Systems and Productivity Metrics – a Review

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✱ Short resume of the presenter

Mauro Almeida has a degree in Computer Engineering and is a Master's student in Software Development and Interactive Systems at the organization Polytechnic Institute of Castelo Branco.

In the last 3 years has worked as a Java programmer at ITSector.

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Systems and Productivity Metrics – a Review

❈ Introduction

Best organizational decisions require an analysis of the organization's data.

IoT solutions and computer solutions collect thousands of data every day and help us optimize and analyze.

Based in the PRISMA methodology a review was performed, of the scientific literature on the use of IoT technologies to support productivity metrics.

This review address some consistent positive evidence on the use of Internet of Things (IoT) technologies to support productivity metrics in industry.

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✸ Roadmap

State of art	• Research and survey of scientific articles (*"IEEE Xplore", "ACM Digital", and Scopus" databases*)

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Research and survey of scientific articles

Preparation:

The review includes the following topics:

1. **Research questions**

2. **Inclusion criteria**

3. **Search strategy**

4. **Results**

5. **Data Extraction and Data Analysis**

6. **Discussion**

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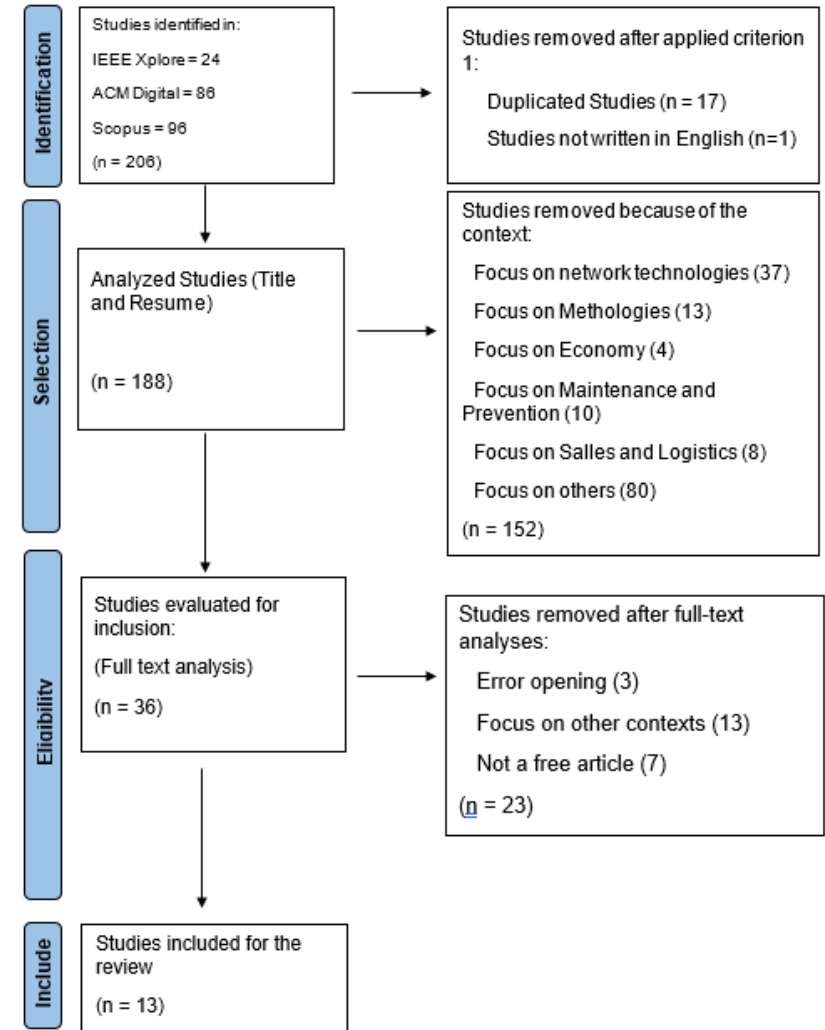**Research and survey of scientific articles**

***Research questions*:**

- (Q1) What systems exist to measure productivity?

- (Q2) What kind of metrics are used to collect information?

- (Q3) What kind of frameworks/tolls allows the data collection?

- (Q4) What data analysis and visualization tools are possible and used?

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Results

Figure 1 - Flow diagram for systematic reviews (PRISMA)

Identification

Studies identified in:

IEEE Xplore = 24

ACM Digital = 86

Scopus = 96

(n = 206)

Studies removed after applied criterion 1:

Duplicated Studies (n = 17)

Studies not written in English (n=1)

Selection

Analyzed Studies (Title and Resume)

(n = 188)

Studies removed because of the context:

Focus on network technologies (37)

Focus on Methologies (13)

Focus on Economy (4)

Focus on Maintenance and Prevention (10)

Focus on Salles and Logistics (8)

Focus on others (80)

(n = 152)

Eligibility

Studies evaluated for inclusion:

(Full text analysis)

(n = 36)

Studies removed after full-text analyses:

Error opening (3)

Focus on other contexts (13)

Not a free article (7)

(n = 23)

Include

Studies included for the review

(n = 13)

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Data Extraction and Data Analysis

Table 1 – Extracted data

Study	Metrics	Technologies	Data visualization
Data visualization on the internet of things: tools, methodologies, and challenges [1]	N/A	N/A	Tableau, Thingsboard, Plotly, IBM Watson IoT Platform, Power BI, Kibana Tool, JavaScript libraries, etc
An Industrial IoT Solution for Evaluating Workers' Performance Via Activity Recognition [3]	Productive and non-productive work time	Wearable Technologies, Cams, RFID, NFC, Bluetooth Low Energy Sensor	Andon Systems
Designing usable interfaces for the industry 4.0 [4]	N/A	N/A	Andon Systems and Stacked Bar, Line and Ring Graphs
Microservice architecture in industrial software delivery on edge devices [5]	N/A	Microservices and Pipeline	N/A
Modelling and assessing the effects of digital technologies on KPIs in manufacturing systems [6]	Overall Equipment Effectiveness (OEE), Time, Quality, Product Quantity	RFID, VR (Virtual Reality)	N/A
Key performance indicators in the production of the future [7]	Data Management, Transparency and networking, Product Management	Profitability-Liquidity KPI system, DuPont System of Financial Control	N/A
…	…	…	…

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Discussion:

(Q1) What systems exist to measure productivity?

R: Systems can be divided into two groups: the first group belongs to the general systems, which serve as a solution for various business ideas. The second group refers to the dedicated systems developed to respond to a given problem.

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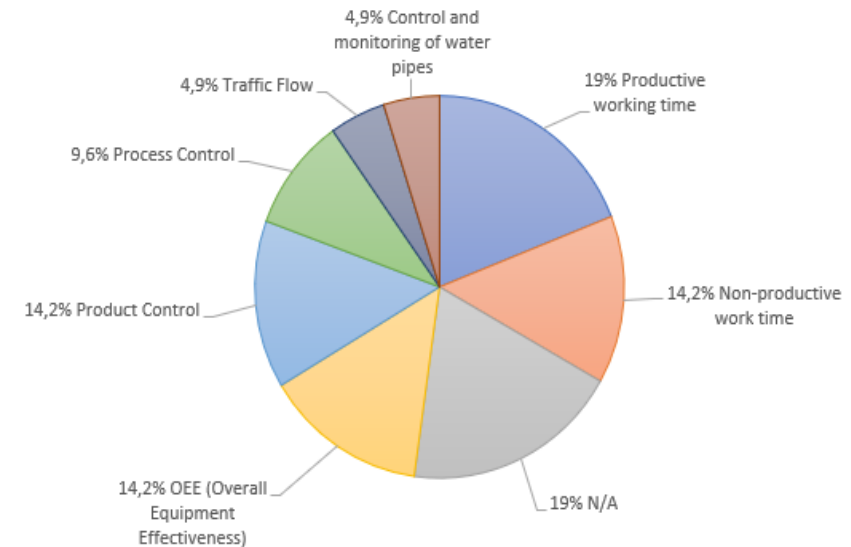
Research and survey of scientific articles

Discussion:

(Q2) What metrics are used in the collection of information?

R: Metrics to be used were dependent on the type of analysis desired. Metrics can refer to equipment but also the employees.

Most referenced metrics: process control, product tracking and quality

(others also mentioned: OEE, movement speed, distances travelled, productive and non-productive working time and water pressure)

- 4,9% Control and monitoring of water pipes
- 4,9% Traffic Flow
- 9,6% Process Control
- 14,2% Product Control
- 14,2% OEE (Overall Equipment Effectiveness)
- 19% Productive working time
- 14,2% Non-productive work time
- 19% N/A

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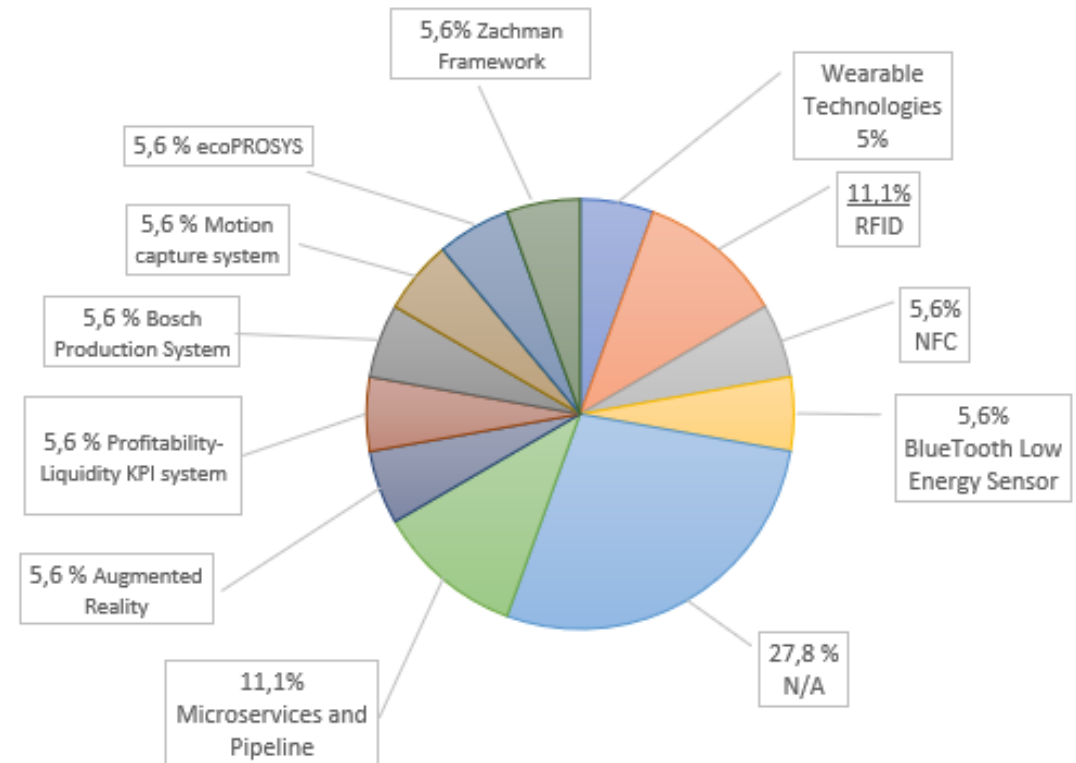# Systems and Productivity Metrics – a Review

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Discussion:

(Q3) What frameworks/tools are used to collect information?

R: Although there are some dedicated frameworks for collecting information, there are many other things developed for a given case study, being almost dedicated systems, only developed to respond to a particular problem.

5,6% Zachman Framework
Wearable Technologies 5%
5,6 % ecoPROSYS
11,1% RFID
5,6 % Motion capture system
5,6% NFC
5,6 % Bosch Production System
5,6% BlueTooth Low Energy Sensor
5,6 % Profitability-Liquidity KPI system
27,8 % N/A
5,6 % Augmented Reality
11,1% Microservices and Pipeline

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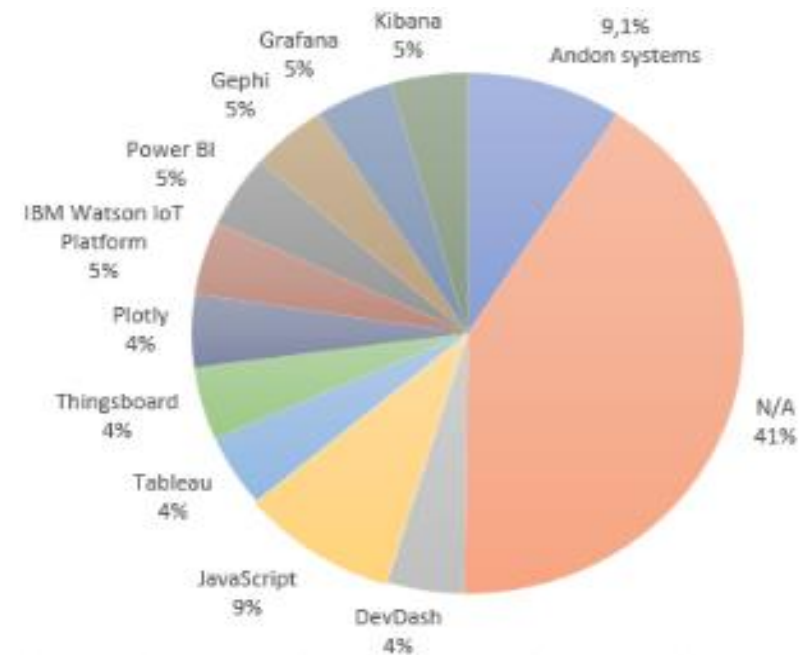# Systems and Productivity Metrics – a Review

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Discussion:

(Q4) What data analysis and visualization tools are possible and used?

R: Tools and graphics in the framework or application itself.

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❋ **CONCLUSIONS**

- Production control systems are complex.

- Technologies can be used, such as the use of contact technologies or the collection of information through sensors, using IoT technologies.

- KPIs are the focus in what concerns the search to improve productivity factors, resulting from metrics and information analysis.

- IoT can be used, associating platforms for data visualization and analysis that allow productivity to be improved.

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End

Thank you

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