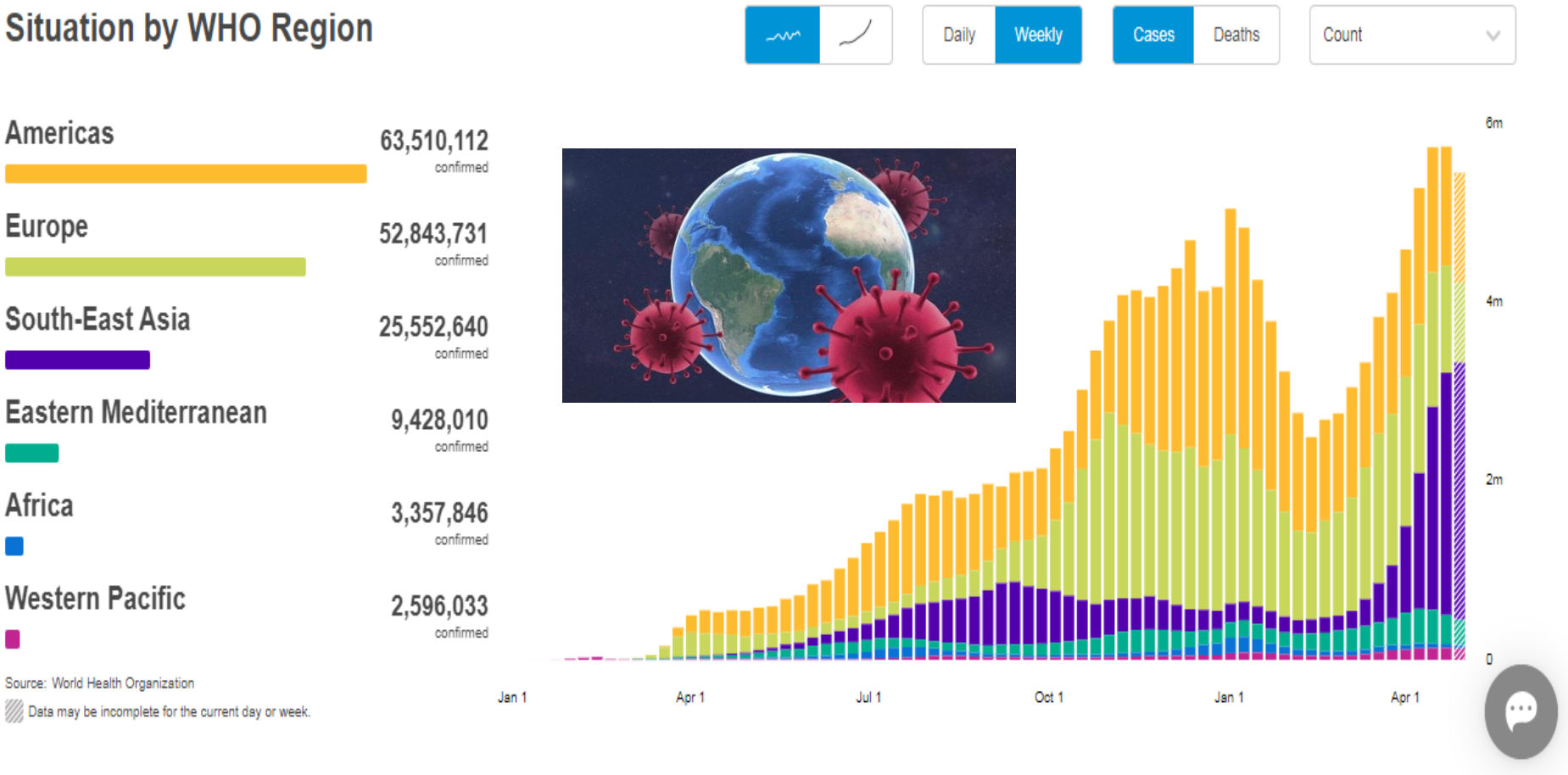
IoT/IoD/IoS/IoRT: la nueva brecha digital

Número de sensores por habitante en 2014 y proyección a 2019



Fuente:
CISCO,2017

Pandemia COVID- 19: hasta 2023 según OMS?



Fuente: WHO,2021

COVID 19: Áreas de impacto

Social

Salud y Educación: Estilos de vida Servicios Infraestructura

Ambiental

Económico

Economía Circular

Política y Derechos Humanos

Fuente: E. Caldwell, 2020

Aplicaciones de Salud 4.0: Lecciones Aprendidas

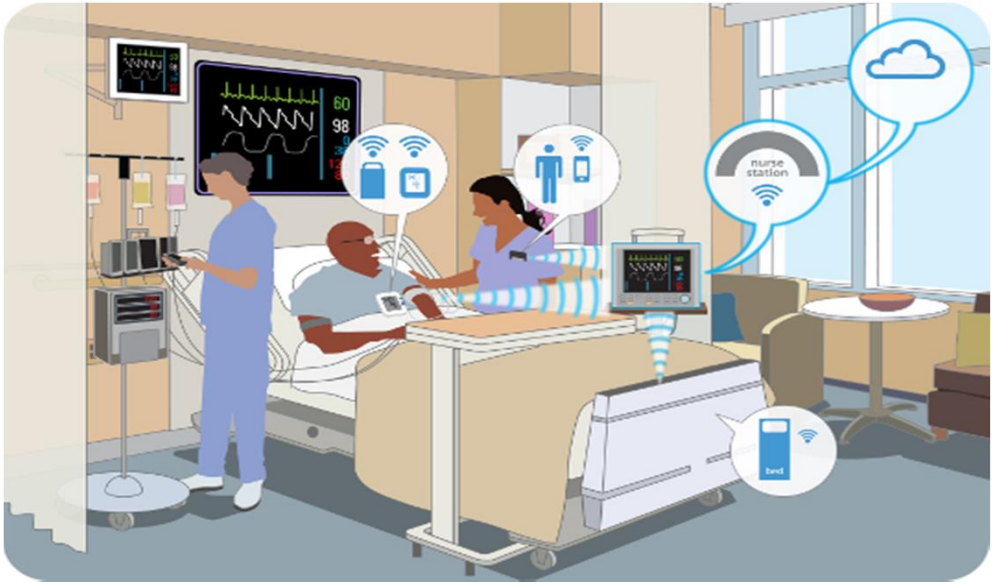
Por:

Eldon Caldwell, Ph.D., Sc.D.

Full Professor/Cathedraticus, University of Costa Rica, Costa Rica

Outstanding Service Award and member of Academy of Fellows, IEOM, USA

Lección 1:
Salud 4.0 ya viene…ya viene…pero todavía no…



Evolución de la Robótica

Robots centrados en reducción de costos y mejora en la calidad

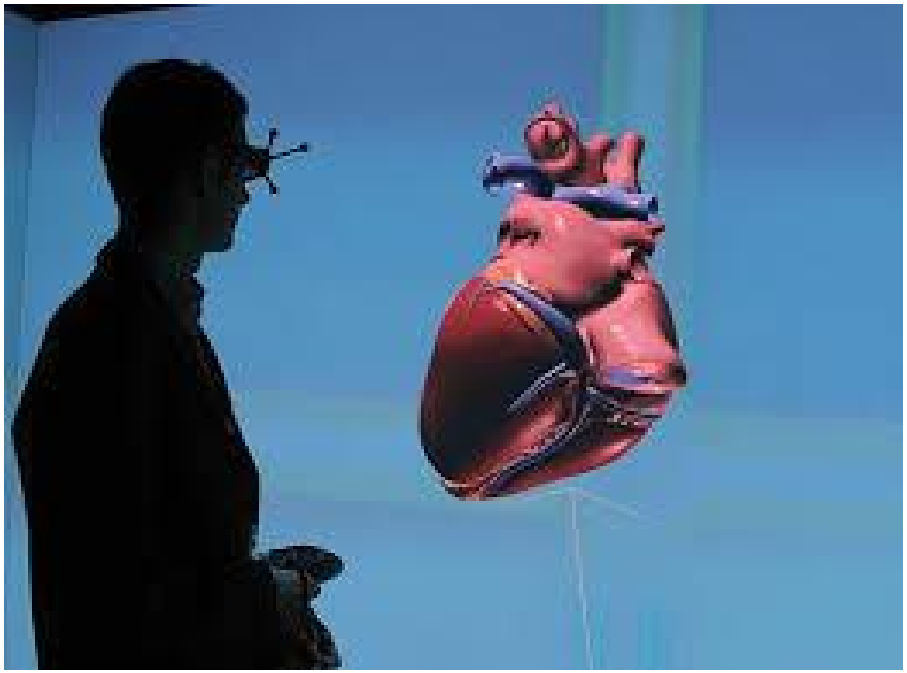
Robótica colaborativa y asistencial

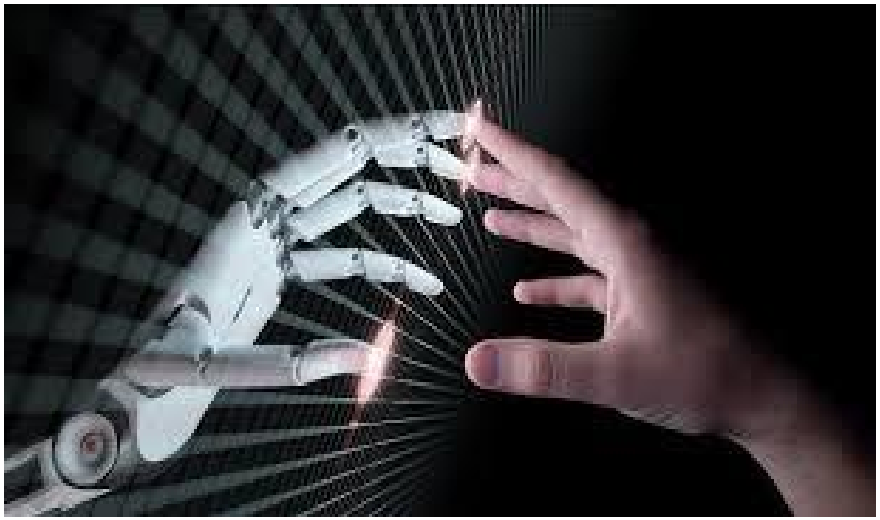
Robótica con sentido social (robots como transformadores de la cultura popular)

Fuente: Eldon Caldwell, 2019

Robótica Asistencial

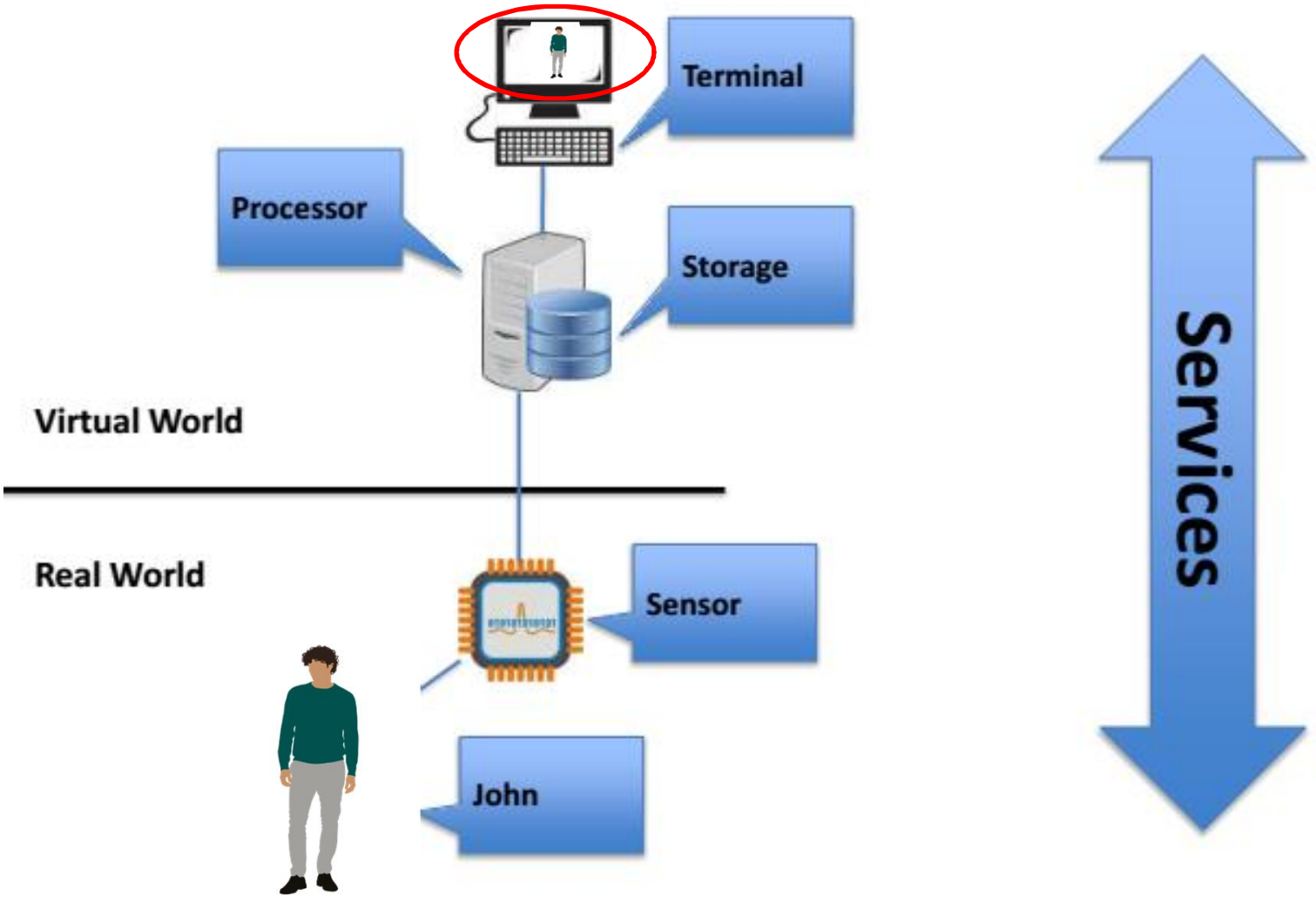
Gemelos digitales



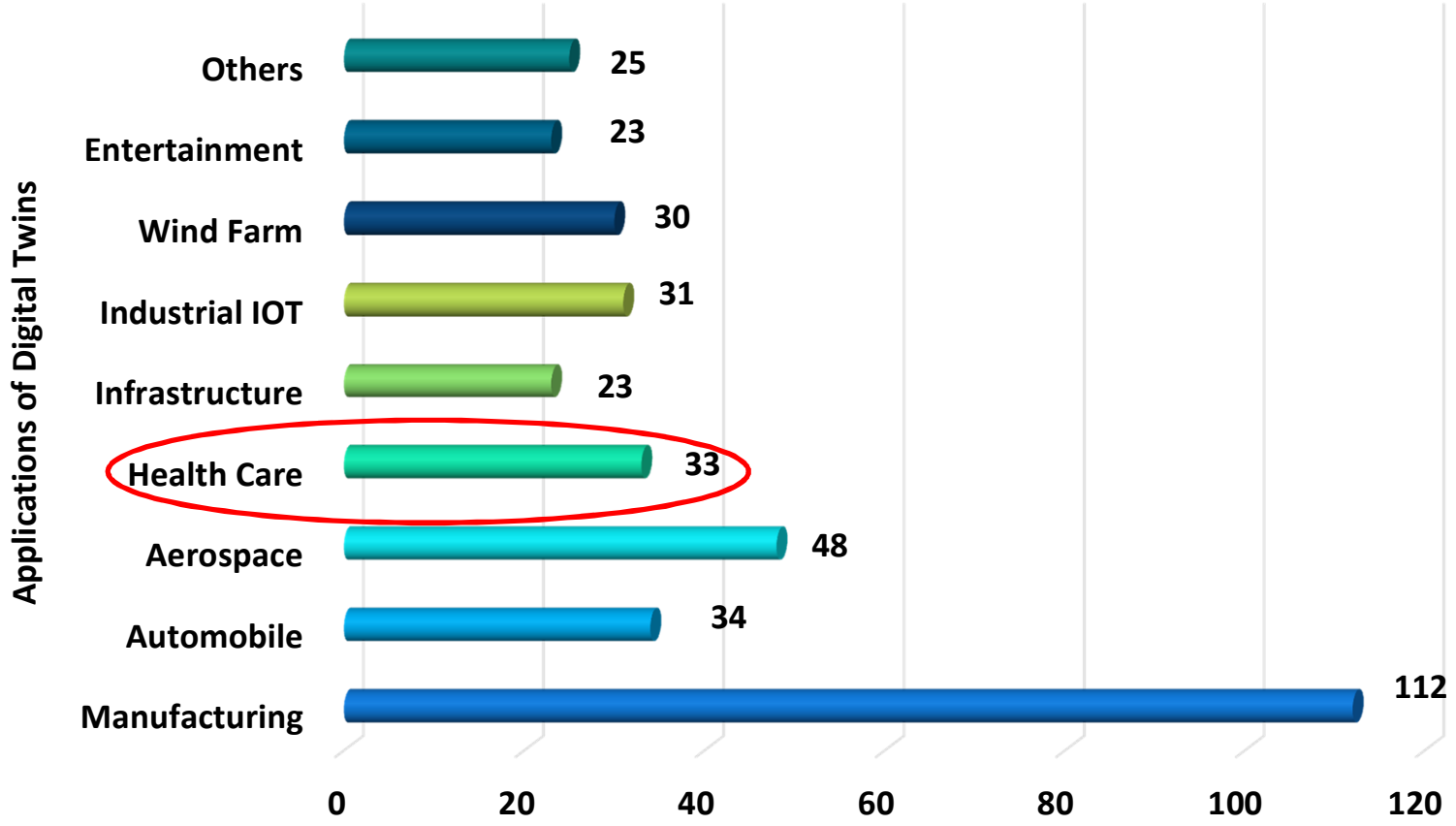


Source: Siemens On the Way to Industrie 4.0,, 2015

Gemelos digitales

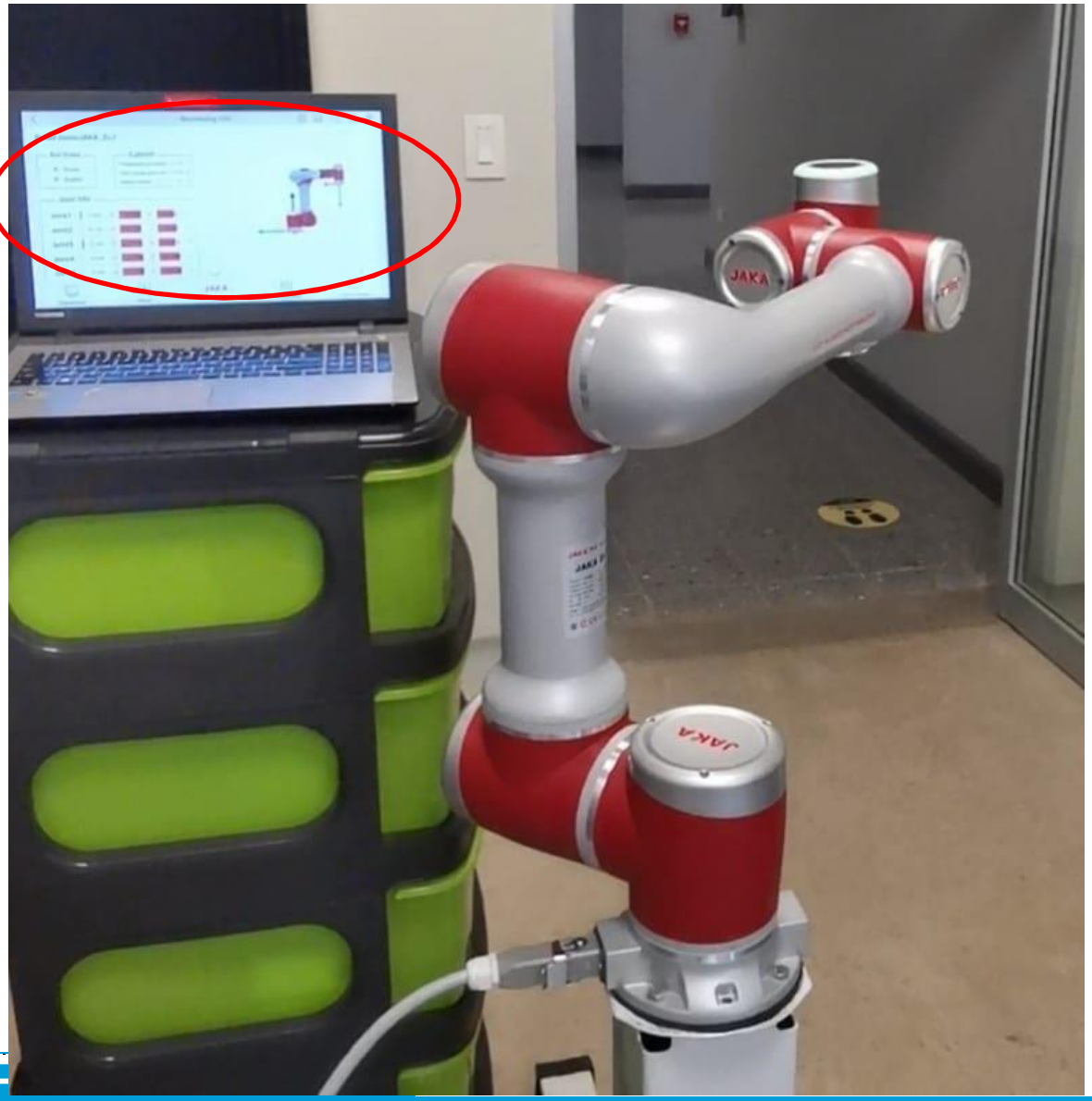


Gemelos digitales

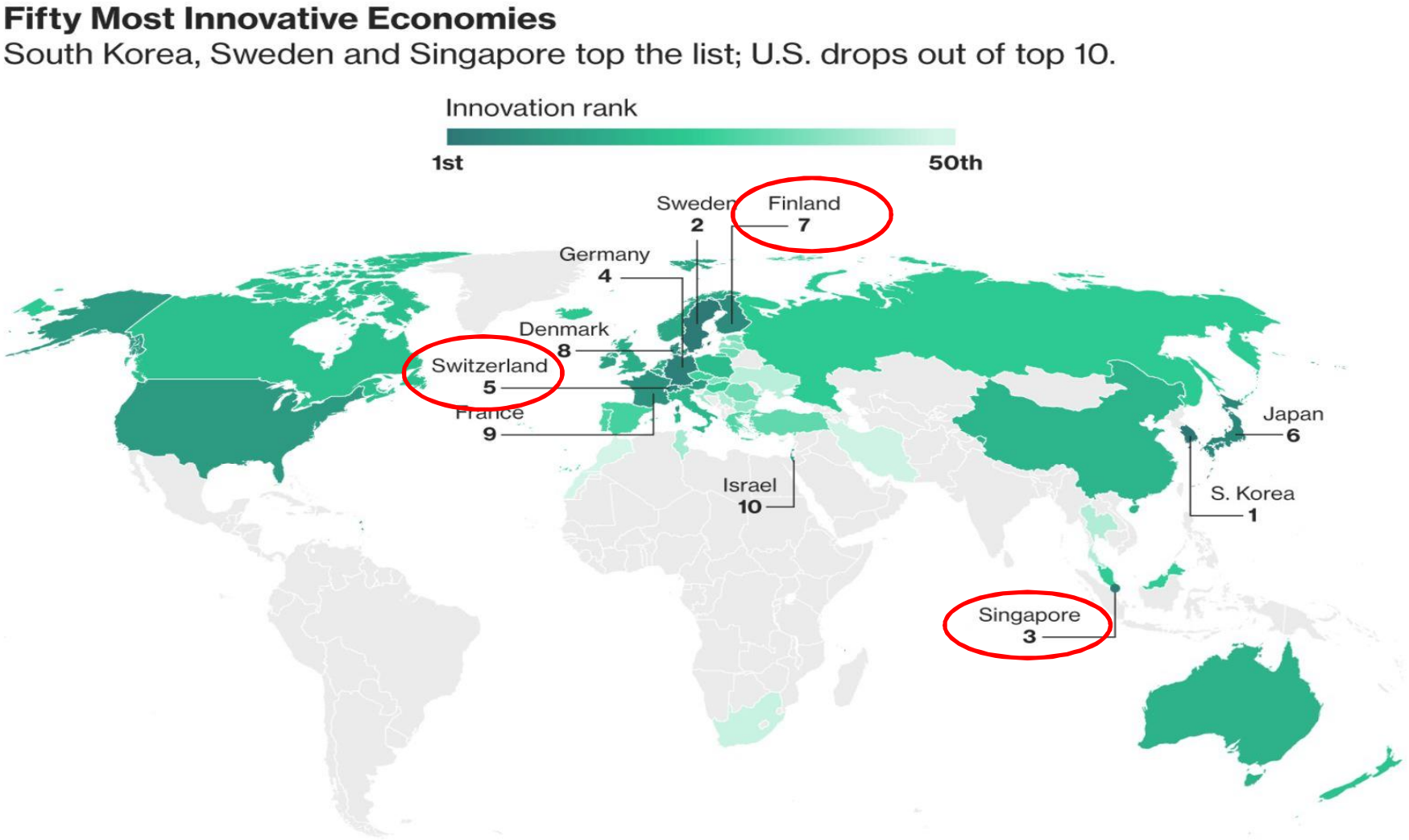


Source: Patent Searching | Research and Analytics | Patent Prosecution/Preparation Support | Litigation and E-Discovery | IP Valuation | Patent Portfolio Watch

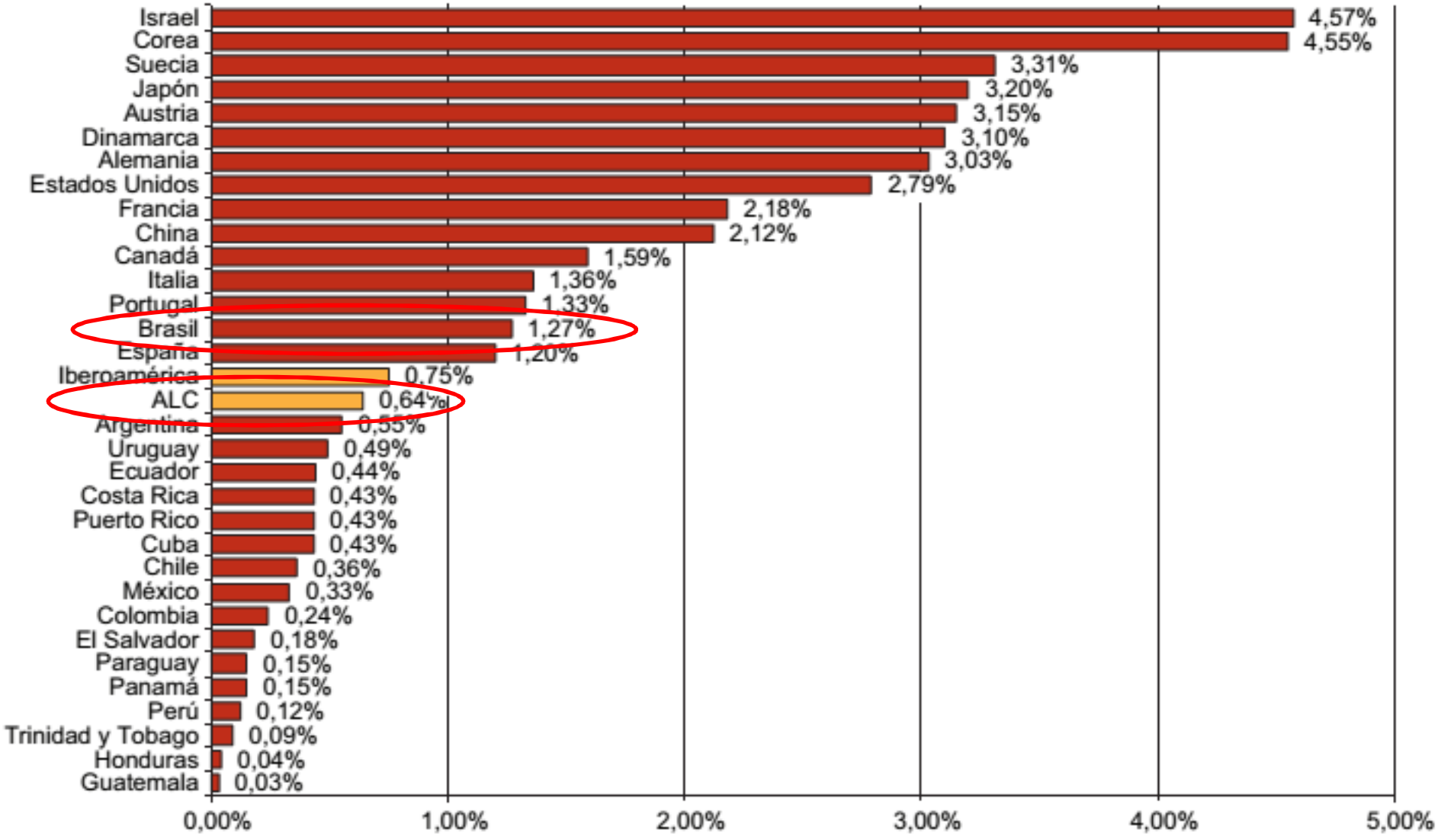
CyberPhysical-Cobots



Lección 2

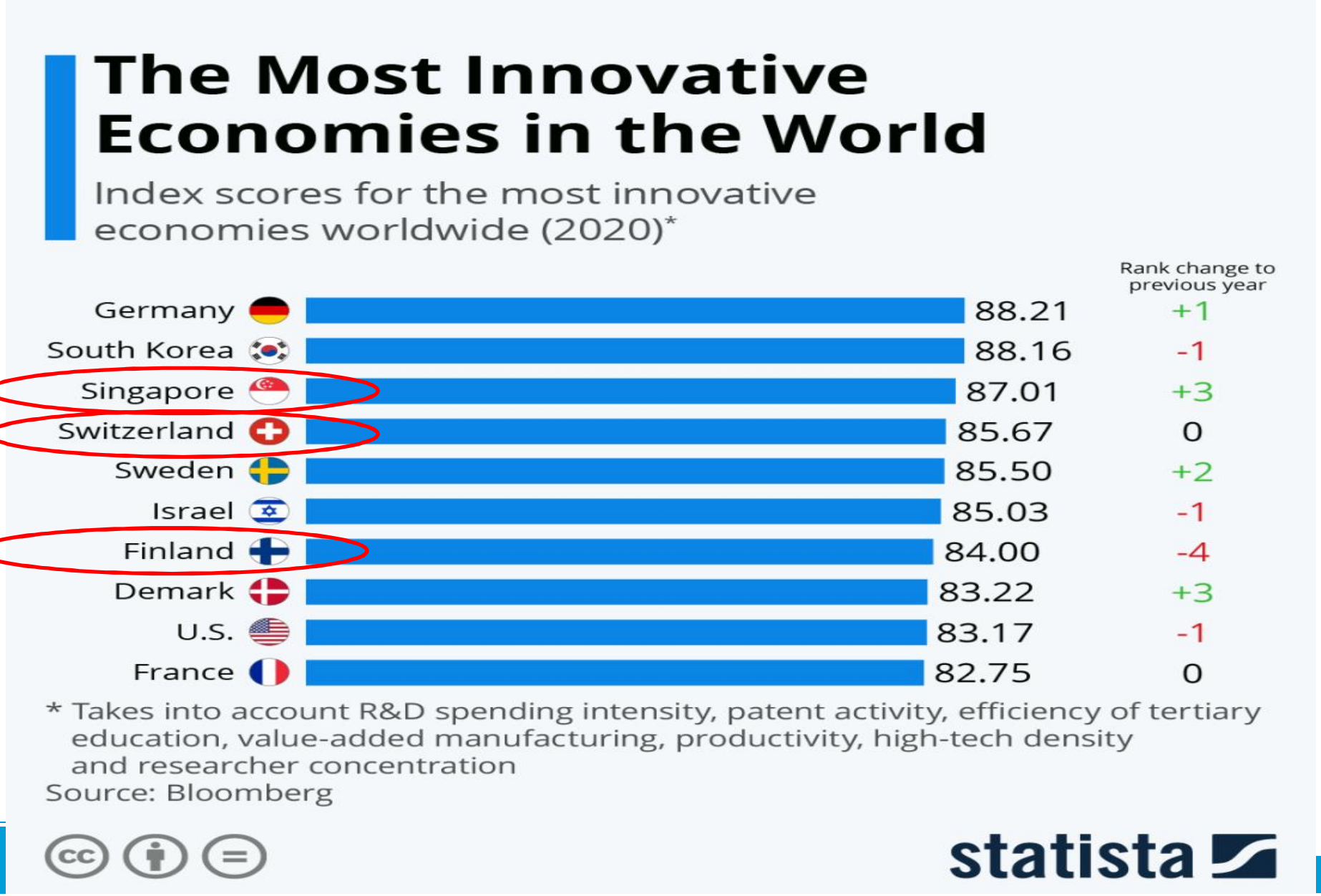

Fifty Most Innovative Economies
South Korea, Sweden and Singapore top the list; U.S. drops out of top 10.
Innovation rank
1st
50th
Sweden
2
Finland
7
Germany
4
Denmark
8
Switzerland
5
France
9
Israel
10
Japan
6
S. Korea
1
Singapore
3
Sources: Bloomberg, International Labour Organization, International Monetary Fund, World Bank, Organization for Economic Co-operation and Development, World Intellectual Property Organization
Bloomberg

Inversión en investigación y desarrollo (I+D), países seleccionados



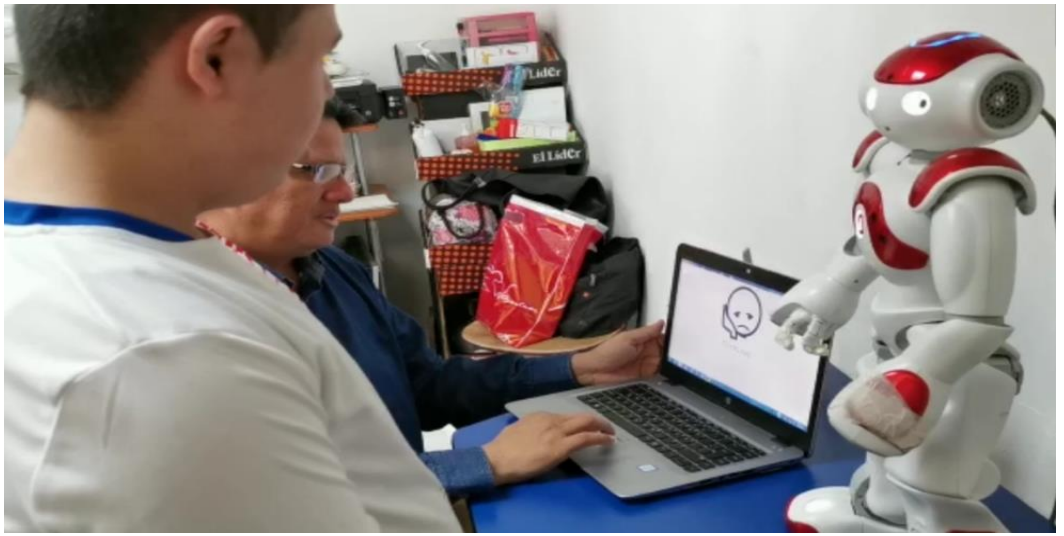
Fuente: Estado de la Ciencia, 2019

Más inversión en I+D no necesariamente significa más innovación



Plataforma robótica ciber-física para Terapia de Habla y Lenguaje

Enfoque colaborativo



Designing a Cyber-physical Robotic Platform for a Speech-Language Therapy

Eldon Caldwell[1], Carlos Andrés Morales[2], Emilia Solís Sánchez[3], Miguel Cazorla[4], and José María Cañas Plaza[5]

[1] Department of Industrial Engineering, Smart, Lean and Cyber-physical Systems Lab., University of Costa Rica, San Jose, Costa Rica eldon.caldwell@ucr.ac.cr
[2] Smart, Lean and Cyber-physical Systems Lab., University of Costa Rica, San Jose, Costa Rica carlosa.morales@ucr.ac.cr
[3] Smart, Lean and Cyber-physical Systems Lab., University of Costa Rica, San Jose, Costa Rica emilia.solis.sanchez@mep.go.cr
[4] Universidad de Alicante, Alicante, Spain miguel.cazorla@ua.es
[5] Universidad Rey Juan Carlos, Madrid, Spain josemaria.plaza@urjc.es

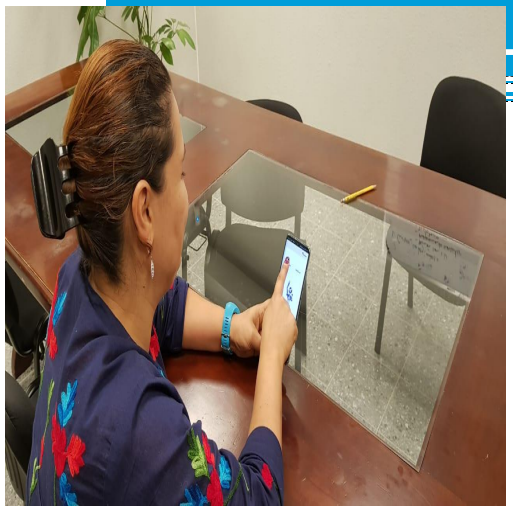
Abstract. This research is centered on social robotics and is motivated on the understanding of human-robot interaction for the improvement of the quality of life, especially in the field of the familiar daily life and employability of those who typically suffer exclusion. More specifically, this research presents the development of a new archetype based system framework that, in this case, allows to the evidence about how humanoid technology and the use of virtualization can be integrated for speech-language therapeutic purposes.

We present the proposal of the archetype based system using a kansei engineering approach which define the orientation of the requirements engineering design. In addition, we present a qualitative validation from the point of view of a speech-language therapeutic expert and the experience of a male and female patient.

The robotic platform was validated in a two stages both, with terapists and patients. Several improvements were identified and human robot interaction was easy when the exercises were perceived as games with the support of mobile devices software integrated with robot.

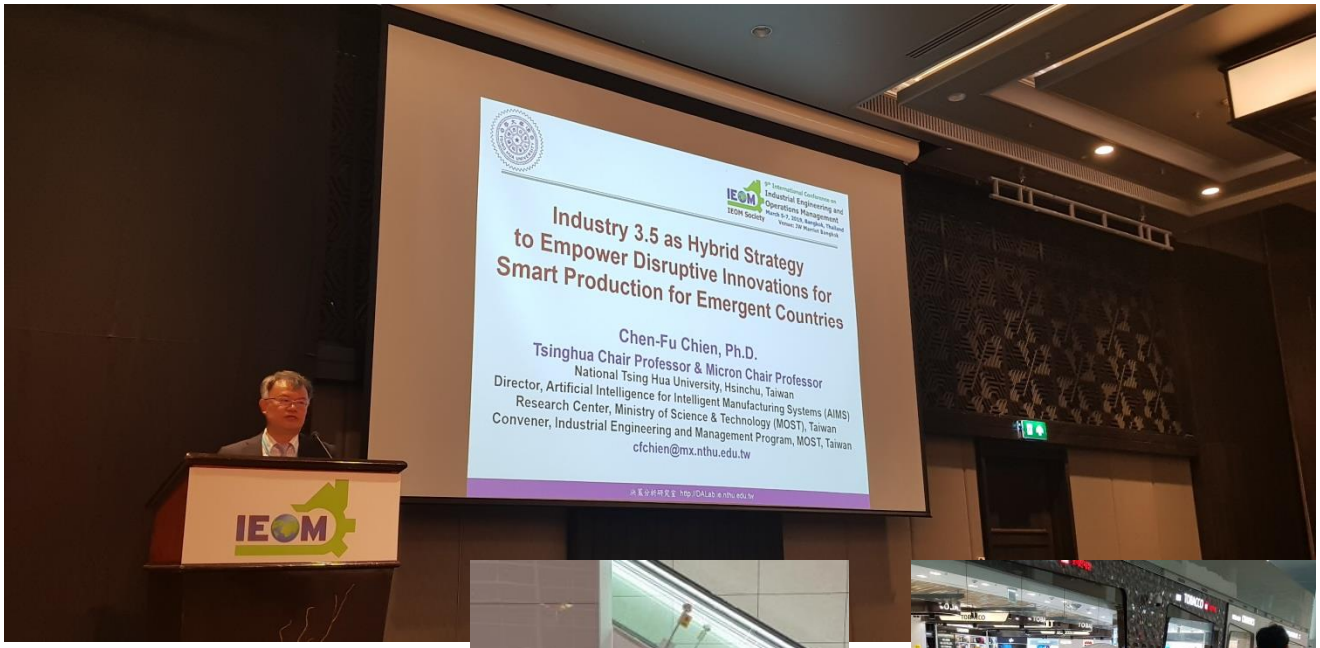
After this two-stage validation, the platform has been adjusted according to the functional and usability requirements identified and ready to prove its effectiveness in an experimental clinical application.

We conclude that cyber-physical smart systems, when robots and applications for mobile devices are integrated, must be based on critical variables of evaluation of the therapeutic impact and not only on technical functionalities related with hardware and software. The theoretical framework is essential and a multi-disciplinary approach with health professionals specialized in specific therapy is absolutely necessary. The most important thing is that the possible practical approach of a cyber-physical platform like this has been evidenced and when tested with therapists and patients there is greater confidence that it can become a useful tool in the treatment of different types of dyslalia.



Lección 3

Taiwan: Salud 3.5?



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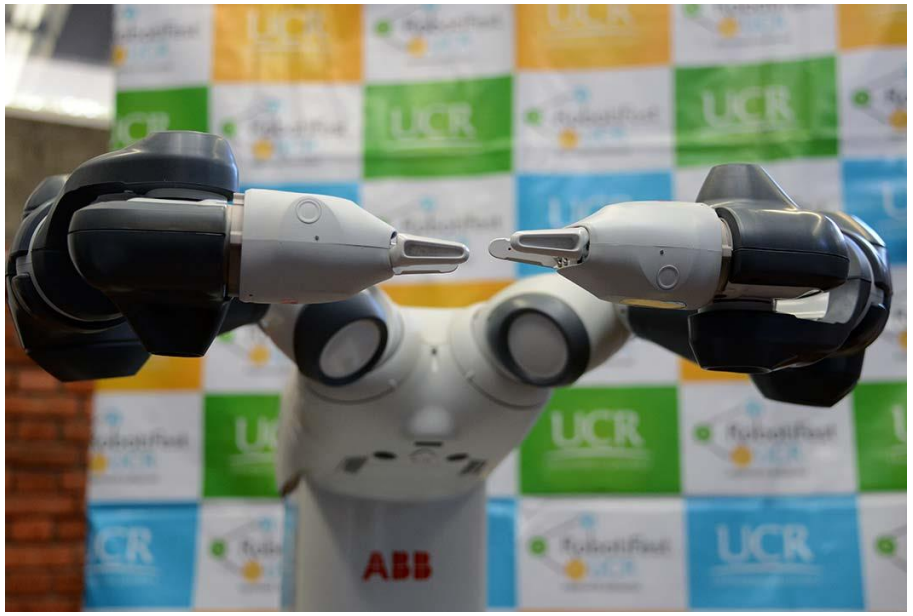
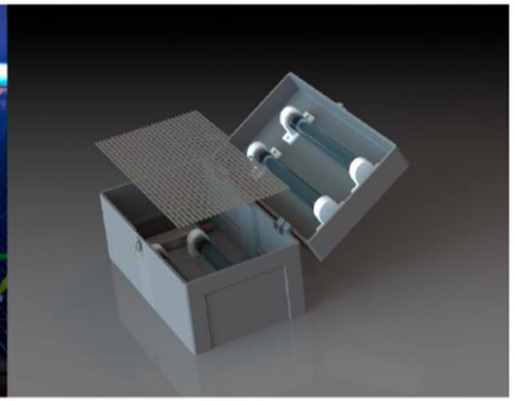
Salud 3.5



Conclusiones

Alineamiento con necesidades



Necesidad de respuestas tecnológicas

- Capacidad del Sistema de Salud
- Prestación de Servicios de Salud
- Compras en línea
- Pagos digitales y sin contacto
- Robot asistentes y sociales
- Tele-medicina
- Educación en entorno virtual
- Tele-salud
- Analítica de Datos / CPS
- Impresión 3D
- Medios de transporte autónomos

GRACIAS!

Eldon Caldwell, Ph.D., Sc.D.

Full Professor / Cathedraticus, University of Costa Rica
Dr.Sc. Informatics / Automation and Robotics, University of Alicante, Spain.
Ph.D. Computer Science/ Industrial Engineering, University of Nevada USA.
Dr. Ed. (in fieri) Education, University of Costa Rica
Outstanding Service Award, IEOM Society, USA
Member of IEOM Academy of Fellows, IEOM Society, USA
DVP, IEEE Computer Society, USA