



WAREHOUSE MANAGEMENT

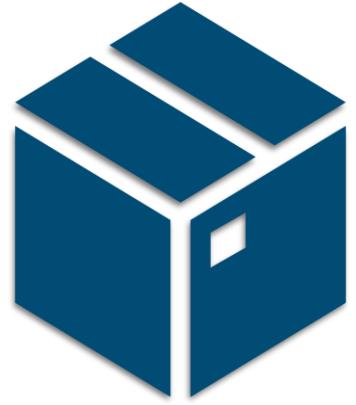
SEBASTIAN STACHOWIAK, MSC ENG.

AGENDA

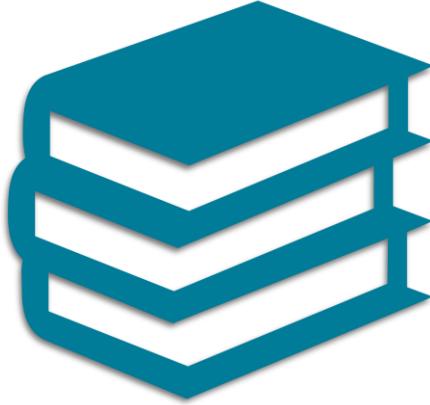
- Introduction
- Warehouse Management Systems
- Warehouse processes digitizing
- Abstraction in IT

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Practice



Science



Applied Doctorate

INTRODUCTION

INTRODUCTION

- A few words about you?

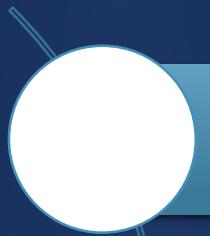
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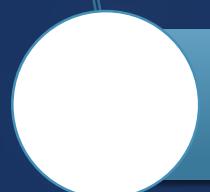
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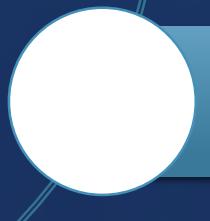
WAREHOUSE MANAGEMENT



Warehouse characteristics

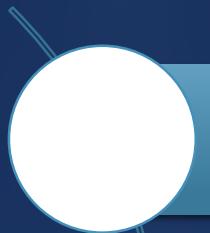


Warehouse functions

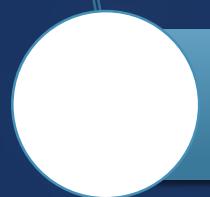


WMS

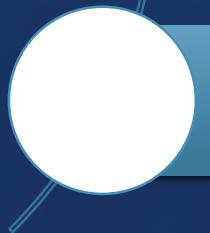
WAREHOUSE MANAGEMENT



Warehouse characteristics



Warehouse functions



WMS



WAREHOUSE MANAGEMENT SYSTEMS

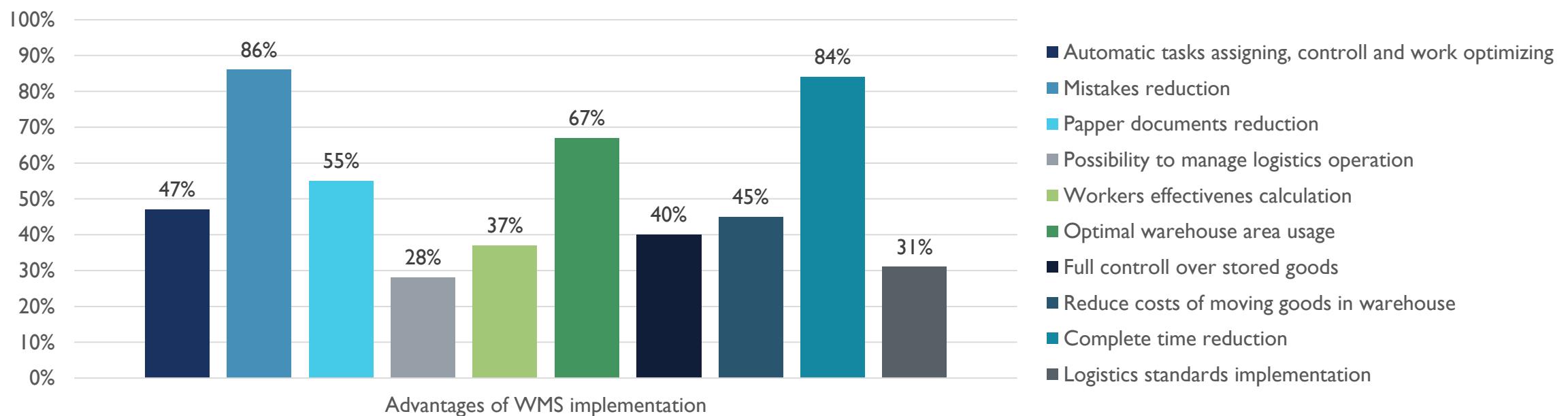
Environment

Factor	Value	Reason
Size of a company	Medium-sized and large enterprises	Cost of an implementation is quite large
Amount and sizes of Logistics processes	Scale of the served Logistics processes is big enough	Profit from implementation has to cover costs
Companies' needs	Improvement area of warehouse management	Research*

Own work based on Jurczak, M. (2019), p. 26-32

ADVANTAGES

Polish nationwide WMS user research (Ogólnopolskie Badanie Użytkowników Systemów WMS)



Own work based on <https://www.erp-view.pl/wms/20376-polski-rynek-wms-pod-lup-consafe-logistics.html>, 2019

WMS FUNCTIONS

Analysis and investigation

Optimization and improvement

WMS FUNCTIONS



WMS MODULES

WMS I

- Goods receipts improvement
- Facilitation of localization and goods issue
- Easy integration with other systems
- Automation of the workflow of documents and reports
- Inventory double time reducement
- HR problems resolutions

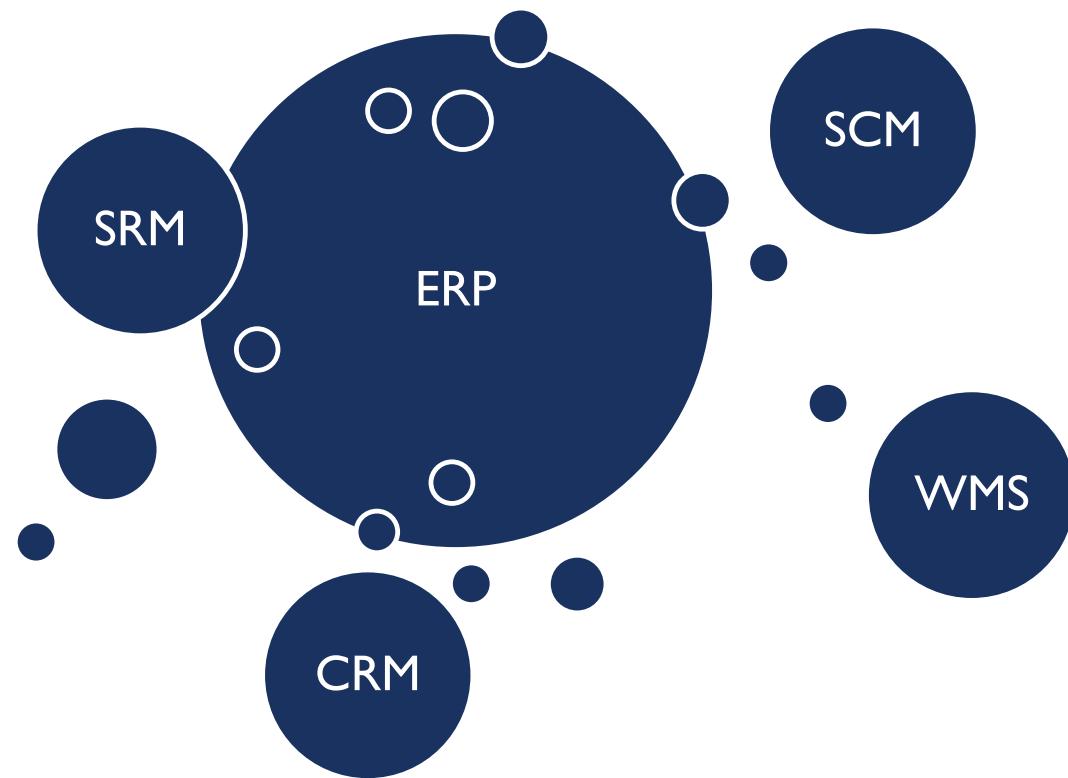
WMS A

- Management of goods received
- Management of locations in the pallet flow racks
- Stock control
- Dispatch of goods

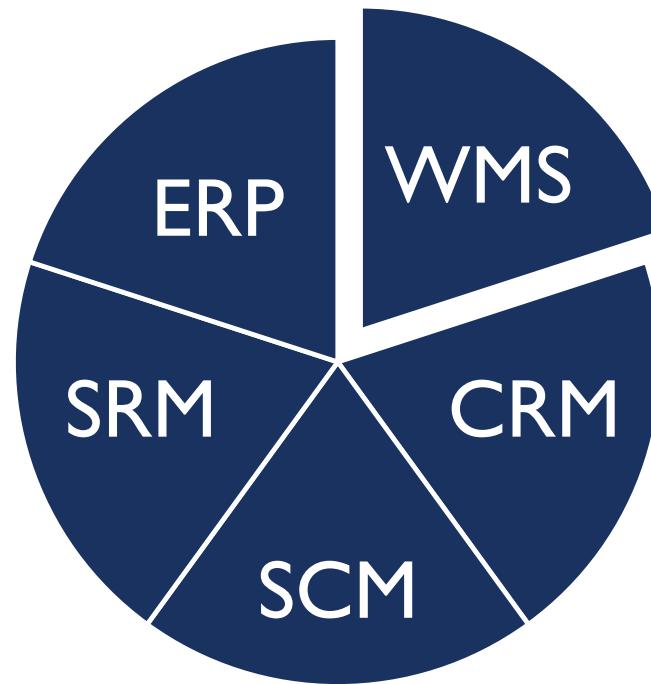
<https://jmblab.com/pl/system-wms/>

<https://www.interlakemecalux.com/warehouse-manual/the-warehouse/what-is-warehouse-management-system-wms>

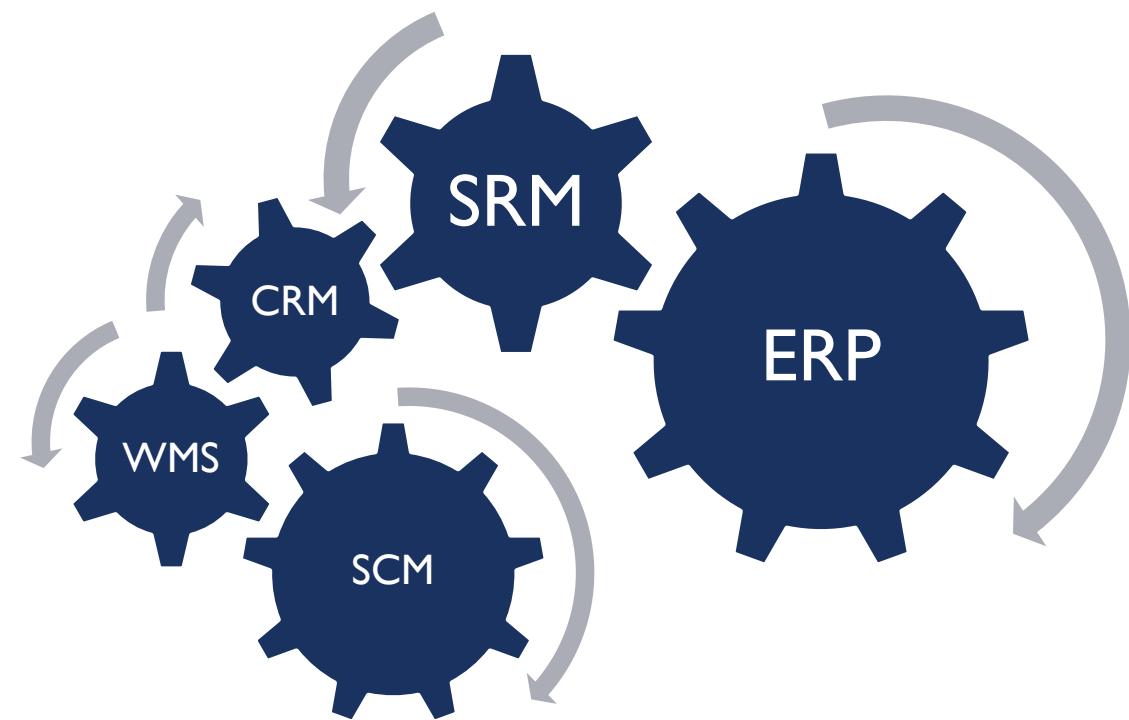
WMS IN ENTERPRISE AND SURROUNDINGS



WMS IN ENTERPRISE AND SURROUNDINGS



WMS IN ENTERPRISE AND SURROUNDINGS



TECHNOLOGIES USED IN WMS



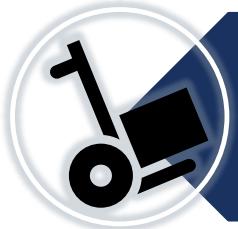
Communication

- Wireless (e.g. WiFi, Bluetooth, GSM)
- Wired



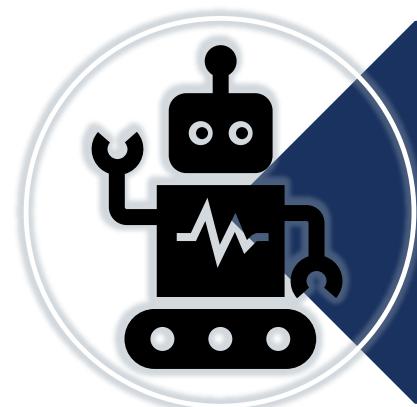
Identification

- RFID
- Barcode (e.g. 1D, 2D)



Completion

- Pick by light
- Pick by voice
- AR (Augmented reality)



Internet of Things

RFID



AUGUMENTED REALITY (CARTOON RELEASED 1989-1996)



AUGMENTED REALITY



AUGMENTED REALITY

Meet

Apple Glass



SUMMARY



System expectations

- High speed and high efficiency of warehouse processes
- Lower costs
- Decision making support
- Integration (with other systems)



The most important

- System has to be adjusted to the needs of the company

Jurczak, M. (2019), s 26-32

Mao, J., Xing, H., & Zhang, X. (2018), p. 1355-1367

AGENDA

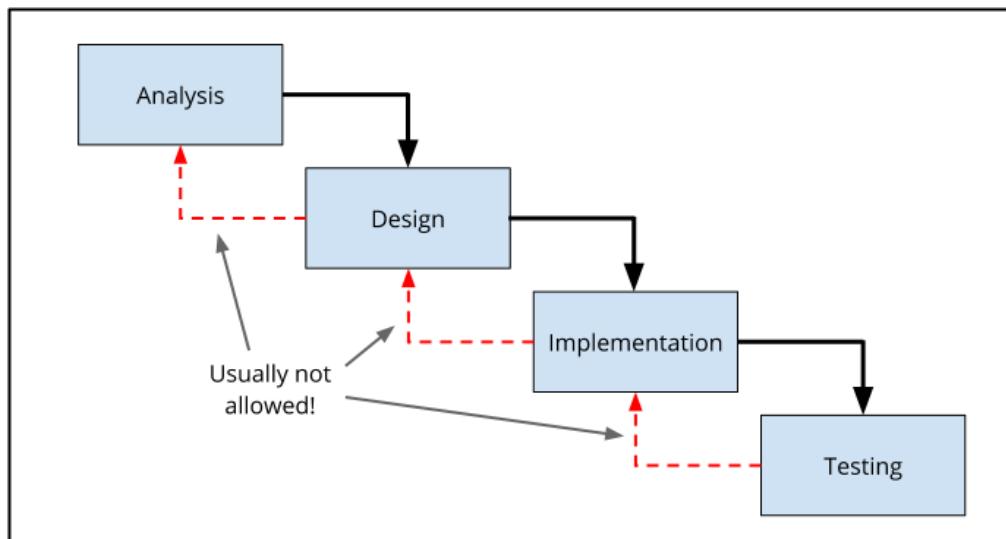
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SOFTWARE ENGINEERING

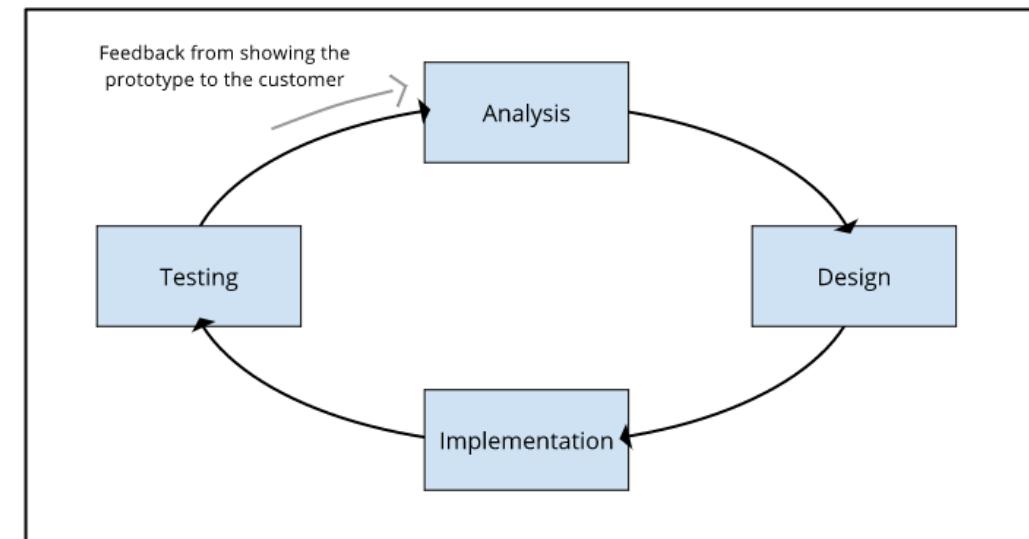
Waterfall



The waterfall process

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Agile software development



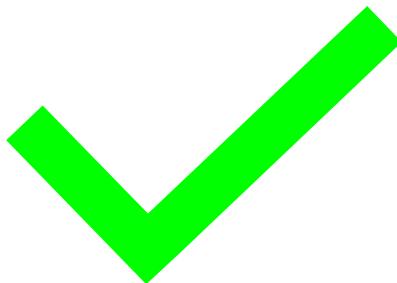
Iterative software development

[To zdjęcie](#), autor: Nieznany autor, licencja: [CC BY-SA-NC](#)

ANALYSIS

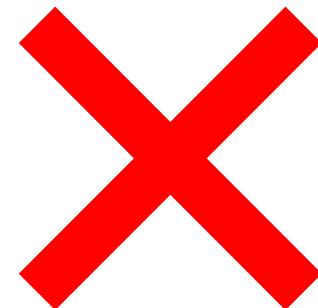
Analysis

What do you need?
How does it work?



Design

How it looks like?



REQUIREMENTS

Functional

- “a function that a system (...) must be able to perform”,
- “what the product must do”,
- “what the system should do”

Glinz, M. (2007, October), p. 21

Non-functional

Glinz, M. (2007, October), p. 25

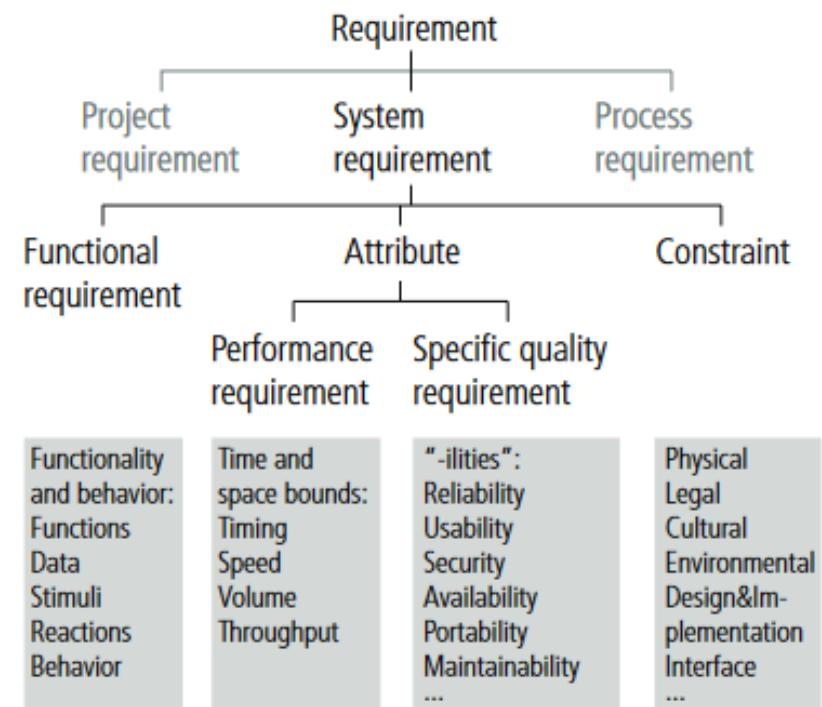


Figure 2. A concern-based taxonomy of requirements

DOCUMENTS

Use Cases

- System Boundary
- User scenario

User Stories

- Informal description of user possibilities

BPMN diagrams

- Process flow

Test Cases

- Steps to execute in defined environment with particular results

UML

- 17 types of diagrams, system models

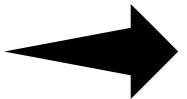
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ABSTRACTION



ABSTRACTION - EXAMPLES

2 BHK Typical Floor Plan
Even Floors



ECO-G 100 4x2

fabryczna instalacja LPG

skrzynia manualna

Już od 83 800 zł

CHARAKTERYSTYKA

Liczba biegów do przodu 6

Maksymalny moment obrotowy w Nm 160

Emisja CO₂ cykl mieszany WLTP (g/km) 125-127 (143-145)

Zużycie paliwa cykl mieszany WLTP (l/100 km) 7,8 (6,4)

Wybierz ten silnik

TCe 90 4x2

benzyna

skrzynia manualna

Już od 79 900 zł

CHARAKTERYSTYKA

Liczba biegów do przodu 6

Maksymalny moment obrotowy w Nm 160

Emisja CO₂ cykl mieszany WLTP (g/km) 138-140

Zużycie paliwa cykl mieszany WLTP (l/100 km) 6,1-6,2

Wybierz ten silnik

TCe 130 4x2

benzyna

skrzynia manualna

Już od 89 500 zł

CHARAKTERYSTYKA

Liczba biegów do przodu 6

Maksymalny moment obrotowy w Nm 240

Emisja CO₂ cykl mieszany WLTP (g/km) 141

Zużycie paliwa cykl mieszany WLTP (l/100 km) 6,2

Wybierz ten silnik

ABSTRACTION - EXAMPLES

Single cabin



Crafter Podwozie z pojedynczą kabiną

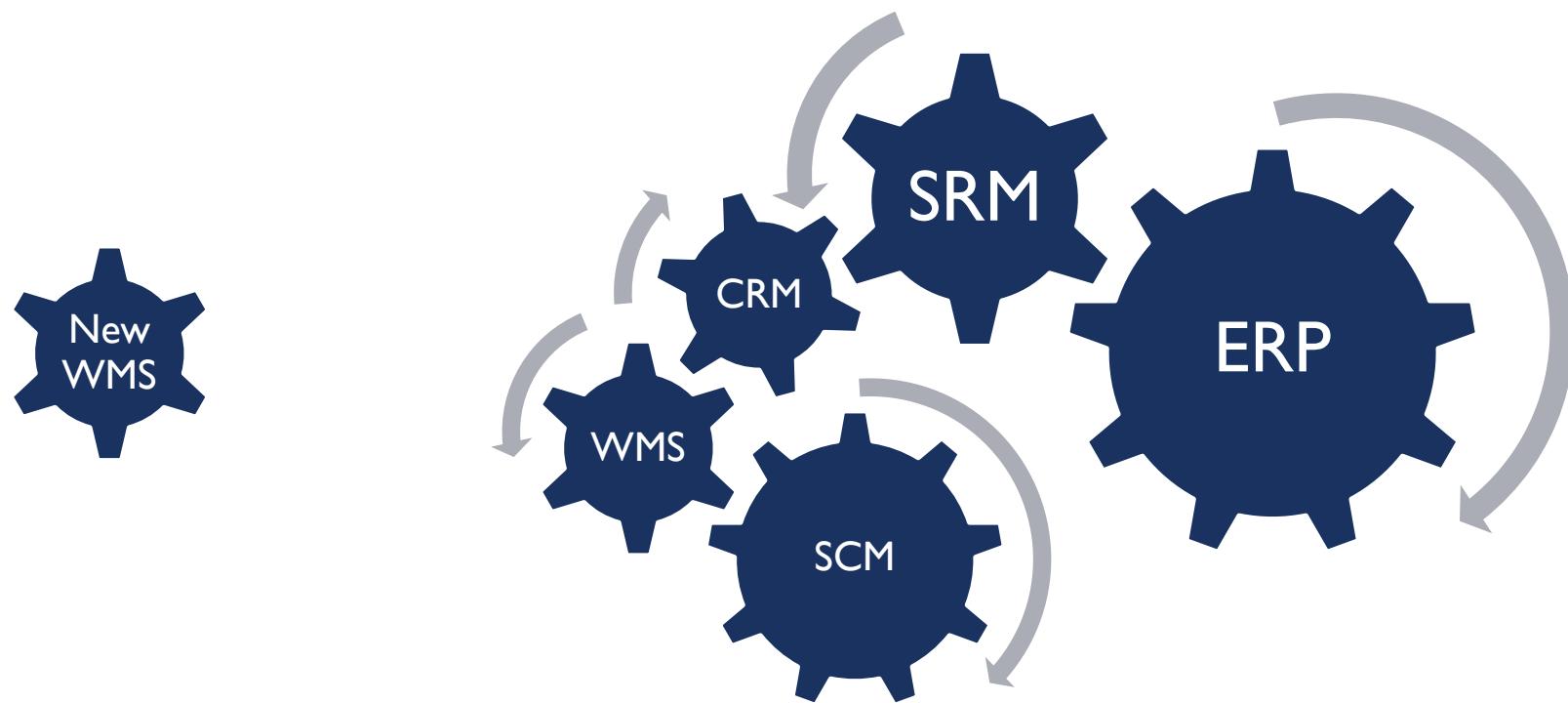
<https://www.vwdostawcze.pl/pl/modele/crafter-podwozie.html>

Double cabin



Crafter Podwozie z podwójną kabiną

WMS IN ENTERPRISE AND SURROUNDINGS



ABSTRACTION

- Standards allow us to use abstraction
- Window in a house project, engine in a car or even same chassis in a different car models.
- WMS interface – it does not matter which solution will be applied



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THANK YOU!

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