

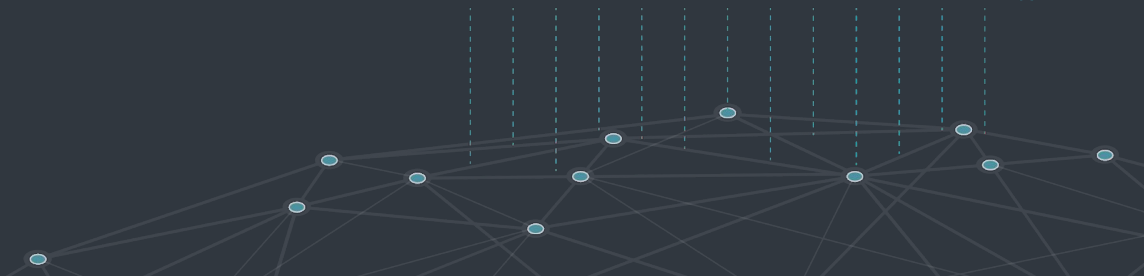


# GS1 Digital Link

Standard Product Identities  
on the **Web**

Dom Guinard @domguinard  
GS1 Digital Link co-chair  
CTO @EVERYTHING

**RUN YOUR BUSINESS DIFFERENTLY™**  
Know what your products know™



# Digitizing products is happening at mass scale



Global barcode upgrade with new web-connected standard—GS1 Digital Link

<https://dfnnr.tn.gg/01/860080009993/21/NiCvrTE6>



ONE CODE FOR ENTIRE LIFECYCLE



Technology originated by EVERYTHING

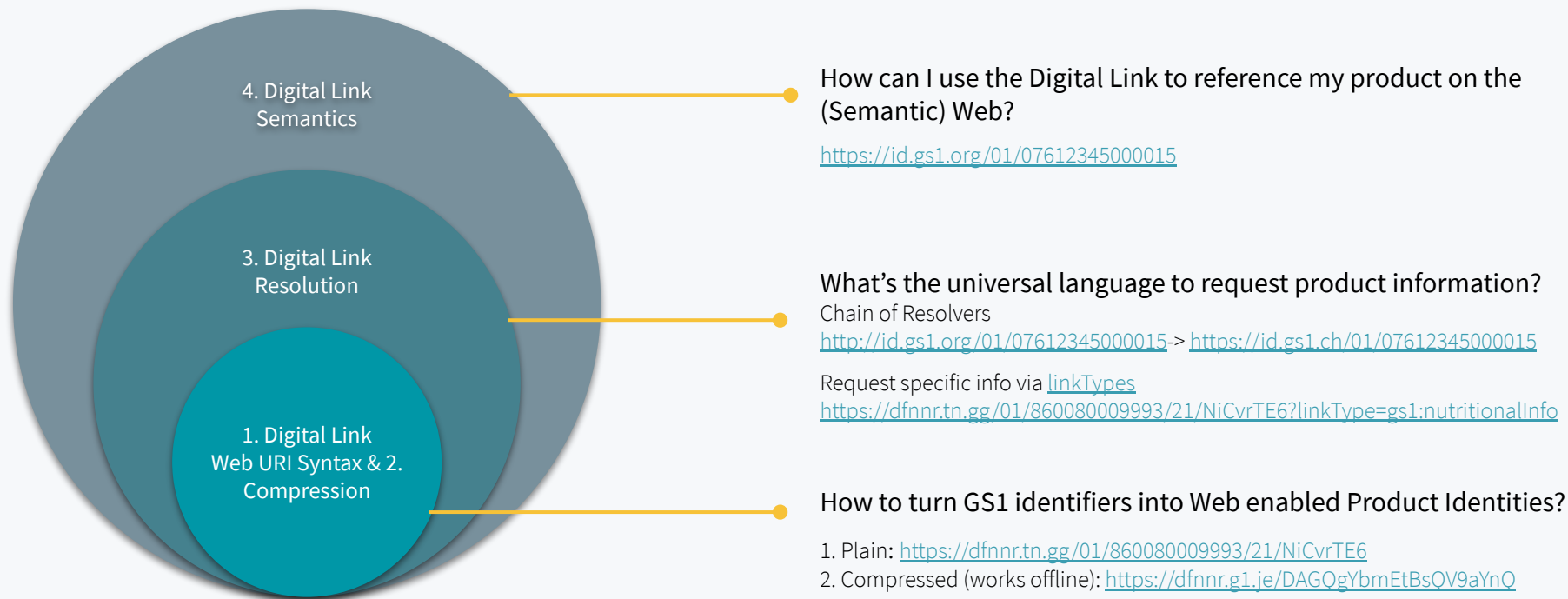
Mass scale digital serialization on packaging—high speed and very low marginal cost



Billions of smartphones can now scan standard product codes with camera



# The GS1 Digital Link Standard in a Nutshell



# Some live projects out there



**Batch level:  
detailed  
product  
provenance**



**Item Level:  
product  
authenticity**



PHARMA

**Item level:  
variable  
product  
information**



**SKU level:  
product  
information**



**SKU level:  
connected  
packs for  
brand content  
and consumer  
data capture**





## A novel solution for counterfeit prevention in the wine industry based on IoT, smart tags, and crowd-sourced information

- Elsevier **Internet of Things** journal
- <http://dx.doi.org/10.1016/j.iot.2021.100375>



### A novel solution for counterfeit prevention in the wine industry based on IoT, smart tags, and crowd-sourced information <sup>☆</sup>



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#### ARTICLE INFO

##### Article history:

Received 8 November 2020

Revised 6 January 2021

Accepted 13 February 2021

Available online 24 February 2021

##### Keywords:

Brand protection

Counterfeit prevention

Digital transformation

Food track and trace

Human sensor network

Smart tags

Wine counterfeit prevention

#### ABSTRACT

This paper describes a novel solution for counterfeit prevention and brand protection in the wine industry. The presented approach combines Internet of Things, Cloud, and Mobile technologies with the use of custom designed smart tags applied to each bottle of wine in order to provide food track and trace capabilities. The smart tags combine QR code with additional information printed with an invisible photochromatic ink. The tags are activated by flashlight on mobile devices during the scanning. Before scanning, users are prompted to select the context of the wine bottle (in store, sold, consumed) in order to provide additional information about each bottle as it moves through the supply chain. This information is used by the custom-made heuristic to help users and wine makers detect issues with individual instances of the product. The system was implemented as a pilot project that was executed during a period of 6 months. End users showed a great interest in the possibility to implement such a system, consumers liked the interaction with the product using the mobile app and smart tags, while wine makers expressed their interest in the solution. Besides counterfeit that affects profit, the benefits of such systems include improved brand protection and reduced risk of health hazards.

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## Dual nature of digital transformation

---

- **Great** possibilities and **benefits**
- **Potentially** great **risk** if not implemented the right way



# TagItWine Project



- Use of active QR codes
- Food track and trace use case
- Counterfeit prevention and detection
- **Partnership development**



- ① **Product Name:**  
Vladika
- 🍷 **Vintage:**  
2015
- 🍷 **Wine type:**  
Dry red wine
- 🍷 **Subregion:**  
Podgorica
- 🍷 **Country of origin:**  
Montenegro

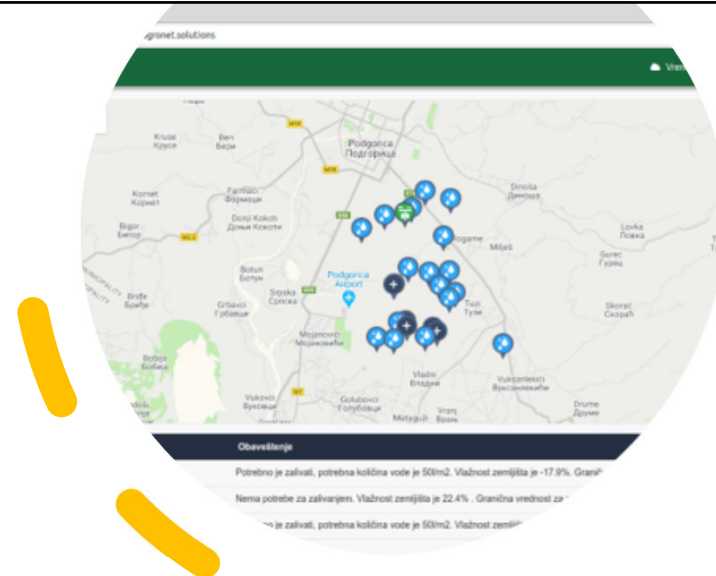
Time:



# DIPOL Project



- Digital transformation:
  - Precision viticulture / agriculture
  - Food supply chain



 **15** member states



**18** Countries

**60**  
Partners



**20** Pilots



**5** Agri Sectors

Global Outreach:

**69**

farming associations

**47** Countries

**1.5 Billion** People



Multi-Actor Approach



Using Practical skills

& knowledge

target results

needs, priorities

& opportunities

**318k** hectares of land

Working with

**5.7k**  
Farmers

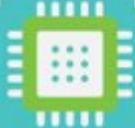


**29k**

Sensors used across

**80**

sites

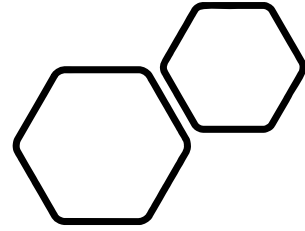


**9.2k** Devices

**& 131** Large Machinery



Horizon 2020  
European Union Funding  
for Research & Innovation

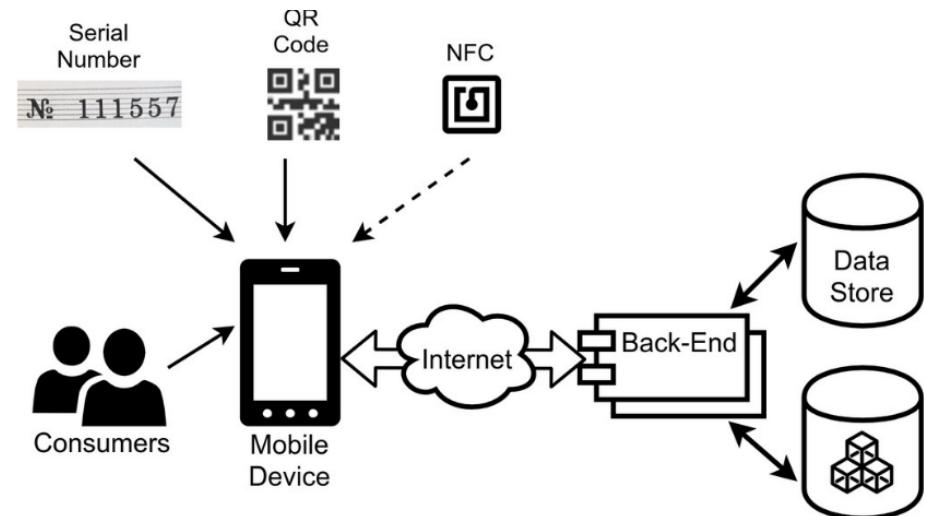


H2020  
DEMETER



# Product ID Type vs. Instance

- Family of product
- Tracking individual object instances
- Traceability throughout production and supply chain
- The use of standards (GS1)



# VIRAL Project

- Educate educators
- Engage and educate farmers
- Engage business partners
- In-house and field labs
- Workshops / conferences / hackatons
- Partnership development



# FoodHub project

- Food product track and trace use case:
  - QR code
  - Human sensor network
  - Tracking and tracing



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# Thank you!

- **TagItWine** project:  
<https://tagitwine.udg.edu.me/>
- **DIPOL** project:  
<https://dipol.udg.edu.me/site/>
- **H2020 DEMETER** project:  
<https://h2020-demeter.eu/>
- **VIRAL** project:  
<http://viralerasmus.org/>
- **FoodHub Centre of Excellence @ UDG**  
<https://foodhub.udg.edu.me/>



**FoodHub**  
Centre of Excellence





**HoneyTag**

**HONEYTAG - BRAND PROTECTION AND QUALITY IMPROVEMENT  
FOR MONTENEGRIN HONEY**

# BRAND PROTECTION

HONEY PRODUCT

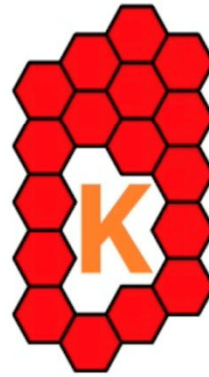
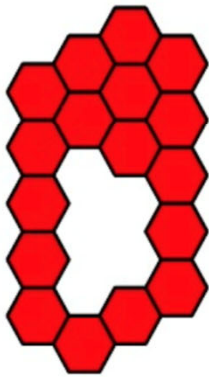
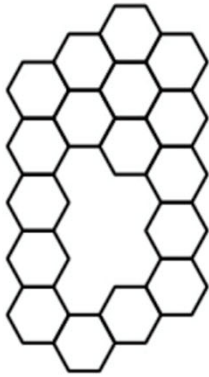


**TAGIT**  
S M A R T

TAGIT HONEY  
PRODUCT





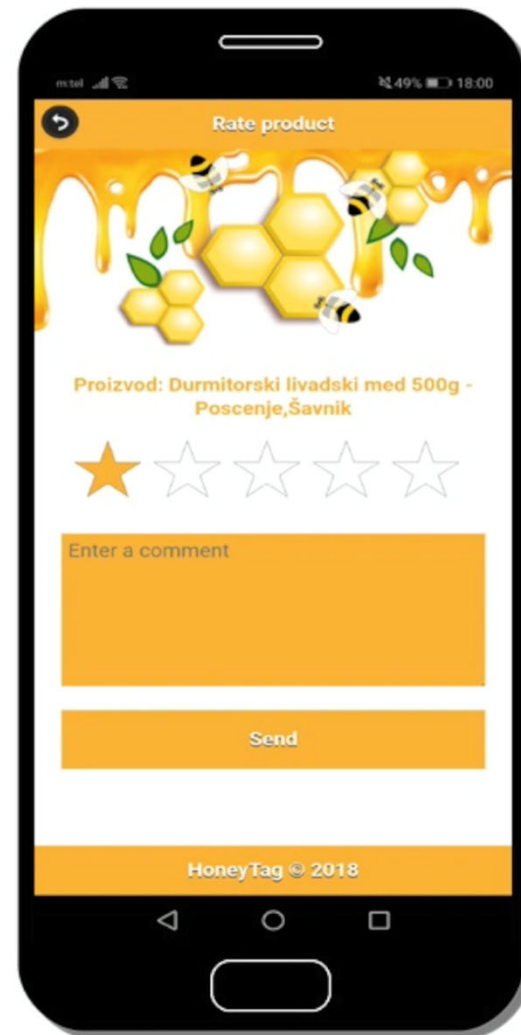




Durmitorski livadski  
**MED**  
PČELAR: ŽELJKO ČIROVIĆ, ŠAVNIK  
TEL: +382 67 480 009  
Osobina prirodnog meda je kristalizacija.  
Dekristalizati na temperaturi do 40 °C.  
Rok trajanja: Najbolje upotrijebiti do 2 godine.  
Proizvedeno: 2018. godine  
Neto: 150g

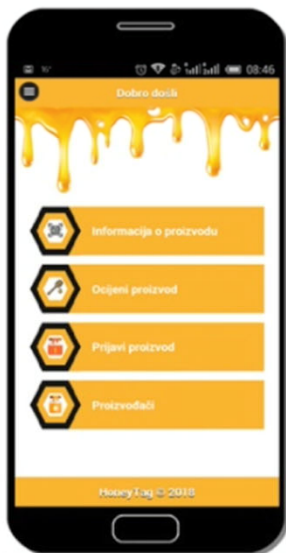
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Dekristalizati na temperaturi do 40 °C.  
Rok trajanja: Najbolje upotrijebiti do 2 godine.  
Proizvedeno: 2018. godine  
Neto: 1000g

Durmitorski livadski  
**MED**  
PČELAR: ŽELJKO ČIROVIĆ, ŠAVNIK  
TEL: +382 67 480 009  
Osobina prirodnog meda je kristalizacija.  
Dekristalizati na temperaturi do 40 °C.  
Rok trajanja: Najbolje upotrijebiti do 2 godine.  
Proizvedeno: 2018. godine  
Neto: 150g





## Some details of the project



### TagItSmart technology

The HoneyTag project is a pilot project within the H2020 TagItSmart project. Its goal is to evaluate TagItSmart components.



### Functional ink

In order to protect the originality and quality of Durmitor honey, each jar is marked with special ink labels that respond to temperature changes and exposure to UV rays.



### Verification of originality

Each jar has a unique ID that allows its tracking from production to consumption. The correctness of the



### Numbers

The project includes 6 producers with a total of 430 hives. 1200 smart labels will be placed on jars that





**PILOT PROJECT WAS BEING IMPLEMENTED IN  
COOPERATION WITH**



**PILOT PROJECT WAS FUNDED BY**



Funded by the Horizon 2020  
Framework Programme of the  
European Union

**FOR MORE INFORMATION ABOUT THE PROJECT  
VISIT THE WEBSITE: [WWW.HONEY-TAG.ME](http://WWW.HONEY-TAG.ME)**

# Smart tag technologies

Liisa Hakola

05/05/2021 VTT – beyond the obvious

## Smart Tag combines 2D code and functional ink

**Visible or electronic markers** (2D codes, NFC) with **environmental sensing functions** (functional ink, sensors, indicators) **combined with software intelligence** (user information, location, etc.) in order to provide **context aware services** to end users



*Change in temperature  
causing QR code to change  
→ different information to  
end user*

## Benefits to value chain

- Consumer engagement
- Direct personal contact with consumers
- Product differentiation
- Product quality & safety
- Product authenticity
- Product integrity
- Reduction of waste, efficient recycling
- Inventory control & management





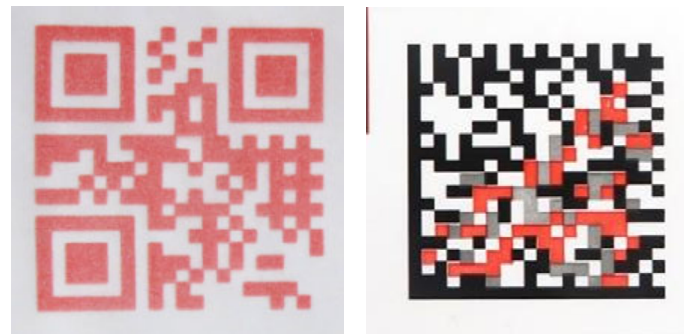
# Enabling technologies: encoding, scanning



*Combination of QR code and OCR*



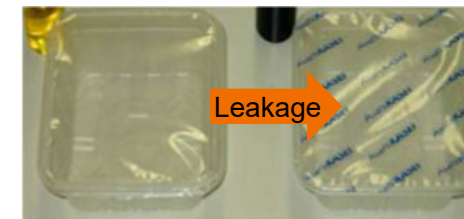
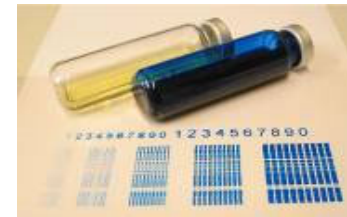
*Combination of individual 2D codes and sensor areas*



*The whole code can be printed with functional ink or just parts of it*

# Quality indicators for food packages

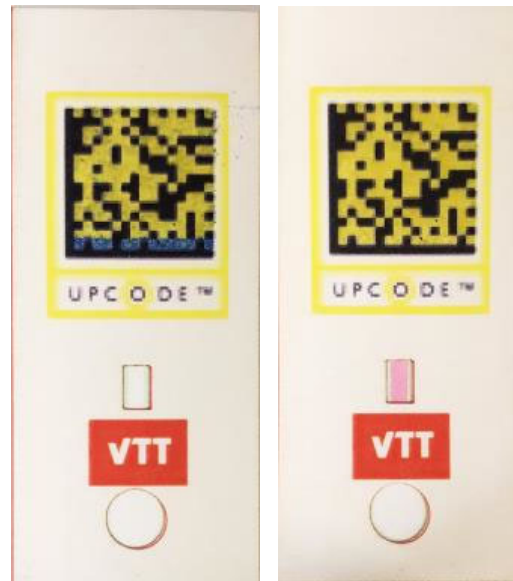
- *Printable visual indicators and sensors for product quality and safety by VTT*
- Various types indicating:
  - Time and temperature
  - Humidity
  - Leakage (oxygen)
  - Food freshness (H<sub>2</sub>S, aldehydes, ketones, amines, ethanol, nitrogen)
  - Ethylene
  - Authenticity
  - Acetone concentration in breath
  - Water quality (e.g. phenolic compounds)



# Smart tag examples



*Oxygen indicator for package leakage*



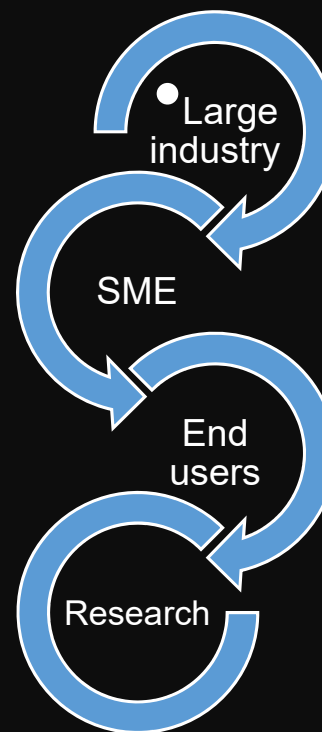
*Humidity indicator for moisture sensitive product quality*



*Nitrogen indicator for spoilage of fish*

# TagItSmart project 2016-2018

Smart Tags Driven Service Platform for Enabling Ecosystems of Connected Objects (Grant No 688061)



Web: [www.tagitsmart.eu](http://www.tagitsmart.eu)

Email: [info@tagitsmart.eu](mailto:info@tagitsmart.eu)

Twitter: @TagItSmart

LinkedIn: TagItSmart group

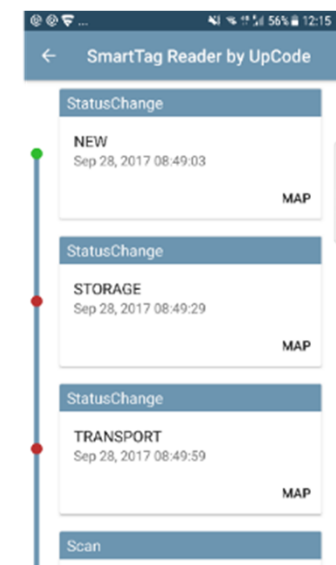
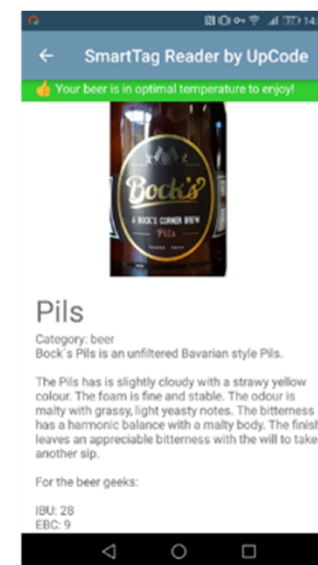
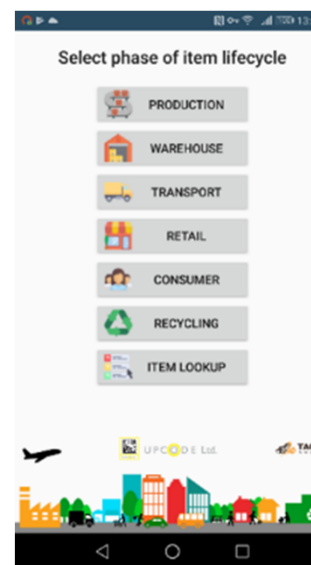


H2020 research and innovation framework programme



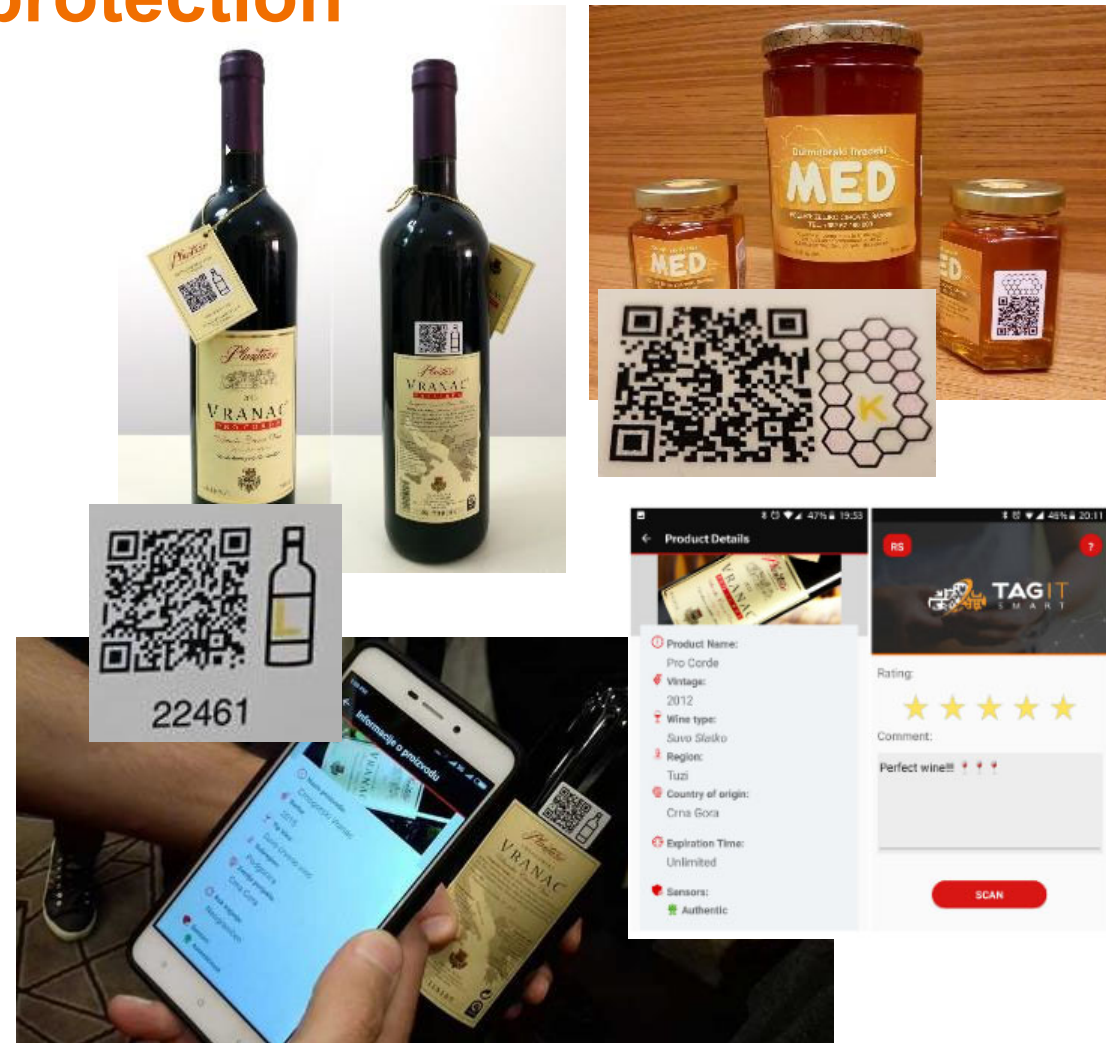
## Smart Tags give information on product lifecycle

- Digital Beer concept, which demonstrates life-cycle of a digital product from manufacturing to recycling
- Printing, encoding, creation of FC, and FC scanner
- Trials with real end-users 2018 (local retail stores, consumers): 8500 tags, 1500 scans, >500 unique users



## Smart tags help in brand protection

- Anti-counterfeiting and extended customer experience
- Pilot with real end users in Montenegro 2018 (wine manufacturer Plantaze): 17 000 tags, >600 users
- Positive feedback from wine manufacturers and consumers
- Adapted for honey jar pilot in Montenegro combined with temperature monitoring





UNIVERSITY  
OF WARSAW



University of  
**Reading**



MEMBER OF  
BASQUE RESEARCH  
& TECHNOLOGY ALLIANCE

**KU LEUVEN**

Smart Tags project  
(2020) targets to  
increase transparency  
and consumer trust in  
the food value chain by  
increasing interactivity  
and information sharing  
between consumers and  
stakeholders with the  
help of smart tags

<https://www.eitfood.eu/projects/smart-tags-for-improving-consumer-interaction-in-food-value-chain-2020>

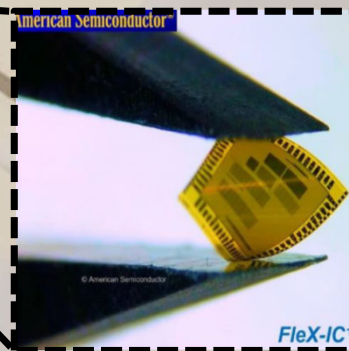
[https://matisiceland.org/smart-tags-pre-pilots-for-monitoring-food-product-conditions/?\\_ga=2.11419828.1882511666.1619598963-1797804897.1606741102](https://matisiceland.org/smart-tags-pre-pilots-for-monitoring-food-product-conditions/?_ga=2.11419828.1882511666.1619598963-1797804897.1606741102)

# Electronic smart tags

- Paper based hybrid electronics
- Sustainable temperature logger tag
- Paper + bare-die ultra-thin RFID temperature sensor chip



Courtesy of American Semiconductor



<https://www.youtube.com/watch?v=CbMFWoooLcQ>

05/05/2021

VTT – beyond the obvious

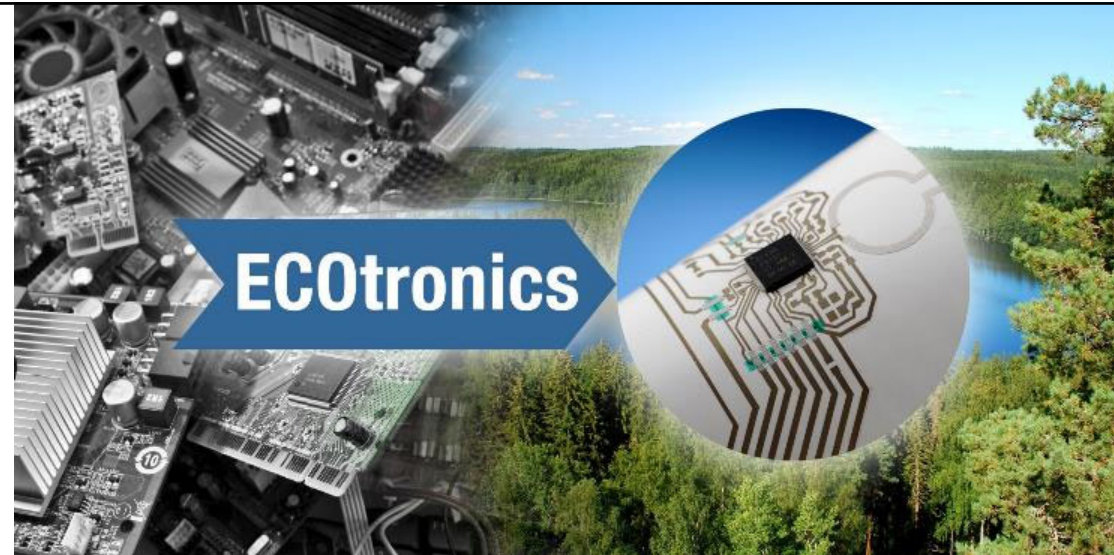




ECOtronic consortium supports renewal of Finnish electronics and optics industry, increases export, and supports development of sustainable electronics and optics throughout their lifecycles.

Sustainability is achieved by

- Selecting highly recyclable and compostable materials
- Promoting environmentally friendly manufacturing technologies to reduce use of materials
- Developing the methodology to recover the materials
- Quantifying the environmental impact of the developed solutions



Combination of expertise from sustainable substrate development, printed and hybrid electronics and optics, and life-cycle assessment & circular economy

- **Research partners:** VTT (coordinator), TAU, LUT, LAMK
- **Industrial partners:** Confidex, GE Healthcare, Green Company Effect, Iscent, New Cable Corporation, Paptic, Stora Enso, Vaisala
- Two-year project 1.8.2019-31.1.2022, ~4.3 M€ budget
- **Contact person:** Liisa Hakola, [liisa.hakola@vtt.fi](mailto:liisa.hakola@vtt.fi)

Follow us: [www.ecotronics.fi](http://www.ecotronics.fi), #ECOtronic

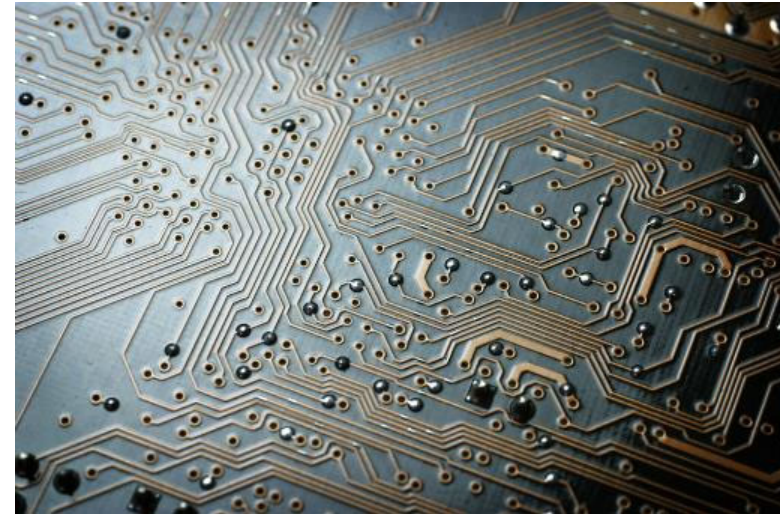


# Two case products with product design



## Intelligent packaging for monitoring food quality

- **Temperature logging label** on bio-based substrate based on printed energy module, temperature monitoring NFC & circuits



## Sensor for monitoring environmental conditions

- **Sensor PCB** on bio-degradable substrate

# Pioneering work in printed paper based hybrid electronics

**Wireless sensor devices on a paper surface** which are manufactured by using **high-end and low-cost printing techniques.**

- Open/close detection in shipping of valuable goods
- Humidity and temperature sensing in shipping of precious goods (paper-based humidity sensors)
- Tracking and tracing of registered post



**EU FP7 ROPAS (2011-2015)**

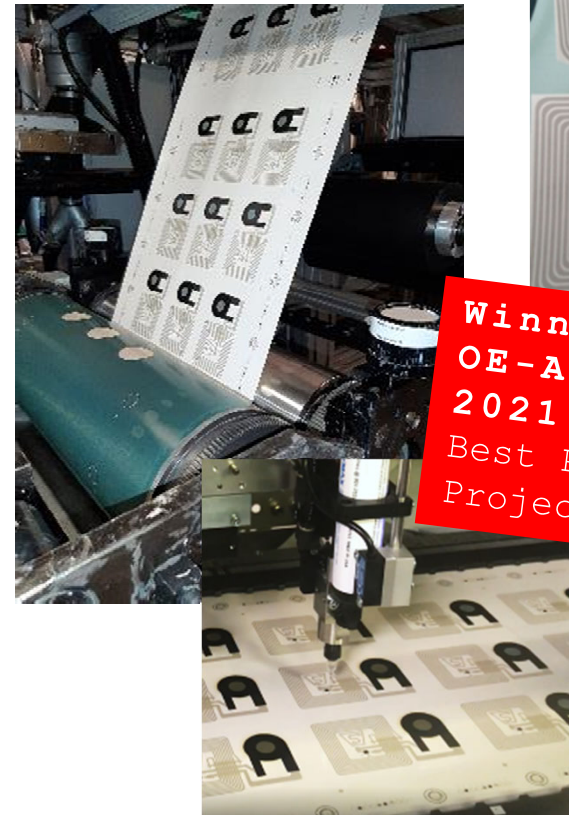
# Scale-Up of Printed Electronics Recyclable SMART materials

- Industrialization of high-performance key materials in order to secure the electronic material supply chain for printed electronics
- Anti-counterfeit label demonstrator
  - Electrochromic display & NFC tag
  - Paper substrate
  - Fully R2R processed at VTT
  - 12 printed layers + assembled chip



SUPERSMART

[www.supersmart-project.eu](http://www.supersmart-project.eu), 2018-2020



Winner of the  
OE-A Competition  
2021  
Best Publicly Funded  
Project Demonstrator

# bey<sup>0</sup>nd

## the obvious

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