

TREND 2022

14.–17.02.2022,
Novi Sad, Srbija



Broj rada: T1.4-17

DESIGN-WITH-IOT AND DESIGN-FOR-AUTOMATION: A PROPOSAL FOR PRODUCT DEVELOPMENT ORIENTED FOR EXCELLENCE

Prof. Rogério Dionísio, PhD and Prof. Pedro Torres, PhD

Polytechnic Institute of Castelo Branco
Castelo Branco, Portugal



XXVIII Skup TRENDOVI RAZVOJA: "UNIVERZITETSKO OBRAZOVANJE ZA PRIVREDU"
TREND 2022, Kopaonik, Srbija, 14–17.02.2022.

Brief summary



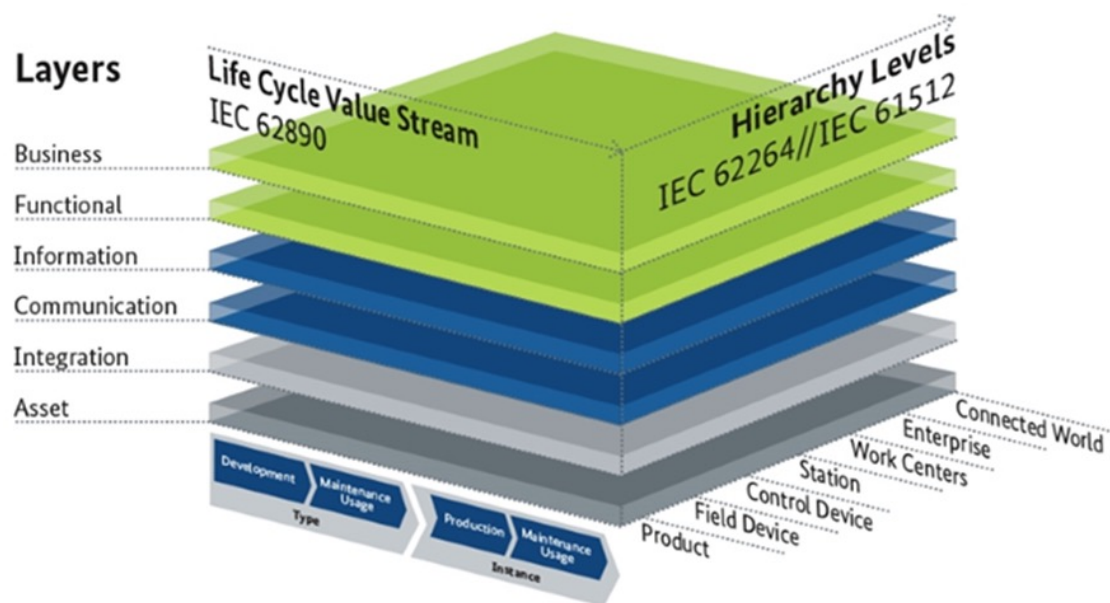
- ▶ This work presents two methodologies for the design and development of new products
 - Design-with-IoT (DwIoT) that aims to integrate IoT technology into products, focusing on a set of guidelines for its implementation.
 - Design-for-Automation (DFA), important in the development of new automation-oriented products in an industry 4.0 context.
- ▶ Case Study
 - Label loom machine retrofitting, using DwIoT and DFA methodologies.

1. Introduction



New Challenges

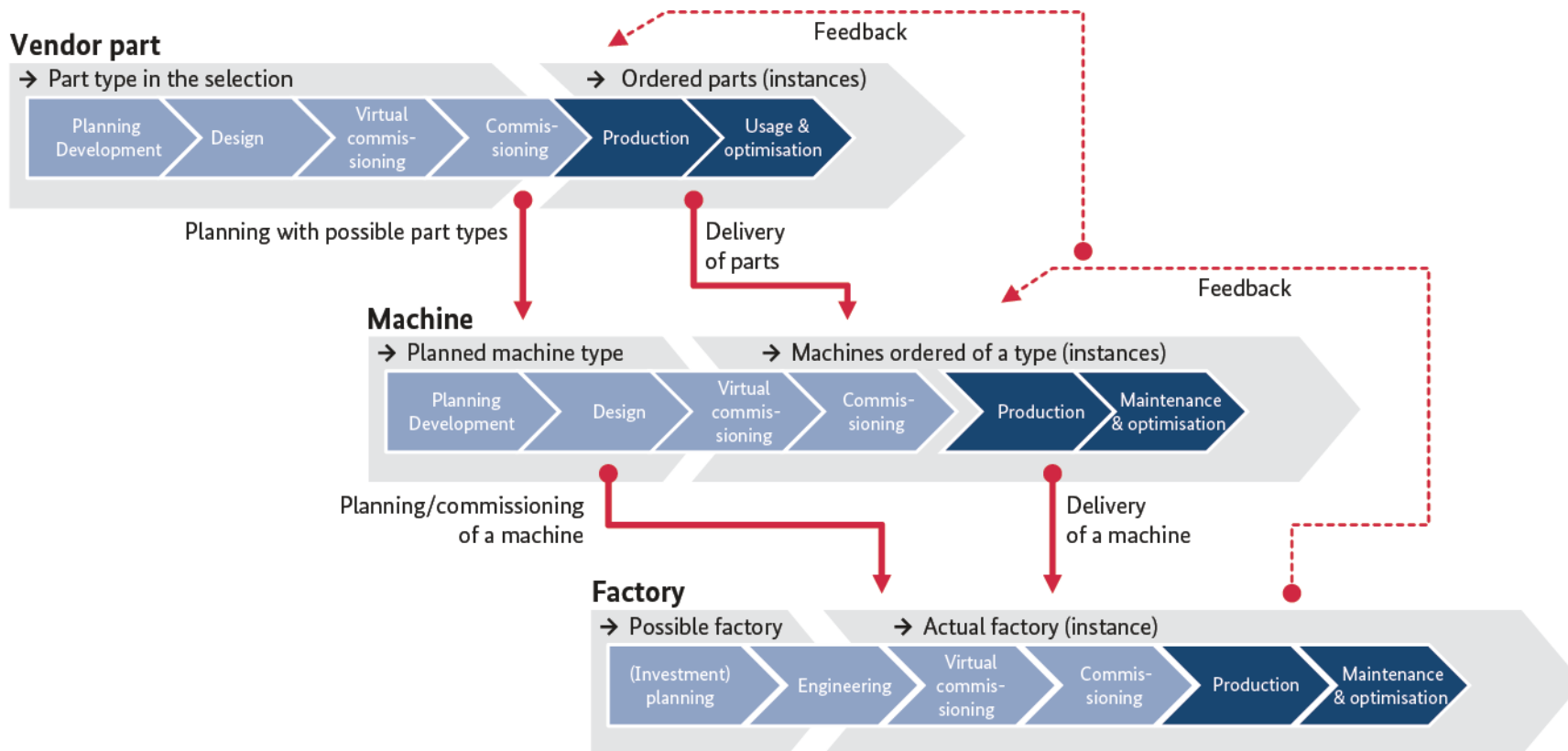
- Changes to the linear model of the product life cycle;
- Products as a services (Industry 4.0);
- Emerging technologies:
 - Additive Manufacturing;
 - Advanced Robotics;
 - Virtual and Augmented Reality;
 - Industrial IoT;
 - OPC-UA.
- Reference Model – RAMI
 - Product Life Cycle management



1. Introduction



Typical cross-linking of the life cycles of supplied part, machine and factory – as type and instance respectively



Source: ZVEI SG Modelle und Standards



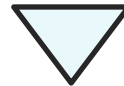
1. Introduction



Lean Design-for-X Methodology: Multidimensional Assessment

Pillar 1

Product break down using the *Modular Design* principles



Pillar 2

Selection of the relevant variables for each “X” domain, and specific KPI’s.



Pillar 3

Simple Visual Management elements



Pillar 4

Determine the aggregated efficiency and effectiveness for each sub-module > module > system > product (Bottom-up analysis)

Design-for-Automation



- Increase efficiency without sacrificing quality;
- Make it durable, testable and reliable;
- Eliminate the surprise factor;

How to do this → Automation and Robotics

XXVIII Skup TRENDOVI RAZVOJA: "UNIVERZITETSKO OBRAZOVANJE ZA PRIVREDU"
TREND 2022, Kopaonik, Srbija, 14–17.02.2022.

2. Design-with-IoT



- ▶ Testing and scalability;
- ▶ Security;
- ▶ Integrated into product;
- ▶ Responsible use of data;
- ▶ Troubleshooting;
- ▶ Context awareness;



DwIoT will have huge implications for the near future -> Electronics that are not smart will be discarded.

4. Conclusions



- ▶ Traditional concepts of automation based in hardware, with hierarchical communications that originated isolated products can now evolve with DFA to methodologies into flexible systems and machines.
- ▶ Consumers will automatically assume that an "electronic" product means "intelligent and combined with integrated connectivity". DwIoT integrates IoT in the product design to overcome this situation and to meet the expectations of consumers.

5. References



- [1] Industrial design in the age of IoT - Bosch Connected World Blog. <https://blog.bosch-si.com/internetofthings/industrial-design-in-the-age-of-iot>.
- [2] Designing the IoT: Best Practices and Examples. <https://onix-systems.com/blog/designing-the-internet-of-things-best-practices-and-examples>.
- [3] IoT Design: These are the principles you have to remember. <https://concisesoftware.com/iot-design-principles/>.
- [4] 7 design principles for IoT — Futurice. <https://futurice.com/blog/7-design-principles-for-iot>.
- [5] Johansson, J. (2008), Design Automation Systems for Production Preparation: Applied on the Rotary Draw Bending Process.
- [6] S. V Nath, A. Dunkin, M. Chowdhary, and N. Patel (2020), Industrial Digital Transformation: Accelerate digital transformation with business optimization, AI, and Industry 4.0. Packt Publishing.
- [7] 5 Rules for Designing for Automation. <https://www.industryweek.com/technology-and-iiot/article/22027527/5-rules-for-designing-for-automation>.
- [8] Ezolino, Juan Stefano (2016), "Design for automation in manufacturing systems and processes", Thesis: M.B.A., Massachusetts Institute of Technology, Sloan School of Management, and the MIT Department of Mechanical Engineering.
- [9] Principles of Design for Automated Manufacturing. <https://www.freshconsulting.com/insights/blog/principles-of-design-for-automated-manufacturing>.

6. Contacts



- Rogério Dionísio
- Polytechnic Institute of Castelo Branco
- Faculty of Technology
- Castelo Branco, Portugal
- email: rdionisio@ipcb.pt



- Pedro Torres
- Polytechnic Institute of Castelo Branco
- Faculty of Technology
- Castelo Branco, Portugal
- email: pedrotorres@ipcb.pt

