



# Analytical Laboratories in the Industry 5.0

João M. da Costa Sousa

# Industry 5.0

- Human-centric
- Sustainable
- Resilient

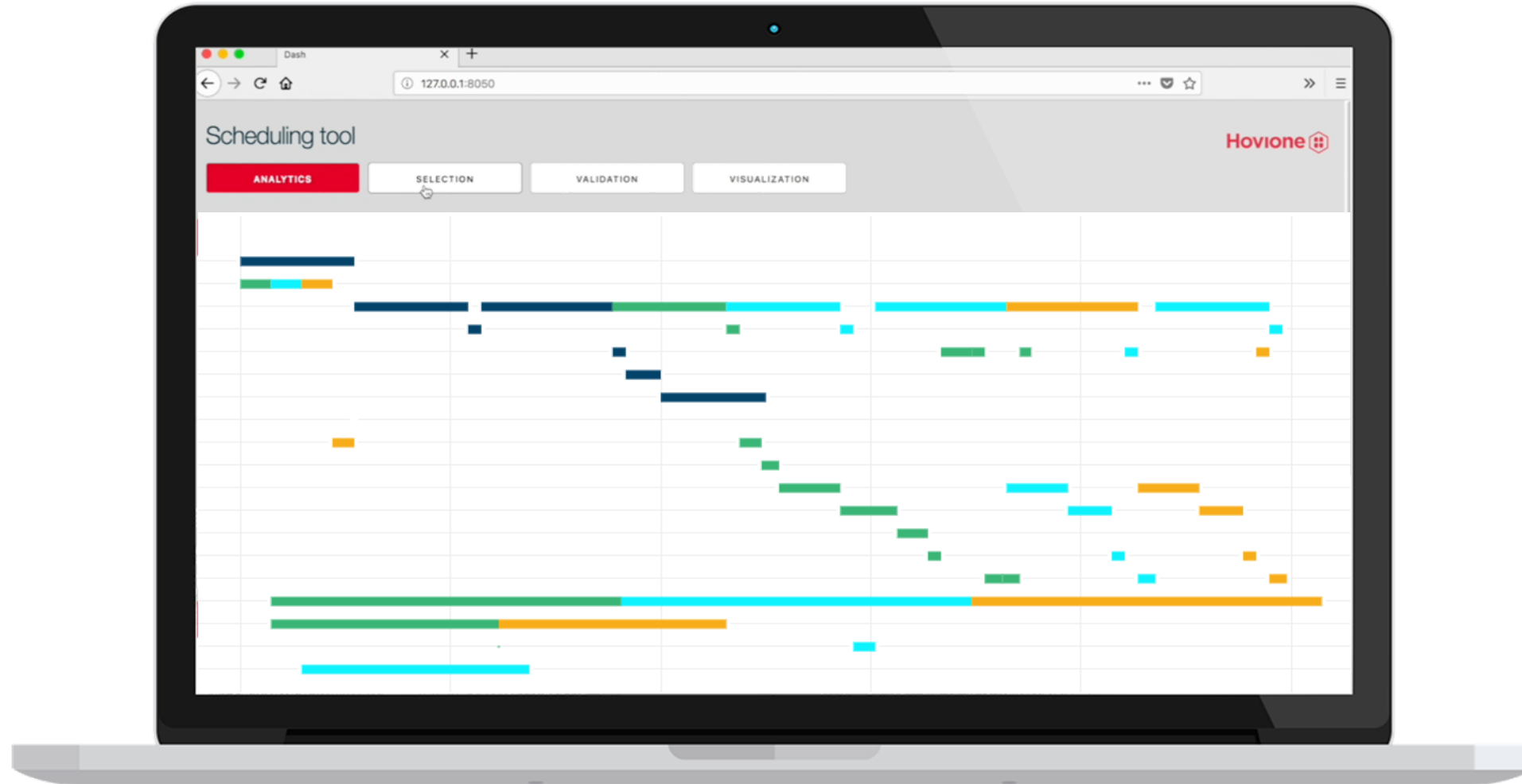


# Analytical Laboratories 5.0

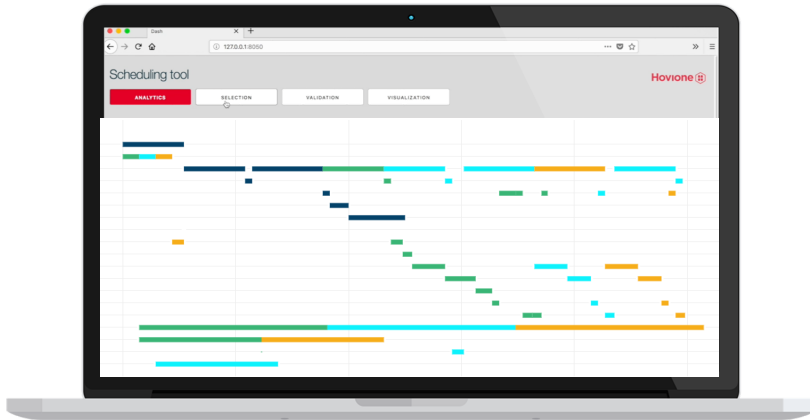
- Increase efficiency making an optimized use of human resources and lab equipment in an Industry 5.0 framework.
- Perform robust and resilient planning and scheduling to manage analytical labs
- Intelligent automation of laboratory tasks
- Team of 20+ researchers from both Hovione and Técnico/IDMEC
- Budget: 1,386,000 € for 3½ years



# Planning and Scheduling



# Planning and Scheduling



International Journal of Production Research



ISSN: (Print) (Online) Journal homepage: <https://www.tandfonline.com/loi/tprs20>



## Pharmaceutical quality control laboratory digital twin – A novel governance model for resource planning and scheduling

Miguel R. Lopes , Andrea Costigliola , Rui Pinto , Susana Vieira & Joao M.C. Sousa

Lopes , Andrea Costigliola , Rui Pinto , Susana Vieira & Joao M.C. quality control laboratory digital twin – A novel governance model for ling, International Journal of Production Research, 58:21, 6553-6567, 1683250

Journal of Manufacturing Systems 62 (2022) 270–285



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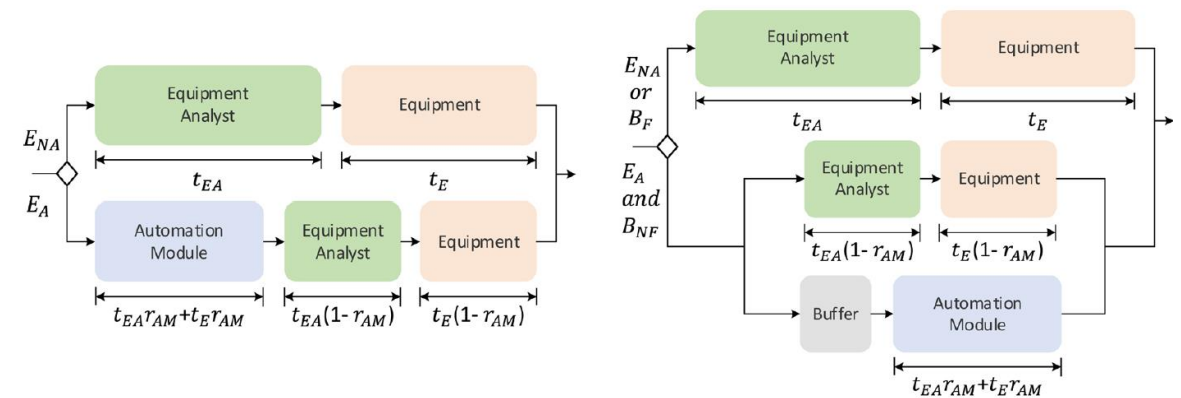
Technical Paper

## Assessing the impact of automation in pharmaceutical quality control labs using a digital twin

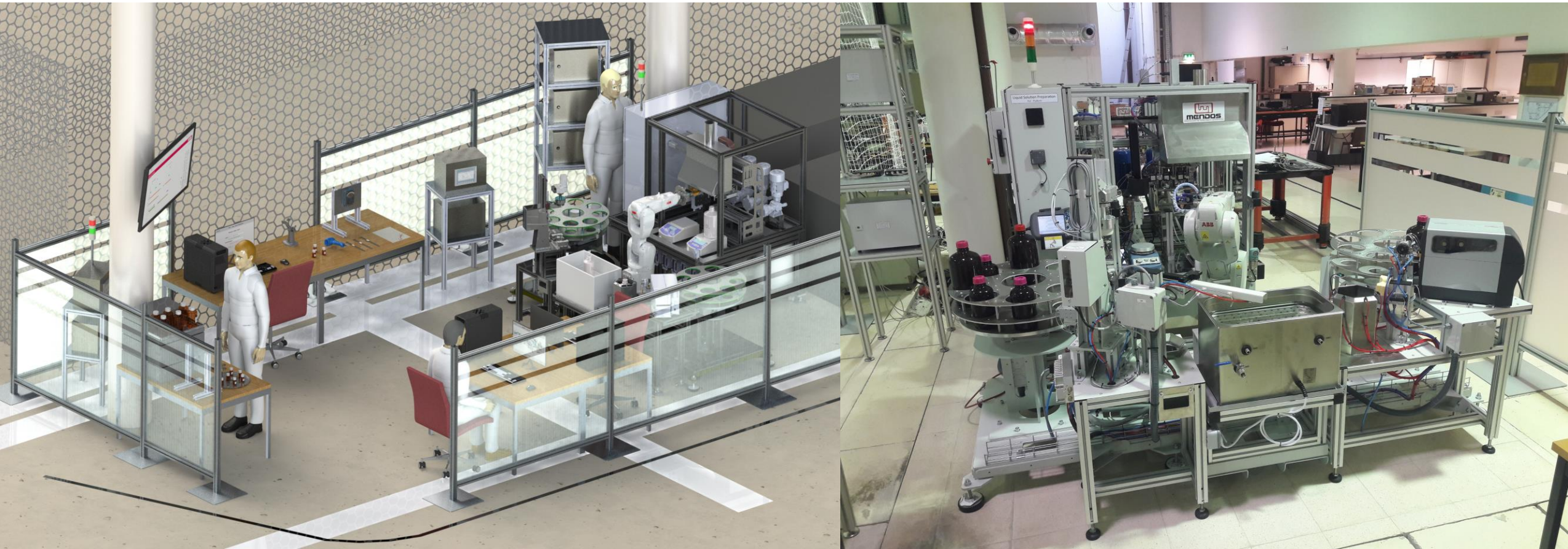
Tiago Coito <sup>a,\*</sup>, Miguel S.E. Martins <sup>a</sup>, Bernardo Firme <sup>a</sup>, João Figueiredo <sup>b</sup>, Susana M. Vieira <sup>a</sup>, João M.C. Sousa <sup>a</sup>

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# Intelligent Automation



# Intelligent Automation



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Computers in Industry

journal homepage: [www.elsevier.com/locate/compind](http://www.elsevier.com/locate/compind)



## A Middleware Platform for Intelligent Automation: An Industrial Prototype Implementation

Tiago Coito<sup>a,\*</sup>, Miguel S.E. Martins<sup>a</sup>, Joaquim L. Viegas<sup>a</sup>, Bernardo Firme<sup>a</sup>, João Figueiredo<sup>b</sup>, Susana M. Vieira<sup>a</sup>, João M.C. Sousa<sup>a</sup>

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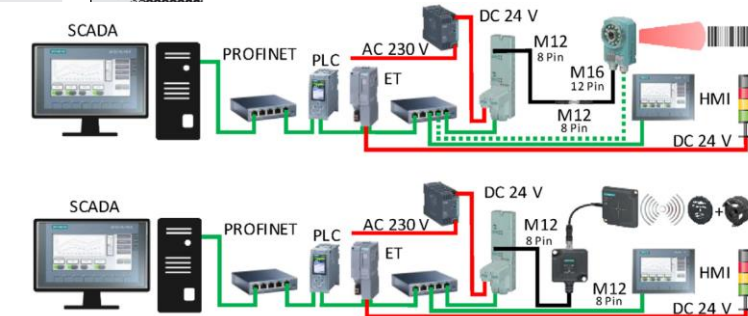


Fig. 8. PLC-Platform.



Article

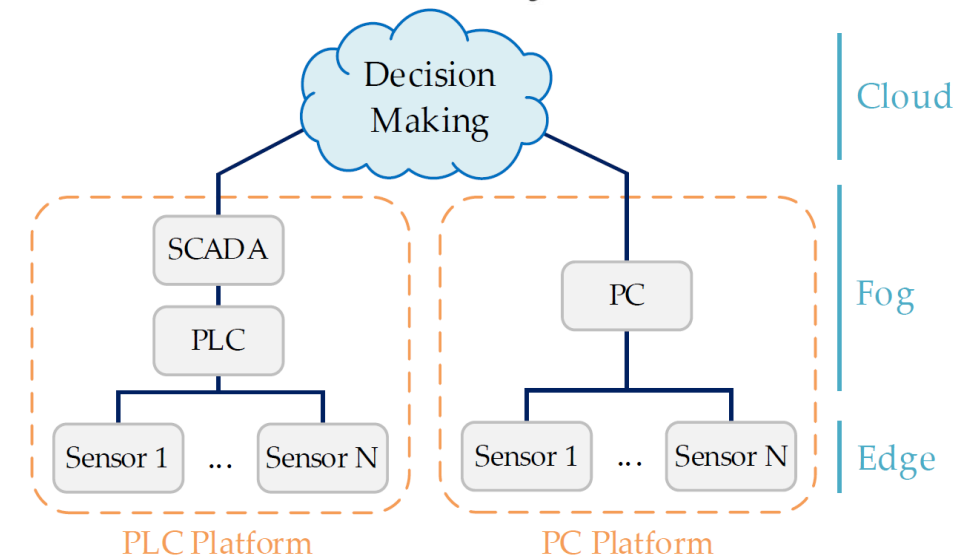
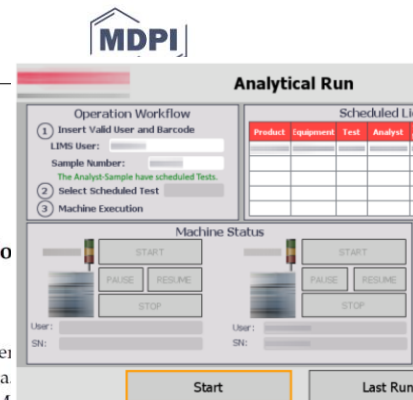
## Intelligent Sensors for Real-Time Decision-Making

Tiago Coito<sup>1,\*</sup>, Bernardo Firme<sup>1</sup>, Miguel S. E. Martins<sup>1</sup>, Susana M. Vieira<sup>1</sup>, João Figueiredo  
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