

# INFORMACIJSKI SISTEMI ODRŽAVANJA

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**Zavod za industrijsko inženjerstvo**

**Seminar - Zenica, 08.04.2014.**



**UDRUŽENJE DRUŠTVO ODRŽAVALACA U BIH**



**UNIVERZITET U ZENICI**  
**MAŠINSKI FAKULTET**



**EKONERG d.o.o. Zagreb**

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- 1. IZBOR DOBAVLJAČA CMMS RJEŠENJA**
- 2. USPOREDBA I IZBOR CMMS RJEŠENJA**
- 3. TRENDIVI RAZVOJA**

# 1. IZBOR DOBAVLJAČA CMMS RJEŠENJA

## Pitanja?

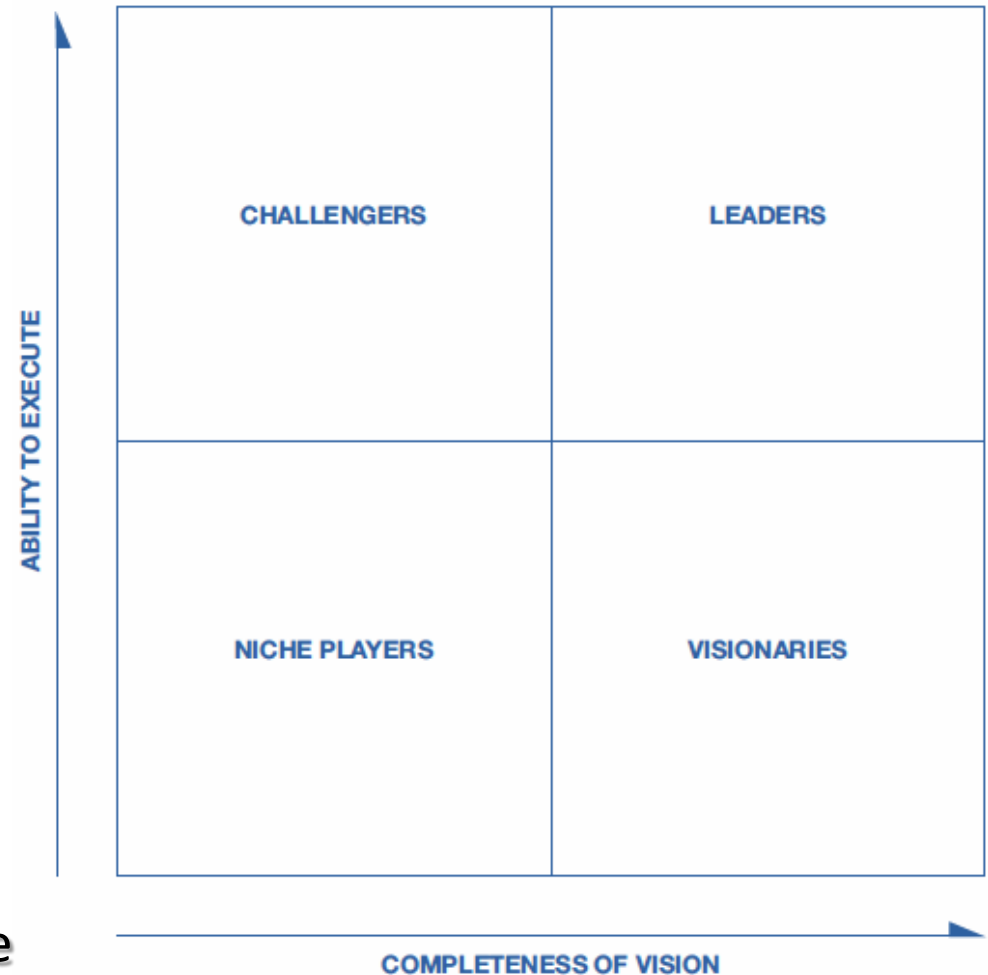
- Tko su 'glavni i ozbiljni igrači' na **CMMS** tržištu?
- Na kojeg od njih mogu računati na duži rok?
- Koji od njih ima najkraće vrijeme odziva?
- Kakva je podrška korisnicima?
- ...

## Rješenje?

- **Gartner** MAGIČNI KVADRAT

- **Gartner**® – je vodeća svjetska analitička tvrtka iz područja informacijskih tehnologija, te neupitni autoritet u generiranju mišljenja, stavova i procjena za sveukupno IT tržište.
- **Magični kvadrat** pruža 2D grafički prikaz pozicioniranja četiri vrste konkurentnih dobavljača CMMS rješenja, gdje je rast tržišta visok a dobavljače razlikujemo kao:
  - ✓ *Challangers*
  - ✓ *Niche Players*
  - ✓ *Leaders*
  - ✓ *Visionaries*

- **Challengers** – dobro izvršavanje zacrtane vizije, dominacija u velikom segmentu tržišta, ne razumiju u kojem smjeru ide tržište.
- **Niche Players** – fokusirani su na mali segment tržišta, slabost u inovacijama, nemaju za cilj nadmašiti konkurenciju.
- **Leaders** – dobra sposobnost izvršavanja vizije, dobra pozicioniranost i u budućnosti.
- **Visionaries** – razumiju u kojem smjeru ide tržište, imaju viziju i sposobnost promjene tržišnih pravila, slabija sposobnost izvršavanja.



Sposobnost izvršavanja zacrtane vizije

## Korisnost Magičnog kvadrata?

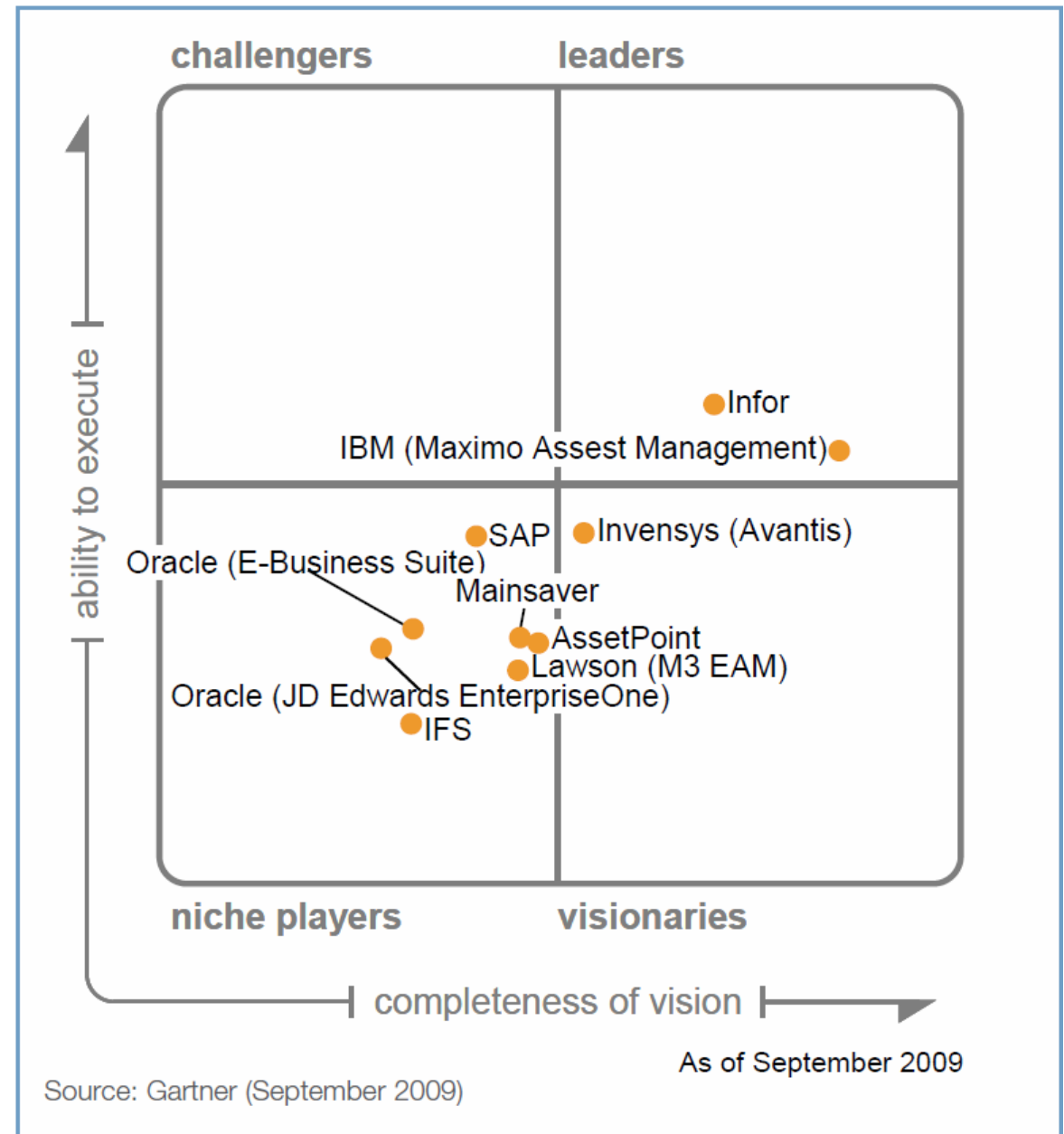
- Brza edukacija o mogućim dobavljačima CMMS rješenja, njihovoj sposobnosti zadovoljavanja trenutnih i budućih potreba krajnjih korisnika.
- Jednostavnost u razumijevanju pozicije koje trenutno na tržištu zauzima pojedini dobavljač CMMS rješenja.
- Mogućnost usporedbe pojedinih dobavljača u izvršavanju zacrtane vizije u budućnosti.

## Iskustvene preporuke?

- Treba imati na umu da fokusiranje samo na '**Leaders**' kvadrant ne mora u svim slučajevima za nas biti najpovoljnije rješenje (postaviti načelo „value for money“!).
- Dobro je u razmatranje uzeti '**Challengers**' kvadrant.
- U određenim slučajevima '**Niche Players**' bolje udovoljavaju potrebama korisnika nego '**Leaders**'.
- Na kraju izbor ovisi o tome kako se određeni dobavljač rješenja uklapa u plan za postizanje zacrtanih poslovnih ciljeva.

## Stanje stvari?

Primjer Gartner kvadranta za EAM/CMMS rješenja namijenjena za proizvodne (procesna i diskretna) djelatnosti





## 2. USPOREDBA I IZBOR CMMS RJEŠENJA

### Cilj?

- Nabava i implementacija provjerenog CMMS rješenja s odgovarajućim funkcionalnostima za odgovarajuću novčanu vrijednost.
- Izbjeći subjektivnost pri razmatranju alternativa.
- Usporediti alternative u odnosu na sve aspekte.

### Rješenje?

- Primjena metoda poslovnog odlučivanja (npr. **AHP**)
- Korištenje specijaliziranih *web* servisa npr. **PlantServices** (<http://cmms.plantservices.com/>)

- Usporedba CMMS rješenja u širokom rasponu aspekata važnih za industriju.
- Princip rada: aspektima se dodaju težine (prioriteti) u % prema mišljenju potencijalnih korisnika CMMS rješenja. Aspektima su pridružene funkcije koje je potrebno rangirati prema slijedećim atributima važnosti:
  - ✓ *Very Important*
  - ✓ *Important*
  - ✓ *Somewhat Important*
  - ✓ *Slightly important*
  - ✓ *Not Important*

- Rješenje: Izabranim CMMS rješenjima dodjeljuju se određeni brojevi bodova izračunani na temelju zadanih težina aspekata kao i atributa važnosti dodijeljenih njihovim funkcijama.



The screenshot shows the Plant Services website. At the top left is the logo "Plant Services" with links for "Contact Us" and "Advertise". To the right are icons for "Follow Plant Services", "Subscribe to Plant Services", "Read the Digital Edition", and "Subscribe to E-Newsletters". A navigation bar below contains links for Home, Topics, Columns & Blogs, Ask the Experts, Webinars, CMMS Review, Products, White Papers, Knowledge Centers, Training, Job Board, and Sign Up. The main content area features a large blue and grey title "CMMS/EAM SOFTWARE REVIEW". Below the title is a paragraph: "Pressures from the real world are driving computerized maintenance management/enterprise asset management (CMMS/EAM) software vendors to rethink and revise not only their products, but how they can help users actually achieve a larger portion of the potential they shrink-wrap in every package." This is followed by another paragraph: "More than ever, CMMS/EAM vendors need you, their clients, to succeed. Many have identified room for improvement and are focusing their efforts on four key areas: industry specialization, implementation, integration and functionality. The changes they wrought have prompted us to revise and expand the Plant Services CMMS/EAM Software Review, our detailed hands-on comparison of current offerings." A central button with a black border and blue text reads "VIEW THE PLANT SERVICES CMMS/EAM SOFTWARE REVIEW". At the bottom, a final paragraph states: "This new version of the review allows you to decide just how in-depth you want to be in controlling product comparisons, from simple browsing of vendor survey data to creating customized scores for each product based on the aspects most important to you."



CMMS/EAM Review

INTRODUCTION

FUNCTIONALITY

VENDOR SUMMARIES

COMPARE PRODUCTS

SOFTWARE ASPECTS

- General CMMS Vendor/Package Information
- Implementation
- Integration
- Multi-site Support
- Global Attributes
- Security and Data Integrity
- User Interface
- Look-ups and Searches
- Data Entry
- Help Features
- Workflow and Business Logic
- Analysis and Reporting
- Work Order Control
- Preventive and Condition-Based Maintenance
- Safety
- Priorities
- Planning and Scheduling
- Inventory Control and Purchasing
- Budgeting and Cost Reporting
- Equipment History
- Mobile Technology
- HR Management
- Fleet Maintenance
- Infrastructure Maintenance
- Service and Technology Asset Management

INTRODUCTION

Welcome to our growing database of CMMS/EAM software packages. This application is designed to let you compare products across a wide range of aspects important to the industry.

We've put the emphasis on you, the user, deciding just how in-depth you want to be in controlling product comparisons, from simple browsing of vendor survey data to creating customized scores for each product based on the aspects most important to you!

To get you started, we've highlighted the three methods in which you can get the most out of this application. Read on!

1 Simple

A good first step is to view our list of reviewed Vendor Summaries, select up to three at a time and hit 'Compare' to view their answers to survey questions.

It's a simple way to familiarize yourself with the basics of each product and view them side-by-side.

You can always browse survey answers in this way.

Later, you may want to return in order to further define your vendor requirements and create a more customized product comparison experience using Methods 2 and 3!

Start ▶

2 Customized

In order to give simple ratings to vendor products based on criteria you choose, take a look at the Software Aspects and apply weightings to each.

Choose the aspects most important to your software needs, and then hit 'Calculate'. You'll be taken to the Vendor Summaries page, but this time each vendor will have a score based on the weightings you've entered.

Create customized rankings based on the criteria most valuable to you!

The first step is to choose between starting with Essential or Full Functionality defaults.

Start ▶

3 Advanced

To further fine-tune the way in which you score vendor products, you can weight the survey questions within each aspect.

Prioritize the aspects that are important to your needs, then hit 'Save and Continue' to move to the next aspect, or 'Calculate' to immediately re-score the products.

This method of ranking questions will allow you to further narrow down the vendor products that are right for your company!

The first step is to choose between starting with Essential or Full Functionality defaults.

Start ▶

aspekti za  
usporedbu

načini usporedbe

- INTRODUCTION
- FUNCTIONALITY
- VENDOR SUMMARIES
- COMPARE PRODUCTS
- SOFTWARE ASPECTS

- General CMMS Vendor/Package Information
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- Budgeting and Cost Reporting
- Equipment History
- Mobile Technology**
- HR Management
- Fleet Maintenance
- Infrastructure Maintenance
- Service and Technology Asset Management
- Calibration
- Engineering Design to Maintenance
- Sustainability
- Other Specialized Modules

**SOFTWARE ASPECTS**

Allocate a total of 100% to the aspects that are important to your application. Once finished, click "Calculate" at the bottom of the page.

Total Weighting: 0%

**Software Aspects**

General CMMS Vendor/Package Information	0%
Implementation	0%
Integration	0%
Multi-site Support	0%
Global Attributes	0%
Security and Data Integrity	0%
User Interface	0%
Look-ups and Searches	0%
Data Entry	0%
Help Features	0%
Workflow and Business Logic	0%
Analysis and Reporting	0%
Work Order Control	0%
Preventive and Condition-Based Maintenance	0%
Safety	0%
Priorities	0%
Planning and Scheduling	0%
Inventory Control and Purchasing	0%
Budgeting and Cost Reporting	0%
Equipment History	0%
Mobile Technology	0%
HR Management	0%
Fleet Maintenance	0%
Infrastructure Maintenance	0%
Service and Technology Asset Management	0%
Calibration	0%
Engineering Design to Maintenance	0%
Sustainability	0%
Other Specialized Modules	0%

Total Weighting:

Choose your market segment to best match up vendor products

General Manufacturing

You have allocated a total of 0% of your total scoring allowance. Please allocate the remaining 100% to continue.

CALCULATE

Equipment History	0%
Mobile Technology	0%
HR Management	0%
Fleet Maintenance	0%
Infrastructure Maintenance	0%
Service and Technology Asset Management	0%
Calibration	0%
Engineering Design to Maintenance	0%
Sustainability	0%
Other Specialized Modules	0%

Mobile Technology	100%
HR Management	0%
Fleet Maintenance	0%
Infrastructure Maintenance	0%
Service and Technology Asset Management	0%
Calibration	0%
Engineering Design to Maintenance	0%
Sustainability	0%
Other Specialized Modules	0%

Total Weighting: 100%

Choose your market segment to best match up vendor products.

General Manufacturing

You have allocated a total of 100% of your total scoring allowance.

CALCULATE

**INTRODUCTION**

**FUNCTIONALITY**

**VENDOR SUMMARIES**

**COMPARE PRODUCTS**

**SOFTWARE ASPECTS**

General CMMS Vendor/Package Information

Implementation

Integration

Multi-site Support

Global Attributes

Security and Data Integrity

User Interface

Look-ups and Searches

Data Entry

Help Features

Workflow and Business Logic

Analysis and Reporting

Work Order Control

Preventive and Condition-Based Maintenance

Safety

## MOBILE TECHNOLOGY

**218. Does your CMMS interface seamlessly with mobile technology (e.g., PDA's, tablets, smart phones) including ability to:**

**a.** Download work orders to the mobile device?  Yes  Configurable  3rd party  No

**Rank the importance of this attribute:**

**b.** Upload from mobile device hours work done?  Yes  Configurable  3rd party  No

**Rank the importance of this attribute:**

**c.** Download parts required?  Yes  Configurable  3rd party  No

**Rank the importance of this attribute:**

**d.** Download other inventory information?  Yes  Configurable  3rd party  No

**Rank the importance of this attribute:**

**e.** Upload parts used?  Yes  Configurable  3rd party  No

**Rank the importance of this attribute:**

**f.** Download tools required?  Yes  Configurable  3rd party  No

**Rank the importance of this attribute:**

**g.** Use built-in scanner for barcode on assets/parts/badges?  Yes  Configurable  3rd party  No

**Rank the importance of this attribute:**

- Very Important
- Very Important
- Important
- Somewhat Important
- Slightly Important
- Not Important



- INTRODUCTION
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  - Calibration
  - Engineering Design to Maintenance
  - Sustainability
  - Other Specialized Modules

### VENDOR SUMMARIES

Vendor scores are calculated based on user weightings for aspects of the questionnaire. You may allocate weightings on the [Software Aspects](#) page (up to 100%), or on individual aspect pages via the menu to the left. Within each Software Aspect page, you may give weightings to individual questions within the aspect as well for a truly customizable calculation.

You have selected 3 products to view and compare criteria for.

COMPARE

#### Vendor: IBM Compare Vendor Criteria

**Product:** IBM Maximo Asset Management **Score: 93**  
**Review Date:** 10/25/2012  
**Annual Sales:** More than \$360 million  
**Customers:** More than 10,000  
**Pricing:** \$4880.00 for IBM Asset Management; minimum pricing = 5 registered users for approx. \$23,500; enterprise pricing = 50 registered users for \$150,000-175,000; add-on modules extra  
**Annual Maintenance:** 20%  
**Website:** <http://www.ibm.com/tivoli/maximo>

#### Vendor: Infor Global Solutions, Inc. Compare Vendor Criteria

**Product:** Infor10 EAM Enterprise Edition **Score: 92**  
**Review Date:** 08/28/2012  
**Annual Sales:** More than \$120 million  
**Customers:** More than 15,000  
**Pricing:** Starts at \$11,520 per concurrent user, Starts at \$3,840 per named user, SaaS starts at \$588 per named user per year/ \$1,764 per concurrent user per yr, Hosted/ASP starts at \$504 per named user per year  
**Annual Maintenance:** 20%  
**Website:** <http://www.infor.com>

GO TO KNOWLEDGE CENTER

#### Vendor: IFS Compare Vendor Criteria

**Product:** IFS Maintenance Module **Score: 89**  
**Review Date:** 11/01/2012  
**Annual Sales:** \$150 - \$200 million  
**Customers:** More than 2,000  
**Pricing:** Starts at \$2,500 per named user  
**Annual Maintenance:** 18%  
**Website:** <http://www.IFSWorld.com>

GO TO KNOWLEDGE CENTER

You have selected 3 products to view and compare criteria for.

COMPARE

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COMPARE

[← PREVIOUS](#) *Summaries*

**KEYWORDS**

**IBM**

Score: 93 / 100

[WEBSITE ▶](#)

**INFOR GLOBAL SOLUTIONS, INC.**

Score: 92 / 100

[GO TO KNOWLEDGE CENTER ▶](#)

**IFS**

Score: 89 / 100

[GO TO KNOWLEDGE CENTER ▶](#)

**MOBILE TECHNOLOGY | [SHOW](#)**

**Weighting: 100%**

**GENERAL CMMS VENDOR/PACKAGE INFORMATION | [SHOW](#)**

**IMPLEMENTATION | [SHOW](#)**

**INTEGRATION | [SHOW](#)**

**MULTI-SITE SUPPORT | [SHOW](#)**

**GLOBAL ATTRIBUTES | [SHOW](#)**

**SECURITY AND DATA INTEGRITY | [SHOW](#)**

**USER INTERFACE | [SHOW](#)**

**LOOK-UPS AND SEARCHES | [SHOW](#)**

**DATA ENTRY | [SHOW](#)**

**HELP FEATURES | [SHOW](#)**

**WORKFLOW AND BUSINESS LOGIC | [SHOW](#)**

**ANALYSIS AND REPORTING | [SHOW](#)**

**WORK ORDER CONTROL | [SHOW](#)**

**PREVENTIVE AND CONDITION-BASED MAINTENANCE | [SHOW](#)**

**SAFETY | [SHOW](#)**

**PRIORITIES | [SHOW](#)**

**PLANNING AND SCHEDULING | [SHOW](#)**

**INVENTORY CONTROL AND PURCHASING | [SHOW](#)**

**BUDGETING AND COST REPORTING | [SHOW](#)**

**EQUIPMENT HISTORY | [SHOW](#)**

**HR MANAGEMENT | [SHOW](#)**



[◀ PREVIOUS](#) [Summaries](#)

<b>KEYWORDS</b>	<b>IBM</b> Score: 93 / 100 <a href="#">WEBSITE ▶</a>	<b>INFOR GLOBAL SOLUTIONS, INC.</b> Score: 92 / 100 <a href="#">GO TO KNOWLEDGE CENTER ▶</a>	<b>IFS</b> Score: 89 / 100 <a href="#">GO TO KNOWLEDGE CENTER ▶</a>
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**MOBILE TECHNOLOGY | [HIDE](#)** **Weighting: 100%**

Aspect Score	93 / 100	92 / 100	89 / 100
▶ Mobile device WO integration	Yes	Yes	Yes
▶ Mobile device work	Yes	Yes	Yes
▶ Mobile device parts required	Yes	Yes	Yes
▶ Mobile device inventory	Yes	Yes	Yes
▶ Mobile device parts used	Yes	Yes	Yes
▶ Mobile device tools required	Yes	Yes	Yes
▶ Mobile device scanner	Yes	Yes	Yes
▶ Mobile device work requests	Yes	Yes	Yes
▶ Mobile device history	Yes	Yes	Configurable
▶ Mobile device schematic	3rd party	Yes	Yes
▶ Mobile device capture actual signatures	Yes	Yes	Yes
▶ Mobile device capture photos & append to docs	Yes	Yes	Yes
▶ Independently written mobile applications	Some (ie, some apps are written completely independent of all attributes)	Minimal (ie, separate apps are typically required for devices with different attributes)	Minimal (ie, separate apps are typically required for devices with different attributes)
▶ Store and forward capability	Yes	Yes	Yes
▶ Tailor screens for mobile device	Yes, comprehensive	Yes, comprehensive	Some
▶ Browser access	Yes	Some	Some

Work Order Control	50 %
Preventive and Condition-Based Maintenance	0 %
Safety	0 %
Priorities	0 %
Planning and Scheduling	30 %
Inventory Control and Purchasing	0 %
Budgeting and Cost Reporting	0 %
Equipment History	0 %
Mobile Technology	20 %
HR Management	0 %
Fleet Maintenance	0 %
Infrastructure Maintenance	0 %
Service and Technology Asset Management	0 %
Calibration	0 %
Engineering Design to Maintenance	0 %
Sustainability	0 %
Other Specialized Modules	0 %

**Total Weighting:** 100%

Choose your market segment to be analyzed:

General Manufacturing

**PlantServices.com**  
THE DIGITAL RESOURCE OF PLANT SERVICES MAGAZINE

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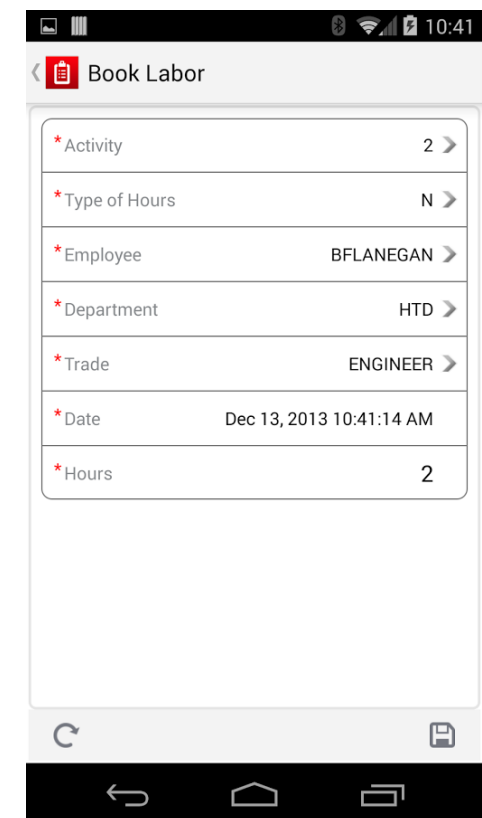
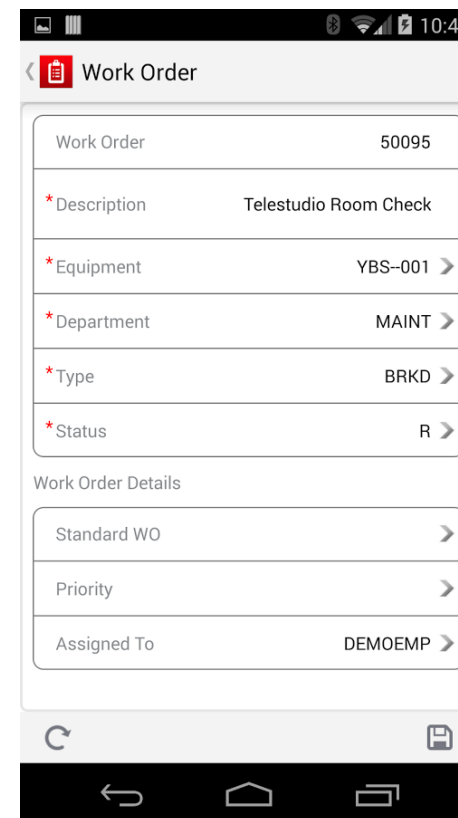
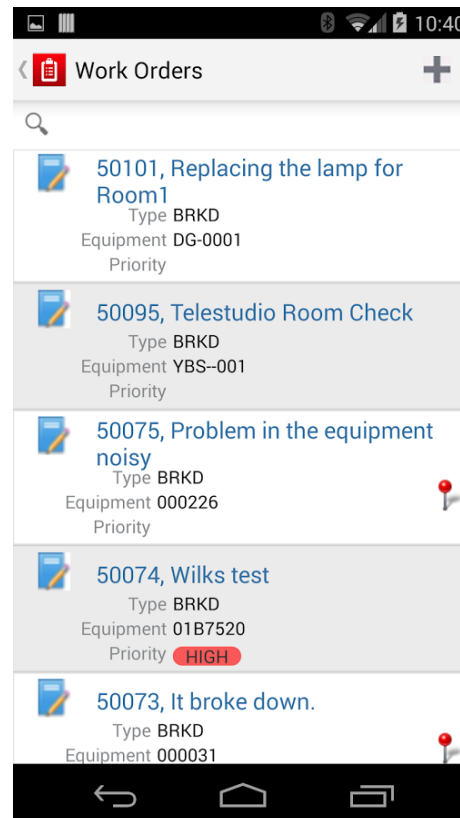
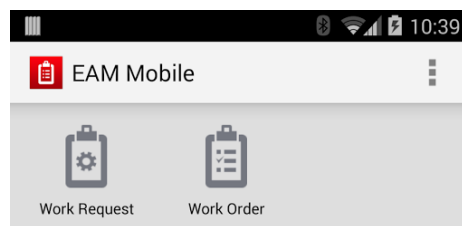
You have allocated a total of 100% [PREVIOUS](#) *Summaries*

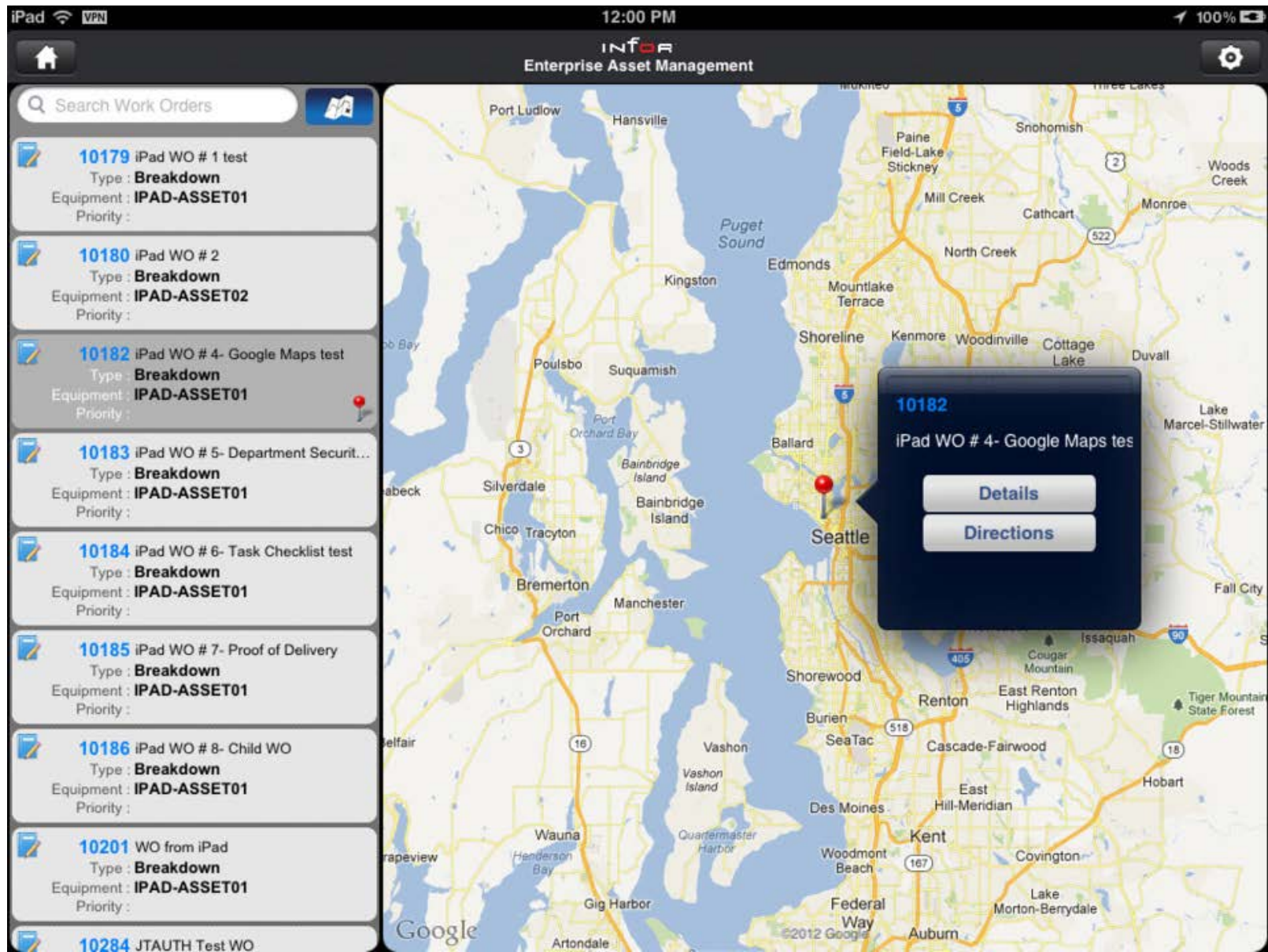
**CALCULATE**

KEYWORDS	IBM Score: 90 / 100 <a href="#">WEBSITE</a>	INFOR GLOBAL SOLUTIONS, INC. Score: 84 / 100 <a href="#">GO TO KNOWLEDGE CENTER</a>	IFS Score: 83 / 100 <a href="#">GO TO KNOWLEDGE CENTER</a>
<b>WORK ORDER CONTROL</b>   <a href="#">SHOW</a>	<b>Weighting: 50%</b>		
<b>PLANNING AND SCHEDULING</b>   <a href="#">SHOW</a>	<b>Weighting: 30%</b>		
<b>MOBILE TECHNOLOGY</b>   <a href="#">SHOW</a>	<b>Weighting: 20%</b>		

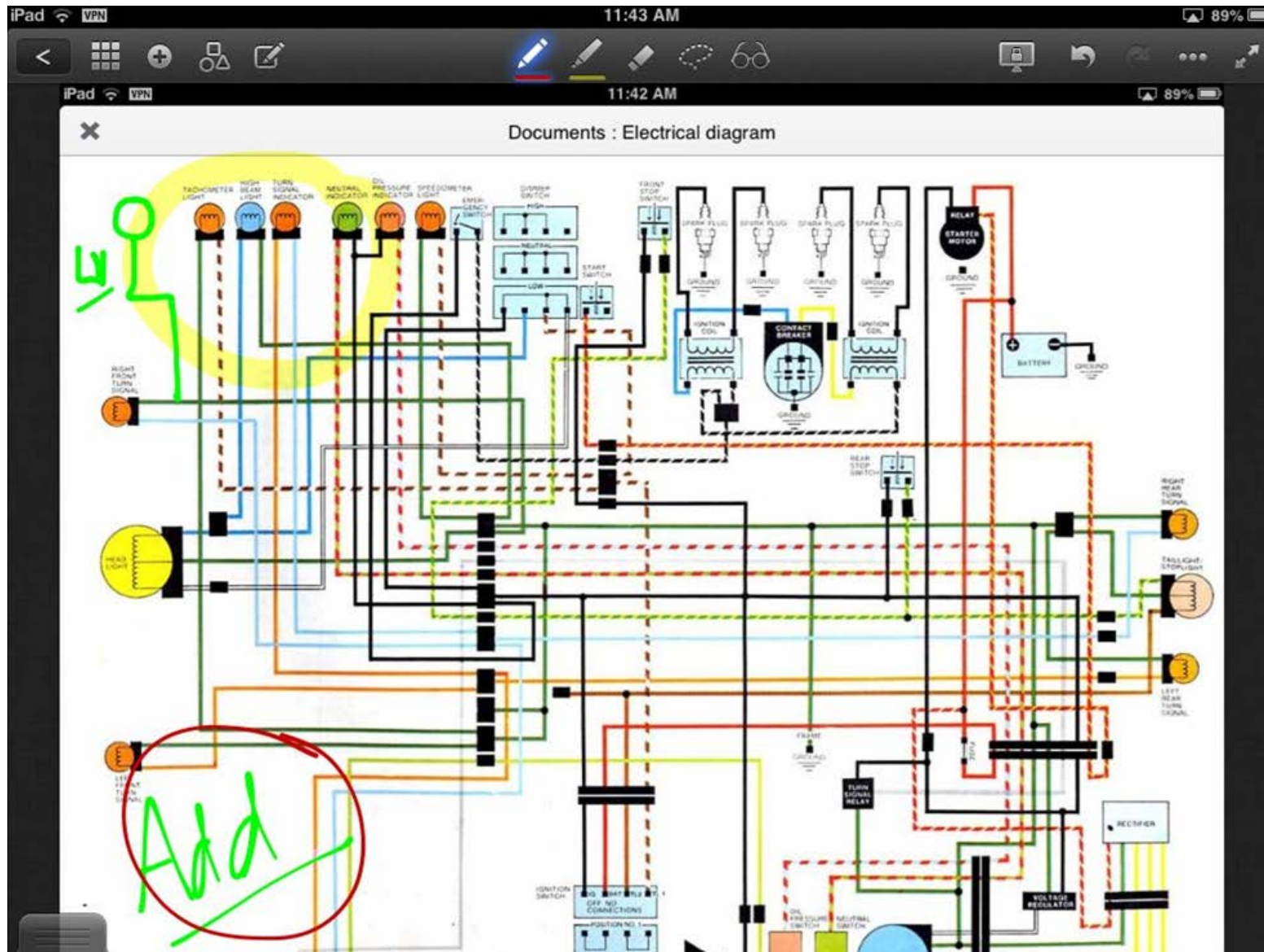
## 3. NEKI TRENDIVI RAZVOJA CMMS RJEŠENJA

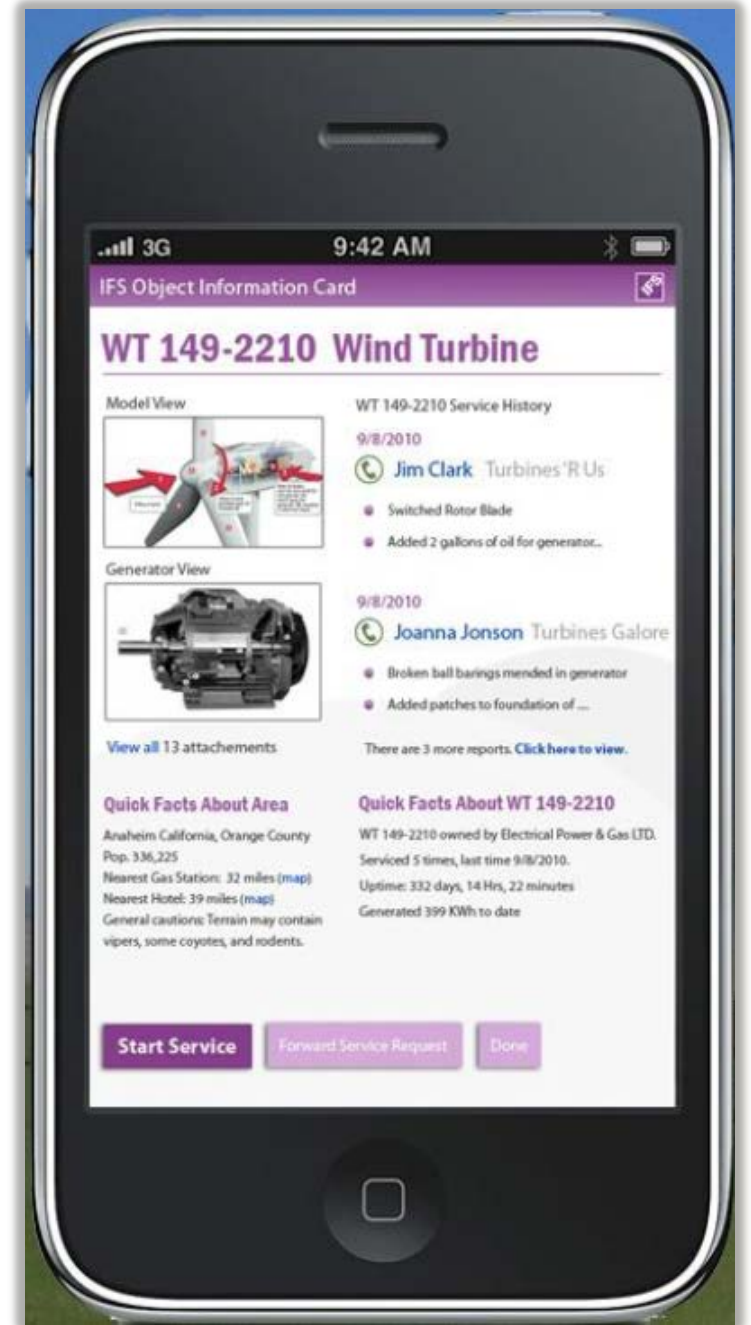
### 3.1 Mobilne aplikacije i primjena na mobilnim uređajima











## 3.2 Cloud Computing

### Definicije

- **Gartner**<sup>©</sup> opisuje računalstvo u oblacima kao **oblik računalstva** u kojem se dinamički, skalabilni resursi pružaju kao usluga putem Interneta.
- **Internet usluga** koja nam nudi teoretski neograničene količine diskovnog prostora, procesorske snage, radne memorije, *bandwitha* u trenutku kad nam je potrebno i onoliko koliko nam je potrebno na način da to sami kontroliramo (kroz našu aplikaciju ili kroz web portal).

- **Ekonomski gledano**, radi se o usluzi gdje više nismo vlasnici infrastrukture (računala, opreme, serverskih prostora i sl.) niti smo zaduženi za njihovo održavanje, već plaćamo vremenski najam one količine koju u pojedinom trenutku koristimo.
- Termin **oblak** koristi se kao metafora za Internet, te predstavlja apstrakciju za kompleksnu infrastrukturu na kojoj se temelji.



## Modeli usluga računarstva u *oblacima*

### 1. Infrastruktura kao usluga (*IaaS*)

- ✓ Usluga pružanja i osiguravanja određene količine računalnih resursa – procesorske snage, memorije, kapaciteta pohrane i osigurane propusnosti mreže.
- ✓ Korisnik kontrolira operacijski sustav, razvijene aplikacije i moguće mrežne komponente poput vatrozida.
- ✓ Najvažnija prednost je upravo nepotrebnost ulaganja u vlastitu računalno-podatkovnu infrastrukturu.

## 2. Platforma kao usluga (*PaaS*)

- ✓ Uključuje pružanje usluge operacijskog sučelja za određenu aplikaciju.
- ✓ Korisnik pritom kontrolira aplikacije koje se tako pokreću, a po potrebi mu je pružena i određena kontrola nad samom uslugom hostinga.
- ✓ Korisnik nema kontrolu nad operacijskim sustavom, sklopovljem ili mrežnom infrastrukturom na kojoj se aplikacija pokreće.

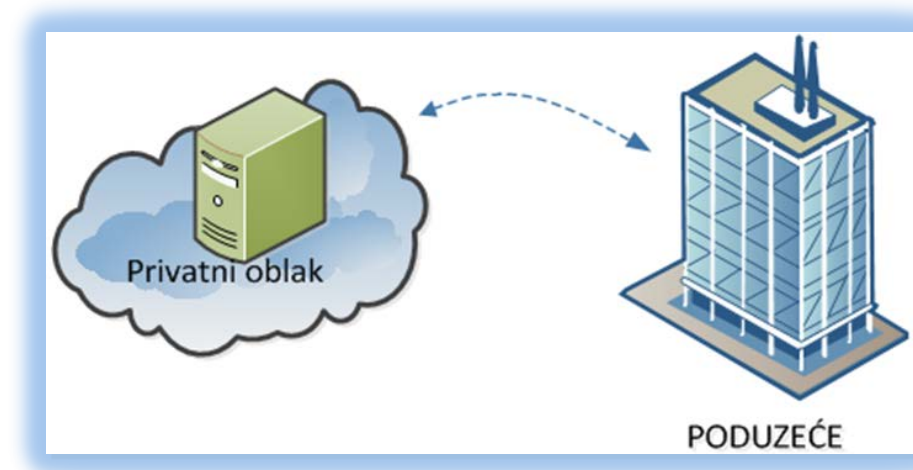
### 3. Softver kao usluga (SaaS):

- ✓ Uključuje distribuciju softvera u kojem proizvođač aplikativnog rješenja izrađuje aplikaciju, upravlja samom aplikacijom i okruženjem koje je podržava (engl. *hosting*), a korisnicima je čini dostupnom putem mreže.
- ✓ Najvažnija razlika softvera zasnovanog na modelu **SaaS** u odnosu na tradicionalni je u tome što se softver ne kupuje, već se plaća usluga njegovog korištenja.

# Modeli implementacije računarstva u *oblacima*

## 1. Privatni oblak

- ✓ Koristi u slučaju kad je infrastruktura oblaka, vlasničke mreže ili podatkovnog centra takva da služi samo jednoj tvrtci ili poduzeću, odnosno djeluje unutar računala u kompaniji.



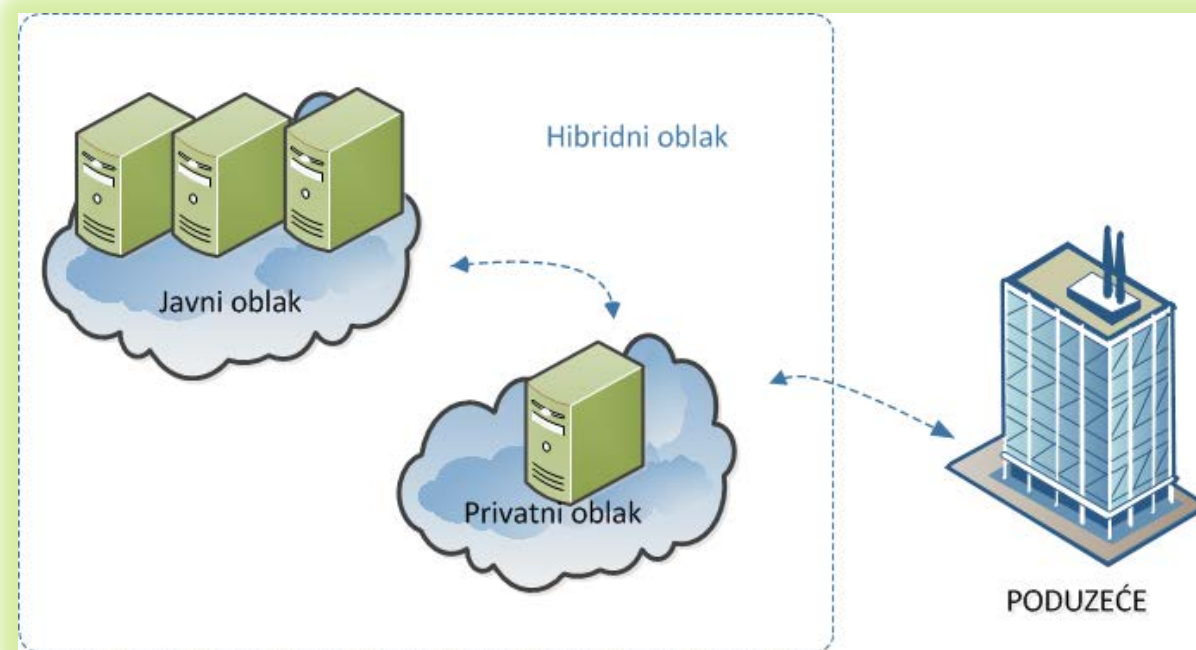
## 2. Javni oblak

- ✓ Najčešća je varijanta *oblaka* u kojoj su usluge dostupne svim korisnicima u obliku plaćanja po dospijeću (eng. ***Pay-as-you-go***).



### 3. Hibridni oblak

- ✓ Oblak sastavljen od dva tipa oblaka: **privatnog** i **javnog**
- ✓ Dio aplikacija, pratećih servisa i podataka smješta se u javni oblak, dok se ostatak IT-sustava i dalje nalazi na privatnom oblaku tj. vlastitoj infrastrukturi tvrtke.



### 3.3 Optimizacija strategije, programa i planova održavanja

- **Specijalizirani optimizacijski** softveri koji se integriraju sa postojećim **CMMS** sustavima ili su njihov integralni dio.
  - ✓ **FMECA (Failure Mode, Effects and Criticality Analysis)** analiza:
    - analiza vrste potencijalnih kvarova u promatranom tehničkom sustavu
    - identifikacija potencijalnih opasnosti uzrokovanih kvarovima
    - analiza kritičnosti tehničkih sustava s obzirom na efekte kvarova



- **Optimizer+** je programski alat namijenjen inženjerima održavanja i gospodarenja fizičkom imovinom
- pomaže u razvoju, održavanju točnosti i ažurnosti i optimiranju programa/planova održavanja - postavljajući ih u korelaciju s poslovno - proizvodnim procesima i relevantnim aspektima na koje procesi utječu (okoliš, sigurnost, pouzdanost, kvaliteta, troškovi)
- Alati poput Optimizer+ su komplementarni modernim informacijskim sustavima održavanja (poput Infor EAM/CMMS sustava) i pridodaju im novi sadržaj i korisne funkcije
- Optimizer+ je usklađen s industrijskim standardima za procjenu i evaluaciju rizika (npr. kolekcijom standarda poput ISO 14224 za industriju nafte i plina)



## **Glavna područja primjene**

- Industrija nafte i plina
- Energetska postrojenja
- Kemijska, farmaceutska i ostala procesna industrija
- Prehrambena industrija
- Rudarstvo
- Vodoopskrbni sustavi ....

**U ovim segmentima industrije i gospodarstva tehničko održavanje je ključna komponenta sa stajališta raspoloživosti sredstava za rad, ali isto tako sigurnosti te mogućeg negativnog utjecaja na ljude i okoliš.**

Sustav Optimizer + je razvijen na bazi najbolje industrijske prakse u održavanju i u sebi ima integrirane ekspertne baze podataka znanja na ovim područjima.

## Način rada i slijed provedbe aktivnosti korištenjem Optimizer+ rješenja

- Definirati ciljeve poslovanja i ključne aspekte koji su relevantni za proces održavanja
- Evaluacija i ocjena kritičnosti tehničkih sustava (temelji se na metodama FMECA, RCM, RBI, RBM, itd.)
- Razvoj, ažuriranje i optimiranje planova održavanja
- Korištenje generičkih baza podataka i datoteka s podacima o kvarovima i tipičnim aktivnostima održavanja
- Simulacija i prognoziranje troškova održavanja, raspoloživosti, pouzdanosti za definirani opseg planova održavanja
- Eksport planova održavanja u EAM/CMMS informacijski sustav održavanja

Kontinuirano praćenje i analiza efekata, korekcije koncepcije ....

## ➤ **Optimizer+** način rada

$P_{lan} D_o C_{heck} A_{ct}$  - ciklički proces održavanja

Podesi parametre  
Eksport u CMMS

ADAPT

PLAN

Aspekti poslovanja

Lista opreme

Analiza rizika  
(FMECA)

Plan održavanja

DO

CHECK

Import podataka  
Optimizer+  
Simulacija / Optimiranje  
Evaluacija scenarija

Eksport u CMMS  
Praćenje ekspluat.

INFOR

Optimizer

## • Identifikacija aspekata i formiranje matrice rizika



Sequence		Likelihood				
		Never heard of in Industry	Heard of in Oil Industry	Occurred in Expro	Several times per year in Expro	Several times per year on installation
Environment	Reputation	Very unlikely	Unlikely but possible	Likely within installation life or 10 yrs (whichever is lower)	Likely within next 1-2 yrs on installation	Several times per yr on installation
		A	B	C	D	E
No Effect	No Impact	0				
Slight Effect	Slight Impact	1				
Minor Effect	Limited Impact	2				
Localised Effect	Considerable Impact	3				
Major Effect	Major National	4				

Primjer aspekata

- utjecaj na ljude
- sigurnost
- utjecaj na okoliš
- raspoloživost
- javno mnijenje

Matrica rizika  
vjerojatnost x intenzitet

Definiranje kriterija prihvatljivosti

GB.GAA (4 levels)

Risk Matrix

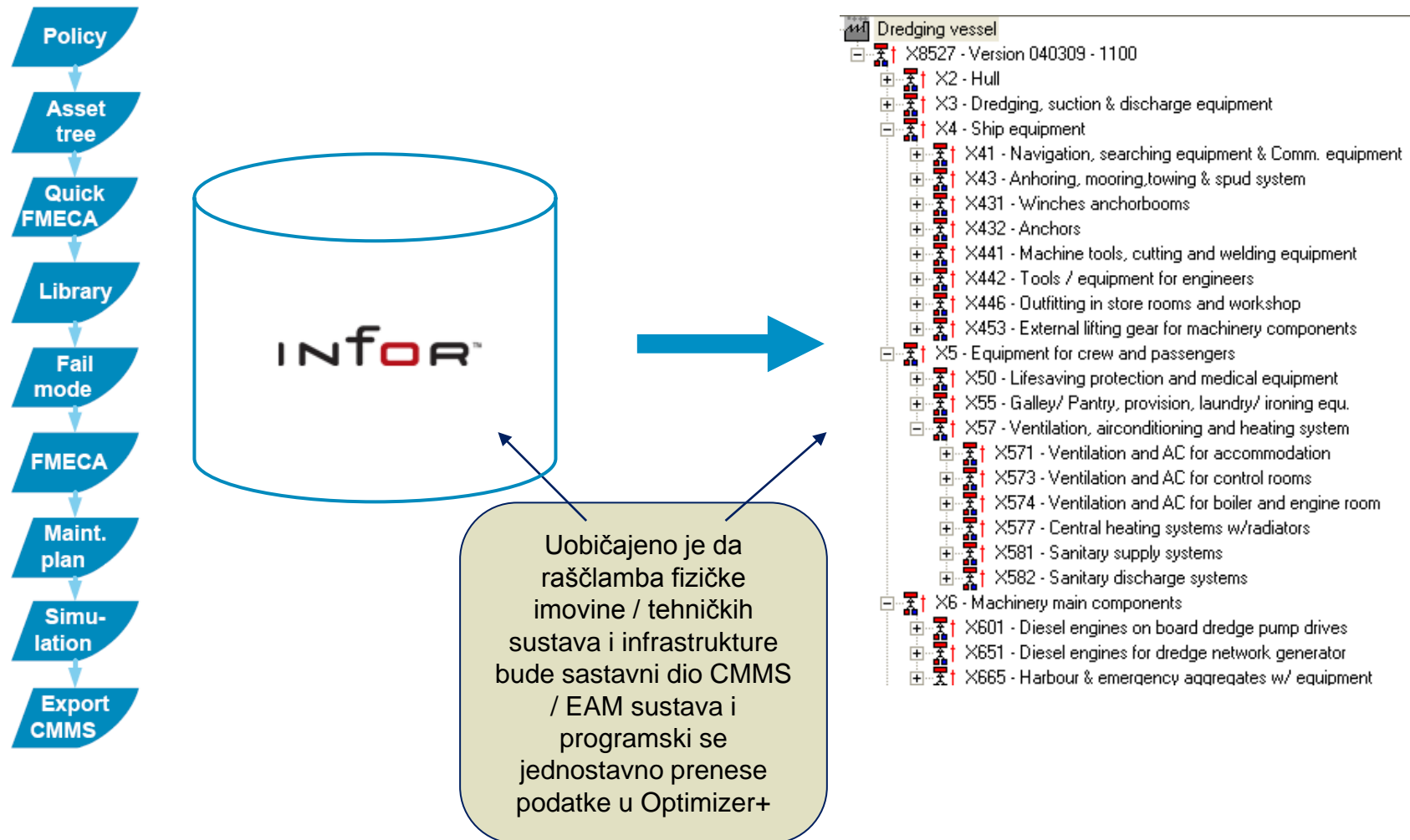
Business Objective: People

Risk Matrix

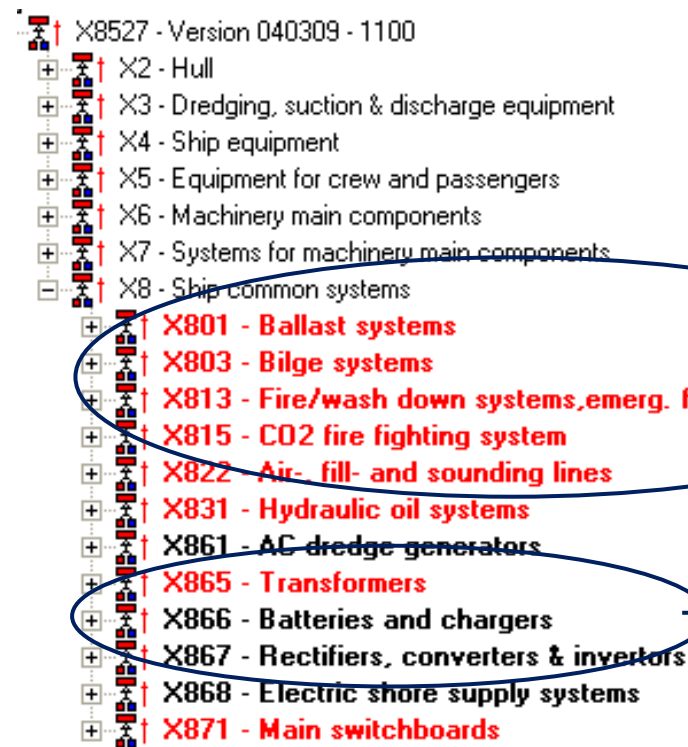
- People
- Assets (Deferment Damage Opportunity)
- Environment
- Reputation

	> 50 Yr (1)	10 Yr < X <= 50 Yr (2)	2 Yr < X <= 10 Yr (4)	1 Yr < X <= 2 Yr (8)	0 hr < X <= 1 Yr (16)
Multiple Fatalities (102)	102	204	408	816	1632
Permanent Total Disability or Single Fatality (51)	51	102	204	408	816
Major Injury or Health Effect (26)	26	52	104	208	416
Minor Injury or Damage to Health (14)	14	28	56	112	224
Slight Injury or Damage to Health (7)	7	14	28	56	112
No Injury or Damage to Health (1)	1	2	4	8	16

- Kreiranje nomenklature i hijerarhijske raščlambe opreme koja je predmet analize na funkcionalne tehnološke cjeline (oblik stabla)



- Inicijalna analiza kritičnosti i FMECA (Failure mode, effects, and criticality analysis)



- Dodjeljivanje prioriteta (pod) sistemima  
 - Dodjeljivanje vrsta mogućih kvarova  
 - Kategorizacija posljedica kvarova

Kritično

Nije kritično

- **Klasifikacija efekata i posljedica pojedinih kvarova**



FMECA							
Part			Failure mode & Effect				
Tag-number	Name	Function	Failure mode	HS&E	Delivery reliability	Reputation	
X3160103	Lub oil header tank tumbling sheaves		Leakage	First aid / minor internal leakage	0 % Availability	Internal	
X3160101	Grease pump cutter ladder		Geen/ onvoldoende...	No effect	100 % Availability, No effect		Local
			Leakage	First aid / minor internal leakage	100 % Availability, No effect		No effect
X31604	Cutter bearing		Excessive wear	No effect	0 % Availability		No effect
X31605	Cutter shaft		Cutterhead stops	No effect	0 % Availability		No effect
X31603	Cutterdrive		No corrosion/ moisture protection	No effect	100 % Availability, No effect		No effect
			Reduced / No displacement	No effect	0 % Availability		No effect
			(leeg)	No effect	0 % Availability		No effect
X31606	Cutter bush		Cutterhead stops	No effect	100 % Availability, No effect	Internal	
X33401	Radioactive density/ el.magn. velocity transmitter		False measurement	Single lost time injury with permanent...	60 % Availability	International	

- **Konsolidacija planova održavanja u obliku standardnih zadataka na temelju provedenih analiza**



MSD E2k V6.1 Utiliver

**FMECA Systems**

**CLM overview**

Air Treatment Utility				Heating, ventilation & air conditioning/Air Treatment Utility			
<b>CLM: 3 monthly job</b>							
<i>Frequency: 3,00 m</i>		<i>Duration: 1,00 h.</i>		<i>Cost: € 25,00</i>		<i>Maintenance effect: Out of service</i>	
<u>TAG</u>	<u>Part</u>	<u>Strategy</u>	<u>Maintenance action</u>	<u>Frequency</u>	<u>Duration</u>	<u>Cost</u>	<u>Effect</u>
G MS	Air Treatment Utility	CBM	Visual inspection HVAC Control Panel - 3 Months	3,00 m	1,00 h.	€ 50,00	N
<b>Total:</b>					<b>1,00 h.</b>	<b>€ 50,00</b>	

Air Treatment Utility				Heating, ventilation & air conditioning/Air Treatment Utility			
<b>CLM: Yearly job</b>							
<i>Frequency: 1,00 yr.</i>		<i>Duration: 1,00 h.</i>		<i>Cost: € 495,00</i>		<i>Maintenance effect: Out of service</i>	
<u>TAG</u>	<u>Part</u>	<u>Strategy</u>	<u>Maintenance action</u>	<u>Frequency</u>	<u>Duration</u>	<u>Cost</u>	<u>Effect</u>
G MS	Air Treatment Utility	CBM	Inspection of bearings - Yearly	1,00 yr.	1,00 h.	€ 25,00	N
G MS	Air Treatment Utility	CBM	Check fan bearings for noise / vibration. Grease bearings. Visual condition inspection. Check fan drive belt condition and tension if applicable - Yearly	1,00 yr.	4,00 h.	€ 25,00	D
G MS	Air Treatment Utility	CBM	Maintain Motors as per Motor Maintenance Strategy - Yearly	8.760,00 h.	4,00 h.	€ 250,00	N
G MS	Air Treatment Utility	CBM	Inspect filters	1,00 yr.	1,00 h.	€ 50,00	N
G MS	Air Treatment Utility	CBM	Inspect Humidifier salt and ratio test. Microbiological testing may be required for certain types of Humidifiers. Refer to manufacturer's guidance. - Yearly	1,00 yr.	1,00 h.	€ 50,00	N
G MS	Air Treatment Utility	UBM	Preventive replacement for V-belt	1,00 yr.	2,00 h.	€ 370,00	D
<b>Total:</b>					<b>13,00 h.</b>	<b>€ 770,00</b>	

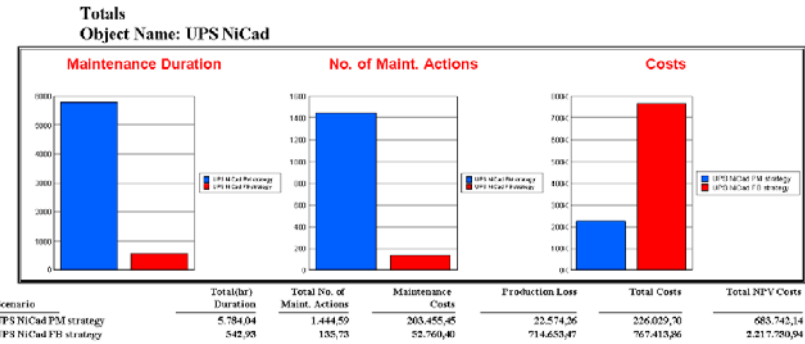


- Simulacija mogućih scenarija konceptata održavanja

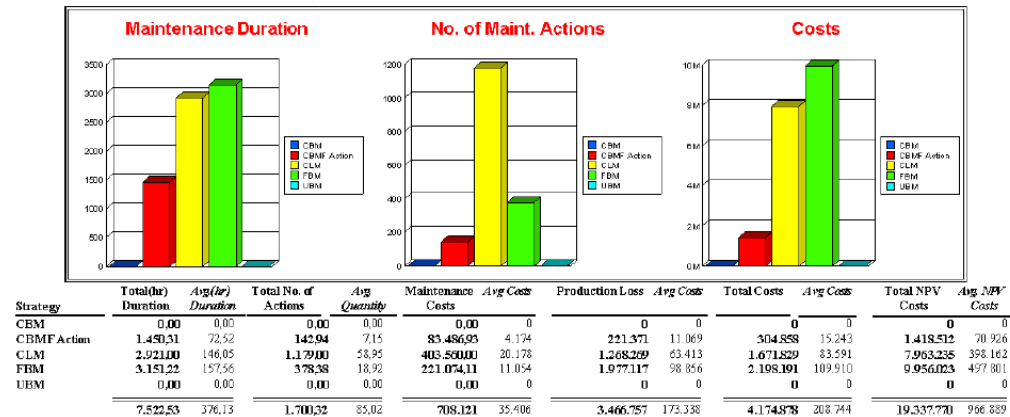


- Kompariranje mogućih scenarija  
 - Raspoloživost  
 - Simulacija troškova u životnom ciklusu

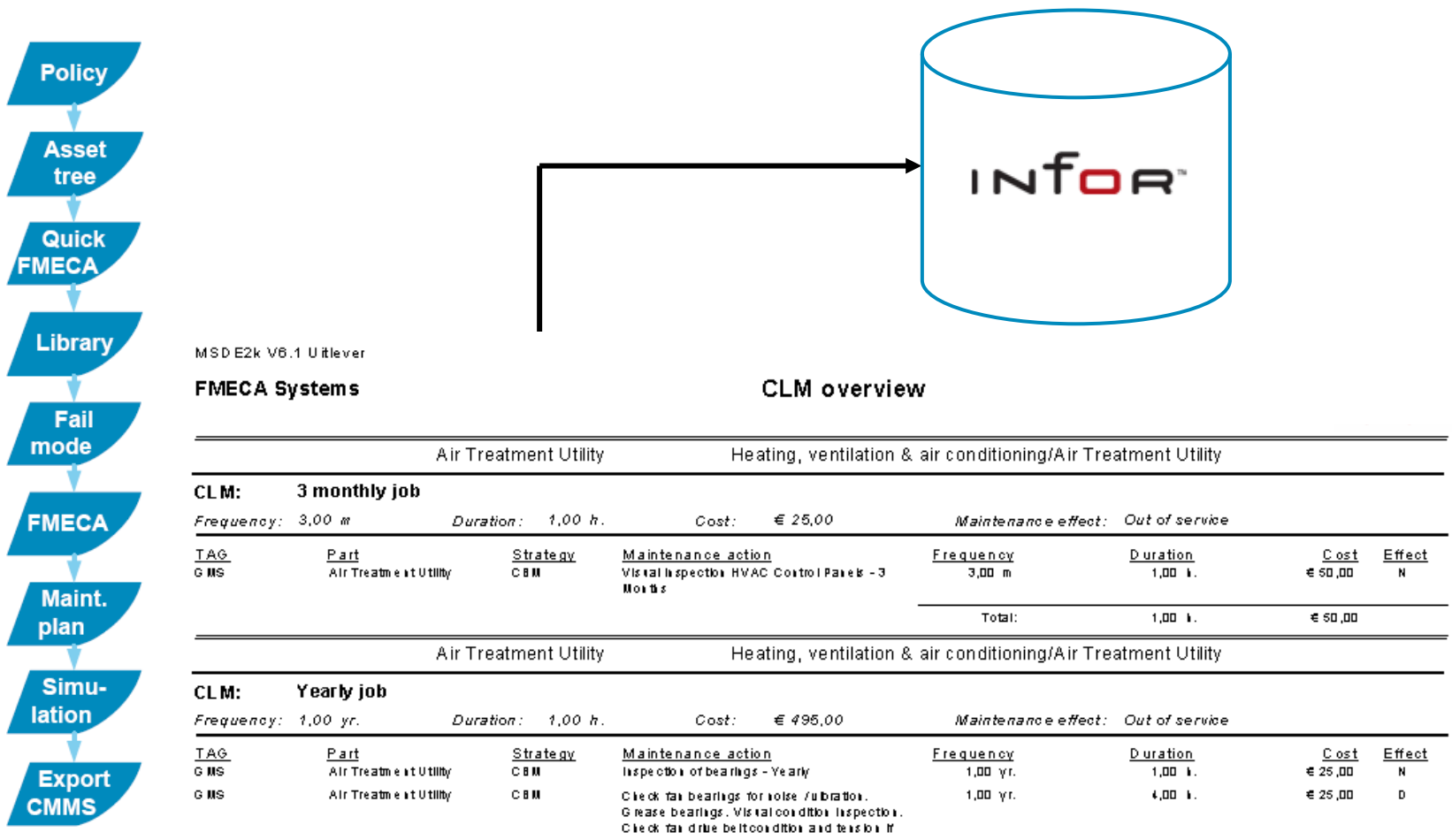
Optimiranje po svim kriterijima



Report Totals  
Object Name: Onderhoud op basis van risico



- Eksport podataka u EAM/CMMS sustav nakon provedbe cijelog procesa analize



- Primjena opisanog koncepta i alata koji podupiru njihovu provedbu mogu dati odgovore na sljedeća i slična pitanja:

*...Gdje je potrebno provoditi najviše održavanja?*

*...Koliki su i gdje nastaju troškovi održavanja i što bi se dogodilo u slučaju manjeg opsega održavanja?*

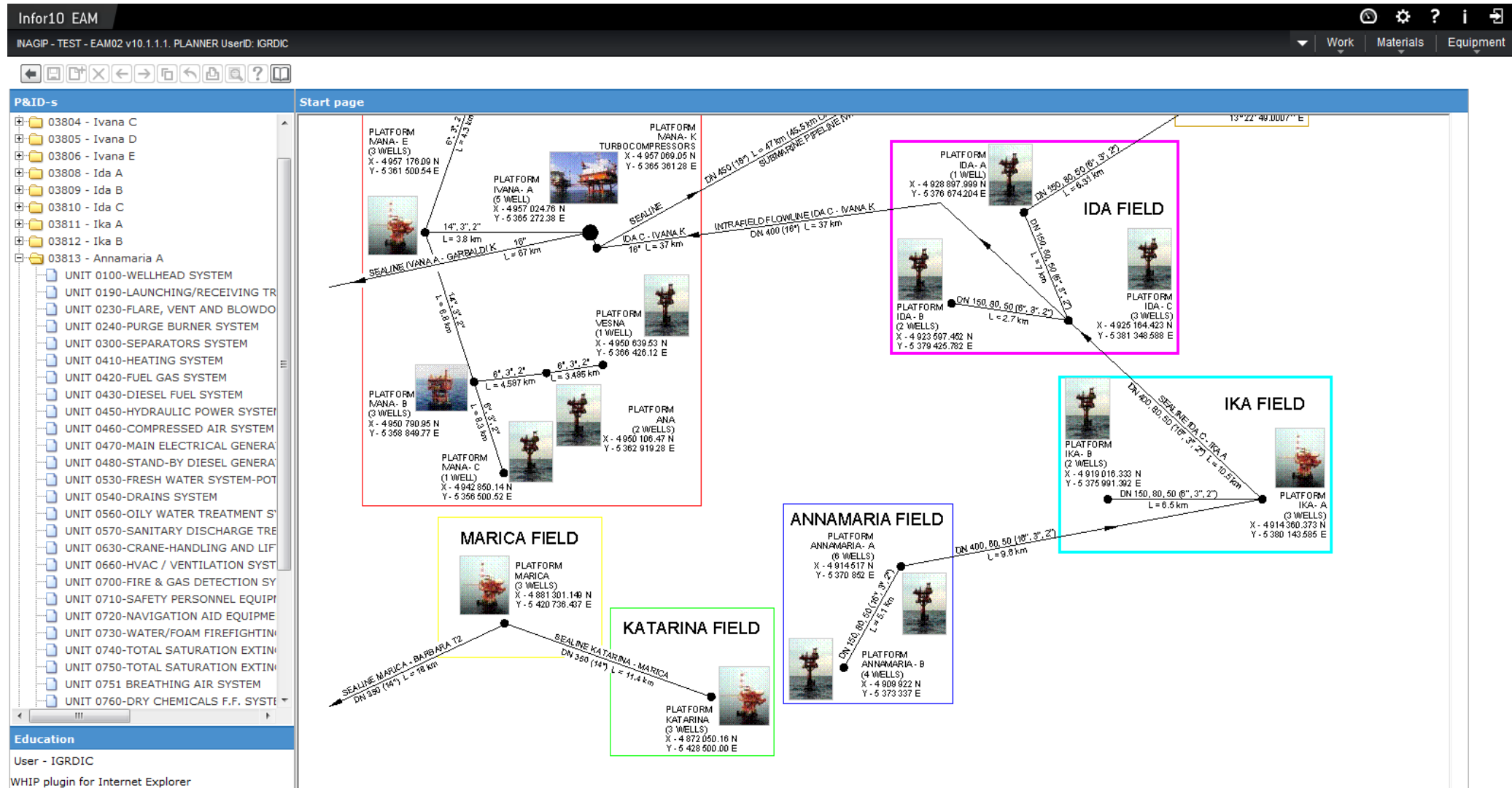
*...Što raditi i čemu dati prioritet ukoliko je budžet održavanja npr. 10 % manji?*

*...Gdje su slabe točke i ključni uzročnici smanjenja učinkovitosti tehničkih sustava (performance killers) i kako ih umanjiti ili eliminirati?*

*...Ima li potrebe za redundancijom u tehničkom sustavu i je li isplativa njena provedba?*

*...Što se može učiniti da se poveća raspoloživost tehničkog sustava?*

# 3.3.1. Optimizacija strategije i procesa održavanja - primjer iz prakse



Tag: 03802100DW011A Well Head X-Mass Tree

Organization: INAGIP  
 Department:  
 Status:



List View Record View Comments Events Costs PM Schedules Structure Meters Documents Parts Associated Reliability Survey

Platform	Tag	Description	Old Tag	Criticality	Parent Tag	Location	Commission Date	Type	Manufacturer	Model
INAGIP		INAgip					09-FEB-2013	Position		
Ivana A	03802	Ivana A			INAGIP		01-OCT-1999	Position		
Ivana A	03802100	Unit 100 - Well Head	0100		03802		01-OCT-1999	Position		
Ivana A	03802100DW011A	Well Head X-Mass Tree	0100DW011A	2 - MEDIUM	03802100	Zone:2	01-OCT-1999	Position	BRE	MS-T-NOS
Ivana A	03802100DW011AMMV011	Manual Master Valve String 1	0100MMV011	3 - LOW	03802100DW011A	Zone:2	01-OCT-1999	Position	BRE	MS-T-NOS
Ivana A	03802100DW011AMMV012	Manual Master Valve String 2	0100MMV012	3 - LOW	03802100DW011A	Zone:2	01-OCT-1999	Position	BRE	MS-T-NOS
Ivana A	03802100DW011AMWV011	Manual Wing Valve String 1	0100MWV011	3 - LOW	03802100DW011A	Zone:2	01-OCT-1999	Position	BRE	M8-T-NO8
Ivana A	03802100DW011AMWV012	Manual Wing Valve String 2	0100MWV012	3 - LOW	03802100DW011A	Zone:2	01-OCT-1999	Position	BRE	M8-T-NO8
Ivana A	03802100DW011API011	Pressure Indicator	0100PI011	3 - LOW	03802100DW011A	Well head pressure S.S.-DW011A - 4S Zone:2	01-OCT-1999	Position	WIK	0-100 bar
Ivana A	03802100DW011API012	Pressure Indicator	0100PI012	3 - LOW	03802100DW011A	Well head pressure L.S.-DW011A - 4L Zone:2	01-OCT-1999	Position	WIK	0-100 bar
Ivana A	03802100DW011API016	Pressure Indicator	0100PI016	3 - LOW	03802100DW011A	Casing-DW011A - CASS 4 Zone:2	01-OCT-1999	Position	WIK	0-100 bar
Ivana A	03802100DW011APT013	Pressure Transmitter	0100PT013	2 - MEDIUM	03802100DW011A	Short string pressure-DW011A - 4S Zone:2	01-OCT-1999	Position	ABB	600T614GU2112211121
Ivana A	03802100DW011APT014	Pressure Transmitter	0100PT014	2 - MEDIUM	03802100DW011A	Long string pressure-DW011A - 4L Zone:2	01-OCT-1999	Position	ABB	600T614GU2112211121

Records: 30 of 100+ [123]



Equipment: MMV00001 Manual Master Valve String 1

Organization: INAGIP

Department: IVANA

Status: Installed



List View Record View Comments Events Costs PM Schedules Structure Meters Material Usage Documents Parts Associated Route on PM schedule

Equipment: MMV00001 \* Manual Master Valve String 1  
Department: \* IVANA

Organization: INAGIP  
Status: \* Installed  
Platform: Ivana A

Equipment Details

Class: VAOH  
Out of Service:   
Criticality: 3 - LOW  
HSE crit.: 1  
Production crit.: 1  
Repair cost crit.: 1

Commission Date: \* 01-OCT-1999  
Equipment Value:  
Meter Unit:  
Dormant Start:  
Dormant End:  
Reuse Dormant Period:   
Ex-Agency Classification:

Hierarchy

Parent Equipment:  
Dependent:   
Cost Roll-up:   
Tag: 03802100DW011AMMV0  
Dependent:   
Cost Roll-up:   
Area:  
Location: Zone:2

Tracking Details

Manufacturer: BRE  
Serial Number: M70910 (5501116)-(5501116)  
Model: MS-T-NOS

Part Association

Part: VAOH  
Store:  
Bin:  
Lot: \*

Material and spare parts used (if any)			
Code	Description	UOM	Qty

External resources manpower						
Contractor	Craft	Starting date	Finishing date	Active Man-Hours	Travelling Hours	Stand by Hours
CROSCO d.o.o.	Mechanic	03.08.2013	04.08.2013			

Internal resources manpower (if any)						
Executor	Craft	Starting date	Finishing date	Active Man-Hours	Travelling Hours	Stand by Hours

**VSDV00106 - SHUT DOWN VALVE - VALVE-GAS SEALINE TO IKA A PLATFORM** FIELDS ARE MANDATORY FOR FILLING

Object part	Failure mode	Failure cause	Action taken	Failure consequence
<input type="checkbox"/> Accessories	<input type="checkbox"/> Abnormal instrument reading	<input type="checkbox"/> Design-related / General	<input type="checkbox"/> Replaced	<input type="checkbox"/> Reduced export/loading
<input type="checkbox"/> Actuator	<input type="checkbox"/> Delayed operation	<input type="checkbox"/> Design-related / Improper capacity	<input type="checkbox"/> Repaired	<input type="checkbox"/> Export/loading system shutdown
<input type="checkbox"/> Control and monitoring	<input type="checkbox"/> External leakage - process medium	<input type="checkbox"/> Design-related / Improper material	<input type="checkbox"/> Modified	<input type="checkbox"/> Flaring - production loss
<input type="checkbox"/> Flow control module	<input type="checkbox"/> External leakage - utility medium	<input type="checkbox"/> Fabrication/Installation-relatedcauses / General	<input type="checkbox"/> Adjusted	<input type="checkbox"/> Flaring - no production loss
<input type="checkbox"/> Flowbase	<input type="checkbox"/> Fails to close on demand	<input type="checkbox"/> Fabrication/Installation-relatedcauses / Fabrication error	<input type="checkbox"/> Refined	<input type="checkbox"/> Reduced injection (Gas or water injection)
<input type="checkbox"/> Heating system	<input type="checkbox"/> Fails to open on demand	<input type="checkbox"/> Fabrication/Installation-relatedcauses / Installation error	<input type="checkbox"/> Checked	<input type="checkbox"/> Injection shutdown (Gas or water injection)
<input type="checkbox"/> Miscellaneous	<input type="checkbox"/> High output	<input type="checkbox"/> Failure related to operation/maintenance / General	<input type="checkbox"/> Serviced	<input type="checkbox"/> No immediate failure consequence
<input type="checkbox"/> Pipe	<input type="checkbox"/> Internal leakage	<input type="checkbox"/> Failure related to operation/maintenance / Off-design service	<input type="checkbox"/> Tested	<input type="checkbox"/> Other (Specify in add. info.)
<input type="checkbox"/> Protection	<input type="checkbox"/> Leakage in closed position	<input type="checkbox"/> Failure related to operation/maintenance / Operating error	<input type="checkbox"/> Inspected	<input type="checkbox"/> Reduced production (Oil and/or gas system)
<input type="checkbox"/> Riser and umbilical termination	<input type="checkbox"/> Low output	<input type="checkbox"/> Failure related to operation/maintenance / Maintenance error	<input type="checkbox"/> Overhauled	<input type="checkbox"/> Production shutdown (Oil and/or gas system)
<input type="checkbox"/> Riser base	<input type="checkbox"/> Minor in-service problems	<input type="checkbox"/> Failure related to operation/maintenance / Expected wear and tear	<input type="checkbox"/> Combination	<input type="checkbox"/> Redundancy, spare capacity reduced or lost
<input type="checkbox"/> Subsea wellhead	<input type="checkbox"/> Other	<input type="checkbox"/> Failure related to management / General	<input type="checkbox"/> Other	<input type="checkbox"/> Unknown
<input type="checkbox"/> Tubing hanger	<input type="checkbox"/> Plugged/choked	<input type="checkbox"/> Failure related to management / Documentation error		<input type="checkbox"/> Shutdown of multiple wells
<input type="checkbox"/> Valve	<input type="checkbox"/> Spurious operation	<input type="checkbox"/> Failure related to management / Management error		<input type="checkbox"/> Shutdown of single well
<input type="checkbox"/> Vertical connection module (VCM)	<input type="checkbox"/> Structural deficiency	<input type="checkbox"/> Miscellaneous / General		

The screenshot shows the Infor10 EAM interface for work order 169024. The main form includes fields for Work Order, Equipment (VSDV00106), Type (CO), Department (ANNAMARIA), and Status (Closed). A modal dialog box is open, displaying a list of failure causes and consequences. The dialog title is "Failure Cause, Failure Consequence, Action Taken and Object part are mandatory fields when WO is in status Technical Closure".

This screenshot shows the 'Closing Codes' section of the work order form. It includes dropdown menus for Failure Mode (LCP), Failure Consequence (OTH), Failure Cause (MIS-05), and Action Taken (SERV). The status is set to 'Technical closure' and the equipment is 'VSDV00106'. The start date is 03-AUG-2013 00:00 and the date completed is 03-AUG-2013 10:56. Downtime hours are recorded as 4.

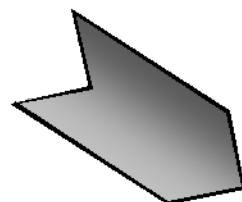
### **3.4 Ključni pokazatelji uspješnosti održavanja (Key Performance Indicators - KPI) - Izračun i analiza korištenjem CMMS sustava**

- **Europska norma EN 15341 - Održavanje - Ključni pokazatelji uspješnosti održavanja**
  - ✓ **Definira indikatore - ključne veličine i parametre koji prikazuju sliku o tome koliko dobro upravljamo održavanjem i koristimo li svoju fizičku imovinu na konkurentan način**

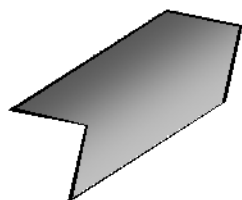


## EN 15341 - Održavanje - Ključni pokazatelji uspješnosti održavanja

Vanjski utjecajni faktori
Lokacija
Socijalna kultura
Radna snaga
Troškovi
Situacija na tržištu
Zakonska regulativa
Sektor/Branša



Unutarnji utjecajni faktori
Kultura kompanije
Težina procesa
Proizvodi
Veličina tvornice
Stupanj iskorištenja
Starost tvornice
Kritičnost procesa



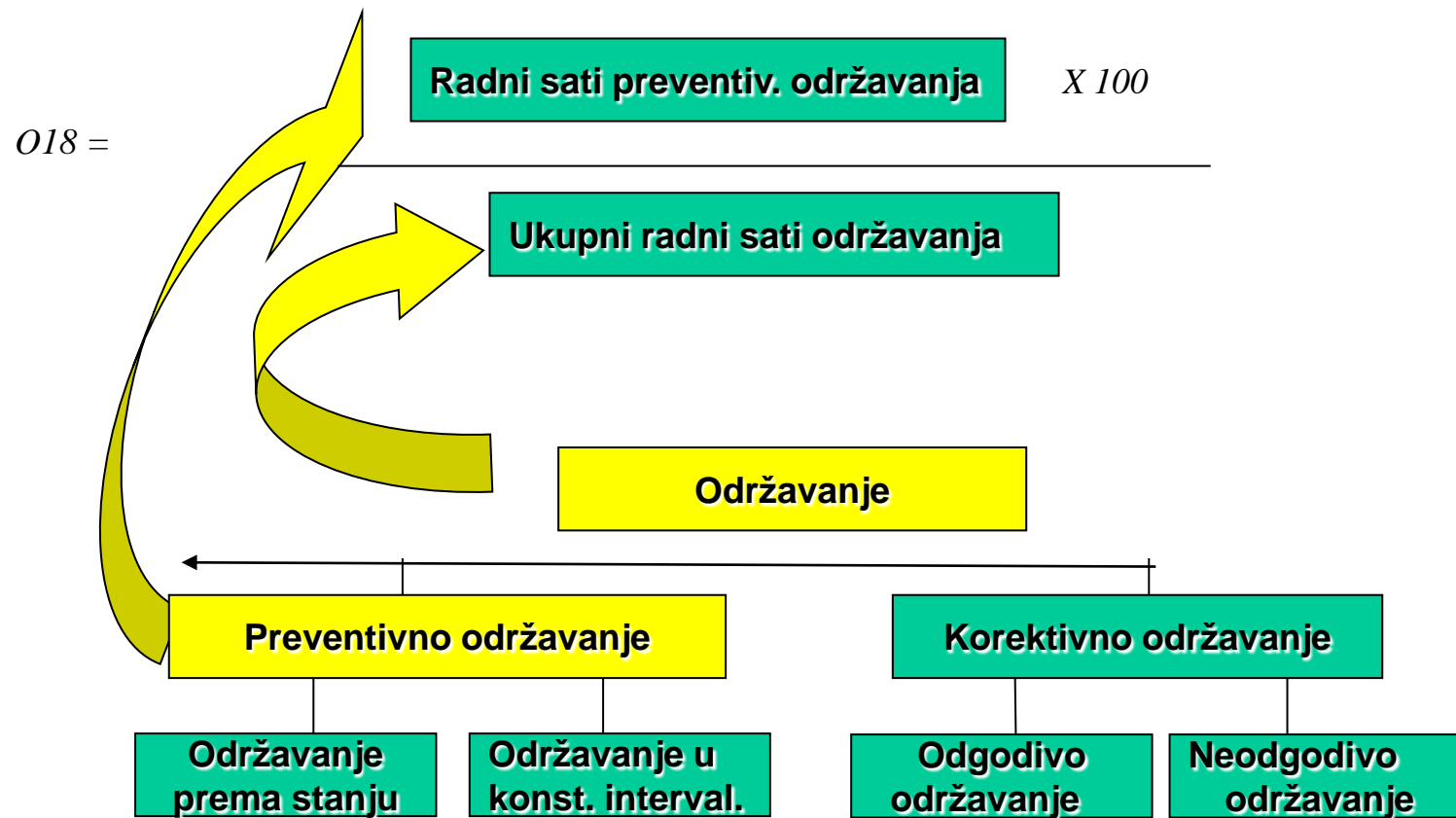
		Razine pokazatelja		
		Razina 1	Razina 2	Razina 3
Grupe pokazatelja	Ekonomski pokazatelji	E1 E2 E3 E4 E5 E6	E7 E8 E9 E10 E11 E12 E13 E14	E15 E16 E17 E18 E19 E20 E21 E22 E23 E24
	Tehnički pokazatelji	T1 T2 T3 T4 T5	T6 T7	T8 T9 T10 T11 T12 T13 T14 T15 T16 T17 T18 T19 T20 T21
	Organizacijski pokazatelji	O1 O2 O3 O4 O5 O6 O7 O8	O9 O10	O11 O12 O13 O14 O15 O16 O17 O18 O19 O20 O21 O22 O23 O24 O25 O26

# Pokazatelj T1

$$OI = \frac{\text{Ukupno vrijeme rada}}{\text{Ukupno vrijeme rada} + \text{Zastoji zbog održavanja}} \times 100$$

**Raspoloživost vezana na održavanje  
(gubitak vremena rada zbog aktivnosti održavanja)**

# Pokazatelj O18



INBOX

Operacije Održavanje Upravljanje

Opis	Prebroji
Otvoreni RN - izvan sustava	129
Otvoreni RN - Sustav 1	30
Otvoreni RN - Sustav 2	46
Otvoreni RN - Sustav 3	40
Zahtjevi za rad - izvan sustava	0
Zahtjevi za rad - Sustav 1	0
Zahtjevi za rad - Sustav 2	0
Zahtjevi za rad - Sustav 3	0
Pregled RN zadnjih 7 dana	0
Narudžbe - nefakturirano	123
Narudžbe - fakturirano	405
Nabava u pripremi	0

SVI KPU



T6 Vrijeme u radu x100/Vrijeme u radu + vrijeme zastoja planiranog održavanja: 99,48 %



T15 Ukupno vrijeme u radu/broj radnih naloga održavanja: 589



O1 Broj djelatnika održavanja x100/ukupni broj djelatnika u poduzeću: 2,65 %



O6 Broj ozljeda djelatnika/ukupni broj održavatelja: 0,27



O12 Broj sati mehaničkog održavanja x100/ukupni broj sati direktnog osoblja odr.: 45,92 %



O21 Broj prekovremenih sati u održavanju x100/ukupni broj sati održavanja: 3,56 %



E3 Ukupni troškovi održavanja / izlazna količina: 27,79



E5 Ukupni troškovi održavanja + troškovi nerasploživosti / izlazna količina: 48,76



E6 Raspoloživost povezana s održavanjem / ukupni troškovi održavanja: 32,32

OSVJEŽI OSOBNE POSTAVKE

OSVJEŽI OSOBNE POSTAVKE

V8.4

DOKUMENTACIJA POSAO MATERIJALI OBJEKTI NABAVA OPERACIJE ADMINISTRIRANJE



Šifra KPU: SQL0006 O21 Broj prekovremenih sati u održavanju x100/ukupni broj sati održavanja

Svi zapisi Jedan zapis Rasponi Korisničke grupe Podređeni

Datasey: Sve šifre KPU Zapisi: 9 od 9 1237 Brzi filter: Šifra KPU sadrži

Šifra KPU	Opis	Učestalost	SQL naredba	Trenutna vrijednost	Zadnje ažuriranje	Sljedeće ažuriranje	Javno	Povijest održ
SQL0001	T6 Vrijeme u radu x100/Vrijeme u radu + vrijeme zastoja planiranog održavanja	1	SQL0001	99,48	09-05-2012	12-05-2012	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
SQL0002	T15 Ukupno vrijeme u radu/broj radnih naloga održavanja	1	SQL0002	589	09-05-2012	10-05-2012	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
SQL0003	O1 Broj djelatnika održavanja x100/ukupni broj djelatnika u poduzeću	1	SQL0003	2,65	09-05-2012	10-05-2012	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
SQL0004	O6 Broj ozljeda djelatnika/ukupni broj održavatelja	1	SQL0004	0,27	09-05-2012	10-05-2012	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
SQL0005	O12 Broj sati mehaničkog održavanja x100/ukupni broj sati direktnog osoblja odr.	1	SQL0005	45,92	07-05-2012	10-05-2012	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
SQL0006	O21 Broj prekovremenih sati u održavanju x100/ukupni broj sati održavanja	1	SQL0006	3,56	09-05-2012	10-05-2012	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
SQL0007	E3 Ukupni troškovi održavanja / izlazna količina	1	SQL0007	27,79	09-05-2012	10-05-2012	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
SQL0008	E5 Ukupni troškovi održavanja + troškovi neraspoloživosti / izlazna količina	1	SQL0008	48,76	09-05-2012	10-05-2012	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
SQL0009	E6 Raspoloživost povezana s održavanjem / ukupni troškovi održavanja	1	SQL0009	32,32	08-05-2012	10-05-2012	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>



**Šifra KPU: SQL0006** O21 Broj prekovremenih sati u održavanju x100/ukupni broj sati održavanja

Svi zapisi   Jedan zapis   **Rasponi**   Korisničke grupe   Podređeni

Donja vrijednost	Gornja vrijednost	Opis	Ikona KPU	Normalna vrijednost
0	5	prihvatljivo	goodtach	0
5,01	10	relativno prihvatljivo	oktach	0
10,01	100	nije prihvatljivo	goodtach	0

**JOŠ VIŠE O TRENDOVIMA RAZVOJA  
CMMS SISTEMA S ASPEKTA IT  
TEHNOLOGIJA I ASPEKTA PODRŠKE  
FUNKCIONALNOSTIMA ZA UPRAVLJANJE  
FIZIČKOM IMOVINOM**

**I U SLJEDEĆIM PREZENTACIJAMA .....**

# Pitanja?

