University of Zagreb
Faculty of Electrical Engineering and Computing
Department of Electronic Systems and Information Processing

Umreženi senzorski sustavi u preciznoj poljoprivredi

Digitalna transformacija u poljoprivredno prehrambenom sektoru – trendovi razvoja u svijetu i stanje u Hrvatskoj

12. lipanj 2019.

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LABORATORY FOR INTELLIGENT SENSOR SYSTEMS

Sadržaj

- „Digitalizacija”
- Senzori (preslikavanje svjetova)
- Prilike su u podacima
- „Internet stvari”
- „Industrija 4.0” u poljoprivredi
- Problem / rješenje (u poljoprivredi)
- LISS istraživanja s primjenom u poljoprivredi
- Umjesto zaključka

It's a smart world

A special report on smart systems
November 6th 2010

The Economist

Top 10 Strategic Technology Trends for 2019

gartner.com/SmarterWithGartner

Source: Gartner

Gartner

Internet stvari, arhitektura

računalni oblak

korisnički uređaj

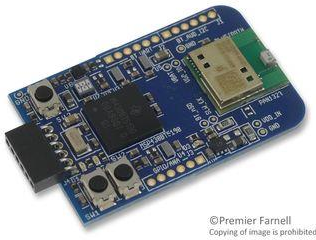
ar

Aplikacijski sloj

Aplikacija
servisi, usluge

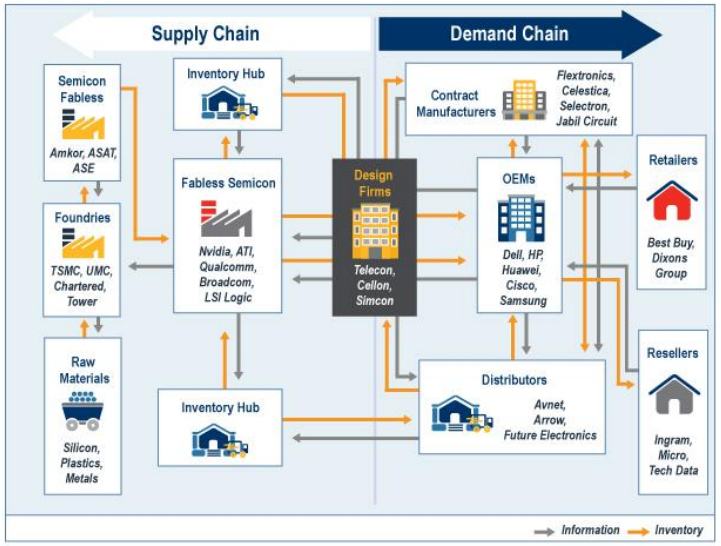
Analitika
algoritmi, strojna inteligencija

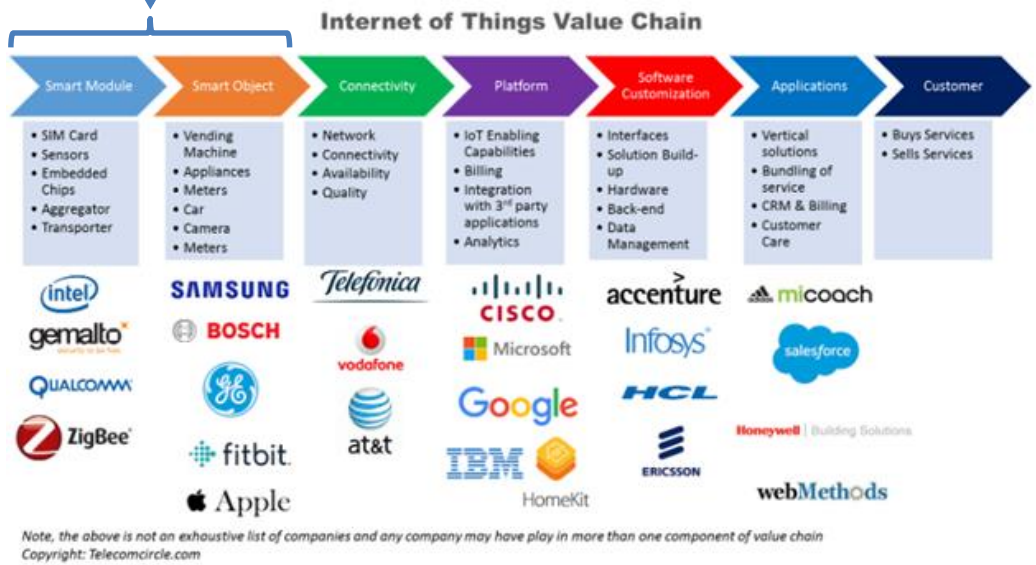
IoT middleware
komunikacija, pohrana



“Stvari” - elektronički uređaj
senzori, obrada,
komunikacija, napajanje

Internet stvari, lanac vrijednosti

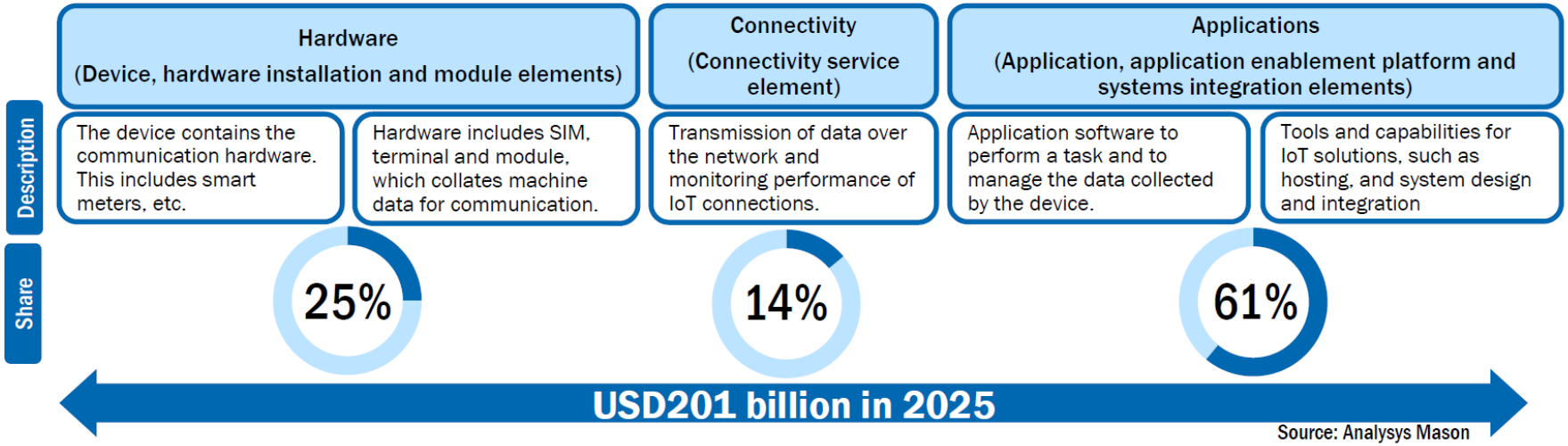




Note, the above is not an exhaustive list of companies and any company may have play in more than one component of value chain

Worldwide: The applications component will contribute the largest share of revenue, reaching 61% by 2025

Figure 2: Percentage of total value chain revenue contributed by each component, worldwide, 2025



Source: Analysys Mason

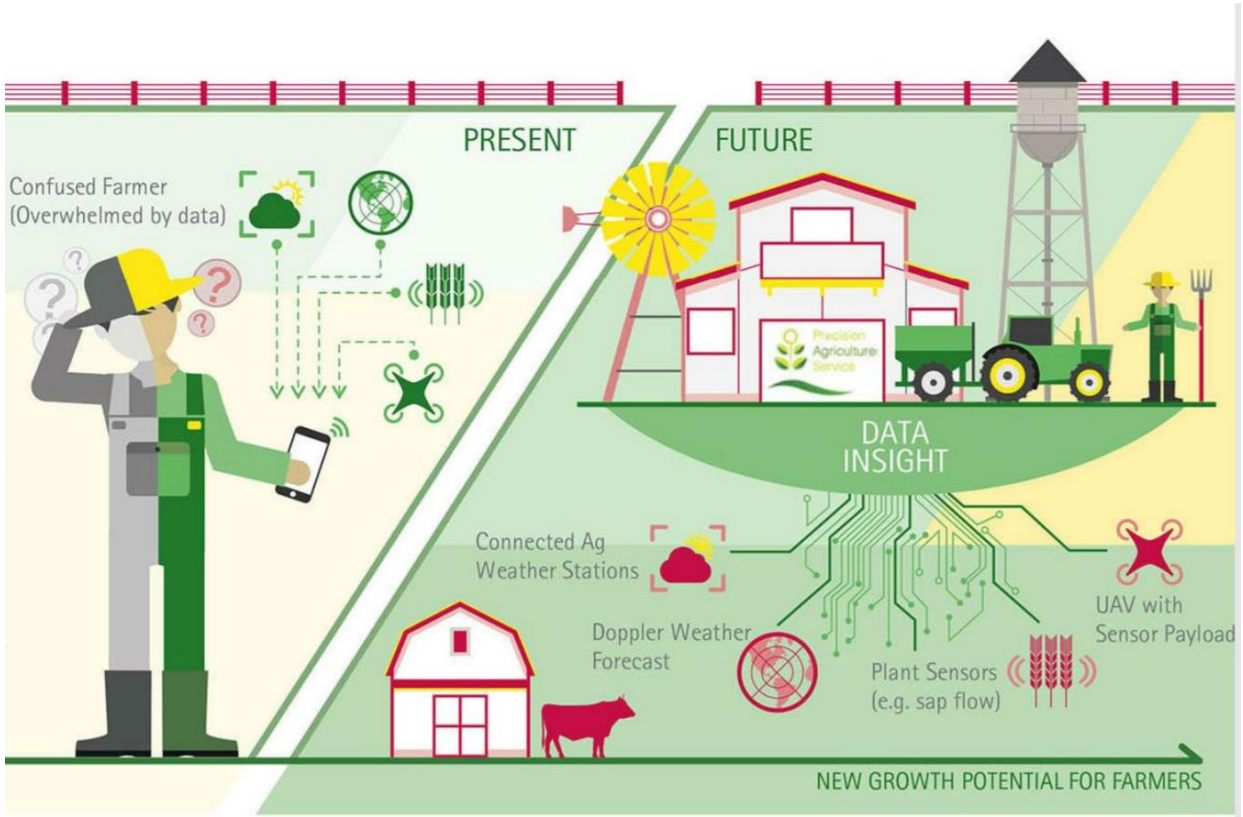
The hardware component generates 25% of total revenue. Network operators may benefit from a share of this revenue, depending on the partnerships they have with device vendors and their roles in the value chain. Connectivity services, including revenue from connectivity and connectivity management, constitute 14% of total revenue. Connectivity typically has a relatively high margin, with EBIT margins often around 10%. Barriers to entry to the wide-area connectivity market are high for mobile IoT connectivity, but IoT can leverage an existing network serving many customers. However, the presence of LPWA connectivity in unlicensed spectrum has lowered its entry barriers.

The applications component will generate the vast majority of revenue: 61% of the total from the value chain in 2025. Software application development generates higher costs (as it requires specific skillsets and resources) and requires specialist sector knowledge. It is also increasingly subject to higher costs, including the requirement for built-in security. Mobile network operators are not typically equipped to provide application services, but will partner or build expertise in sectors where they are pursuing an end-to-end strategy. The share of revenue contributed by each category fluctuates very little between 2016 and 2025.

The amount of collected data will be enormous. It can be expected that a very large number of real-time sensor data streams will exist, that it will be common for a given stream of data to be used in many different ways for many different inference purposes, that the data provenance and how it was processed must be known, and that privacy and security must be applied. Data mining techniques are expected to provide the creation of important knowledge from all this data. Enabling streams to act as primitives for unexpected future inferences is an interesting research problem. In addition, the overall system solution must deal with the fact that no inference method is 100% correct. Consequently, uncertainty in interpreted data can easily cause users not to trust the system.

J. A. Stankovic, "Research Directions for the Internet of Things," in *IEEE Internet of Things Journal*, vol. 1, no. 1, pp. 3-9, Feb. 2014.

EU, IoT u poljoprivredi (Industrija 4.0)



Digital Transformation Monitor

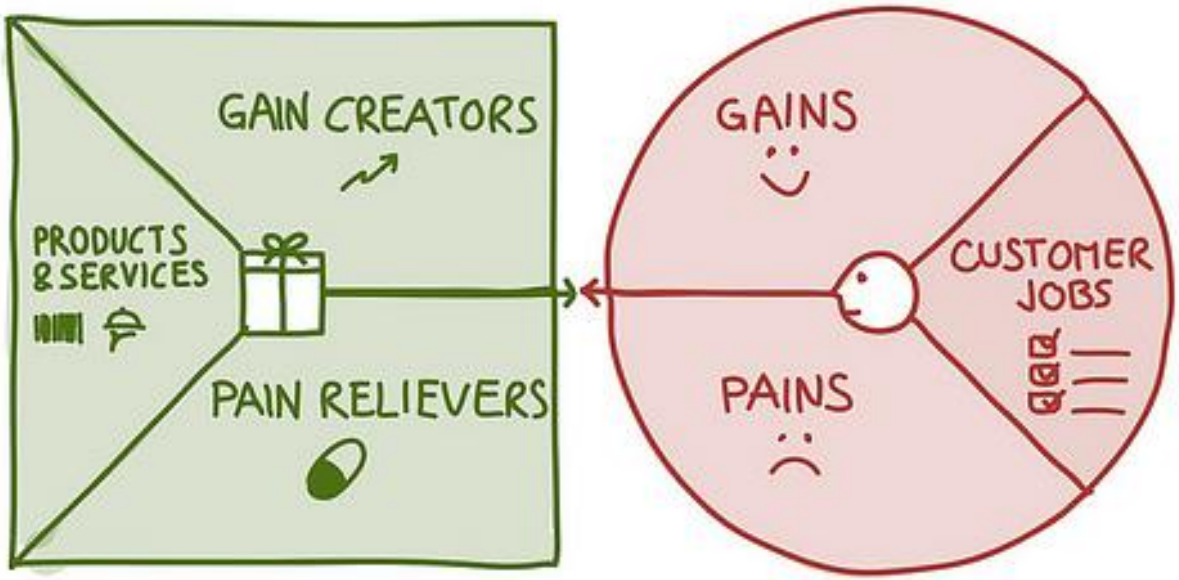
Industry 4.0 in agriculture: Focus on IoT aspects

New measurement tools

Finally, a key transformation resides in the ability to collect more data and measurement about the production: soil quality, irrigation levels, weather, presence of insects and pests. Here also this ability takes several forms from sensors deployed on tractors and implements to direct deployment of sensors in the field and soil or to the use of UAVs/drones or satellite imagery to collect measurements from above[5].

The lifespan of agricultural technology largely outplays the lifespan of communication technologies. It is thus important that innovations are able to deploy on existing machines.

Što je problem, ako je IoT rješenje?



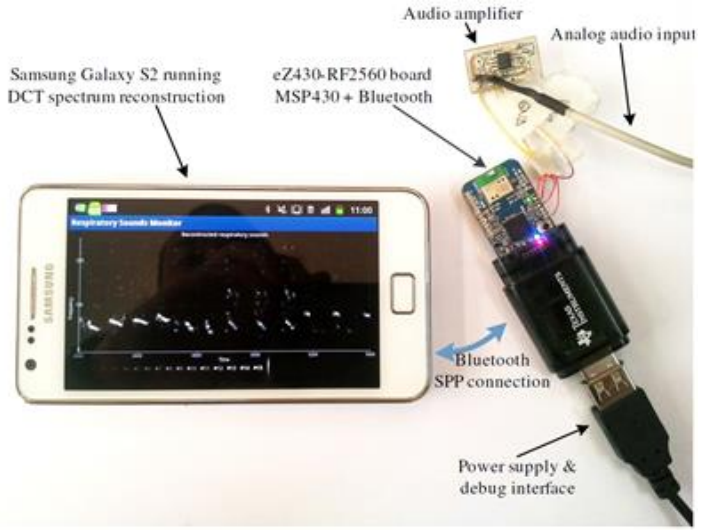
POLJOPRIVREDA NA KOLJENIMA

U Hrvatsku uvezeno 38.000 tona krumpira, raste uvoz jabuka, krušaka i lubenica

Autor: N. S. ▪ Zadnja izmjena 06.06.2019 21:31 ▪ Objavljeno 06.06.2019 u 21:30

LISS – istraživanja s primjenom u poljoprivredi

- Mikrorazina – smanjiti potrošnju umreženih senzora, izvesti senzore koji ne troše, koristiti energiju iz okoline
- Dobivanje informacije na mjestu izvora senzorskog signala složenim postupcima obrade i raspoznavanja
- Ključna dodana vrijednost – domensko znanje, podrazumijeva multidisciplinarnost (vidjeti lanac vrijednosti)



MasliNET

Multimodal environmental monitoring system for microclimate and pest monitoring in olive groves, Siemens, 2008-2011

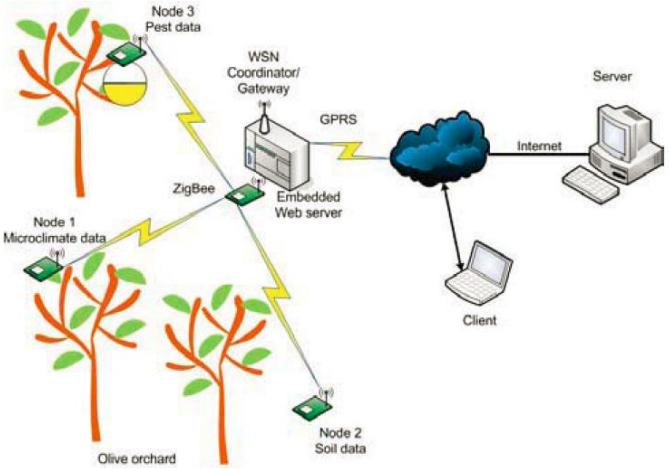


Figure 1.The WSN-based olive grove monitoring system

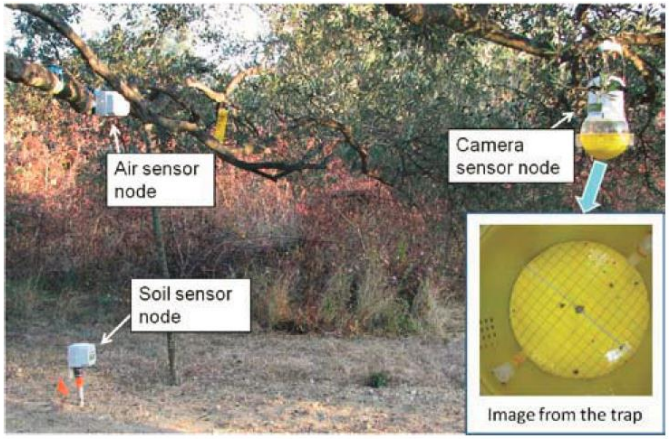
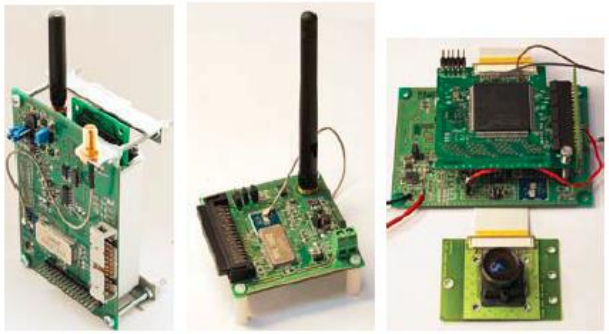


Figure 9. MasliNET system (G1) deployment in an olive grove in Petrčani, October 2008.



a) b) c)

Figure 2. a) the coordinator/gateway, b) the sensor node, c) the camera node

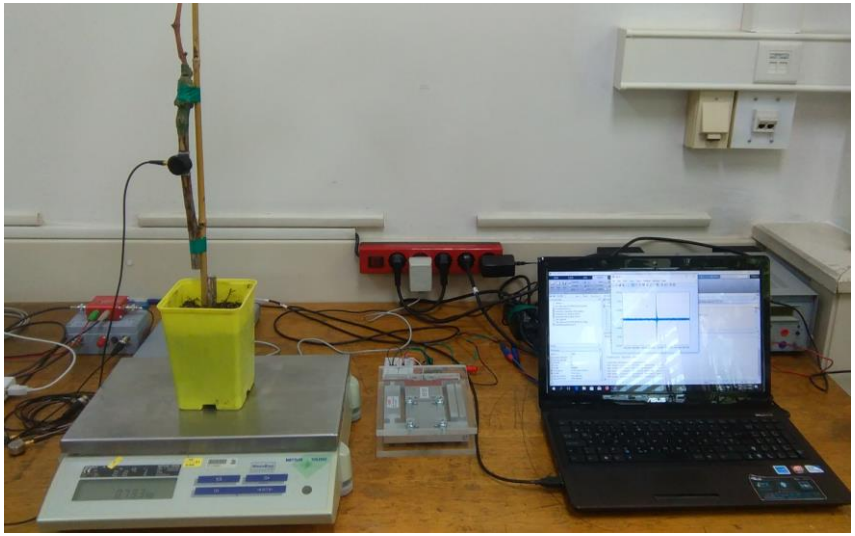
a) b) c)

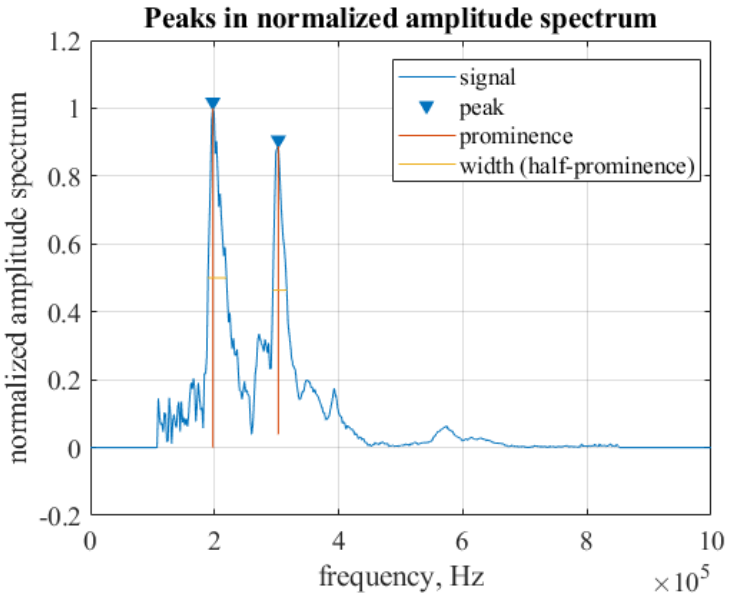
Figure 4. a) fly trap with the camera node, b) the sensor node, c) the coordinator/gateway with a solar panel

SENSIRRIKA

Advanced sensor systems for precision irrigation in karst landscape, HRZZ, IP-2016-06-8379, 2017-2021

Design of novel sensors for water-stress related physiological parameters (real time analysis of passive ultrasound emissions)



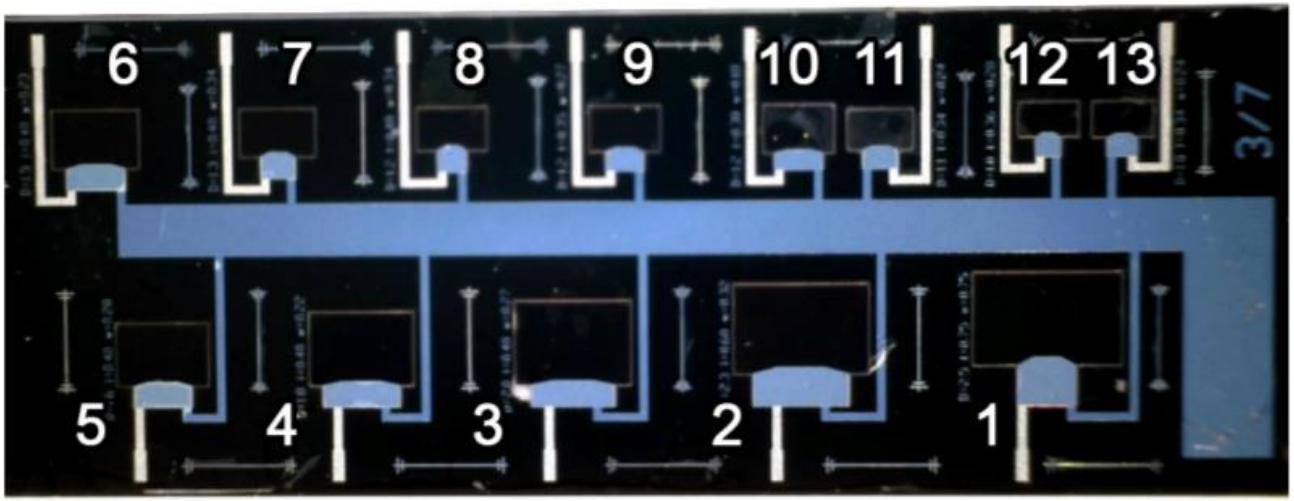


Croatian Science Foundation

Collaboration: UNIZG Faculty of Agriculture, University of Natural Resources and Life Sciences, Vienna (BOKU)

UKF Gaining Experience Grant Award

Transferring knowledge on microelectromechanical design – plant embolism sensors for agriculture, Unity Through Knowledge Fund, 2019

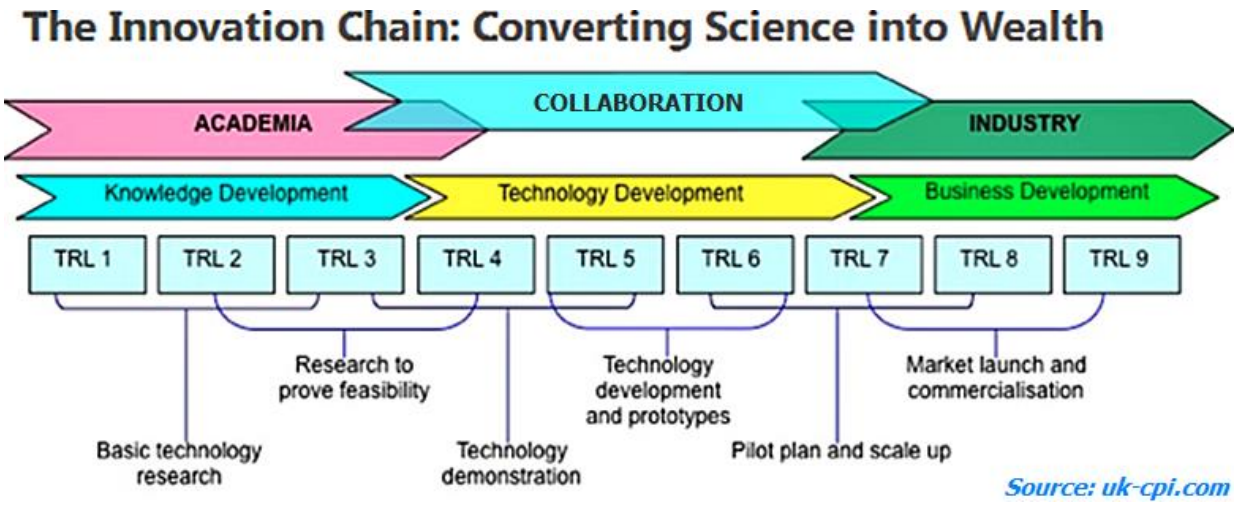


MEMS resonators as zero power sensors for plant embolism

UNITYTHROUGH KNOWLEDGEFUND

Collaboration: Centre de Nanosciences et de Nanotechnologies (C2N), CNRS, Univ. Paris-Sud, Université Paris-Saclay, France, UNIST Faculty of Science

Umjesto zaključka – koordinacija!



Contributions to New Zealand's primary industries (nutrition, wool, red meat, dairy)

Multi-scale modelling of wool is used to predict mechanical, moisture and thermal properties of knitted fabric from the measured properties of the fibres. Increasingly, what we wear makes a difference, particularly in areas such as elite sports, race car driving, diving, flying and space exploration. Modelling fabric's interaction with our body and even our naturally occurring bacteria could lead to the development of new products that enhance performance or even provide energy to power devices.