

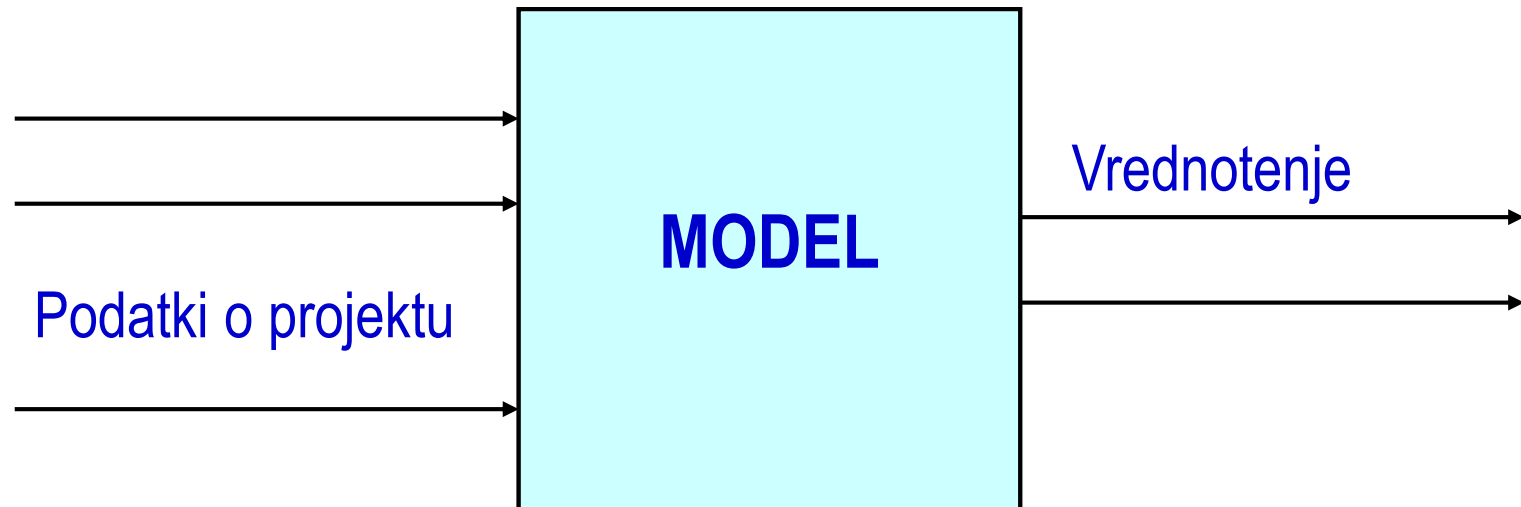
Praktični primeri uporabe večkriterijskega modeliranja

Proizvodni program

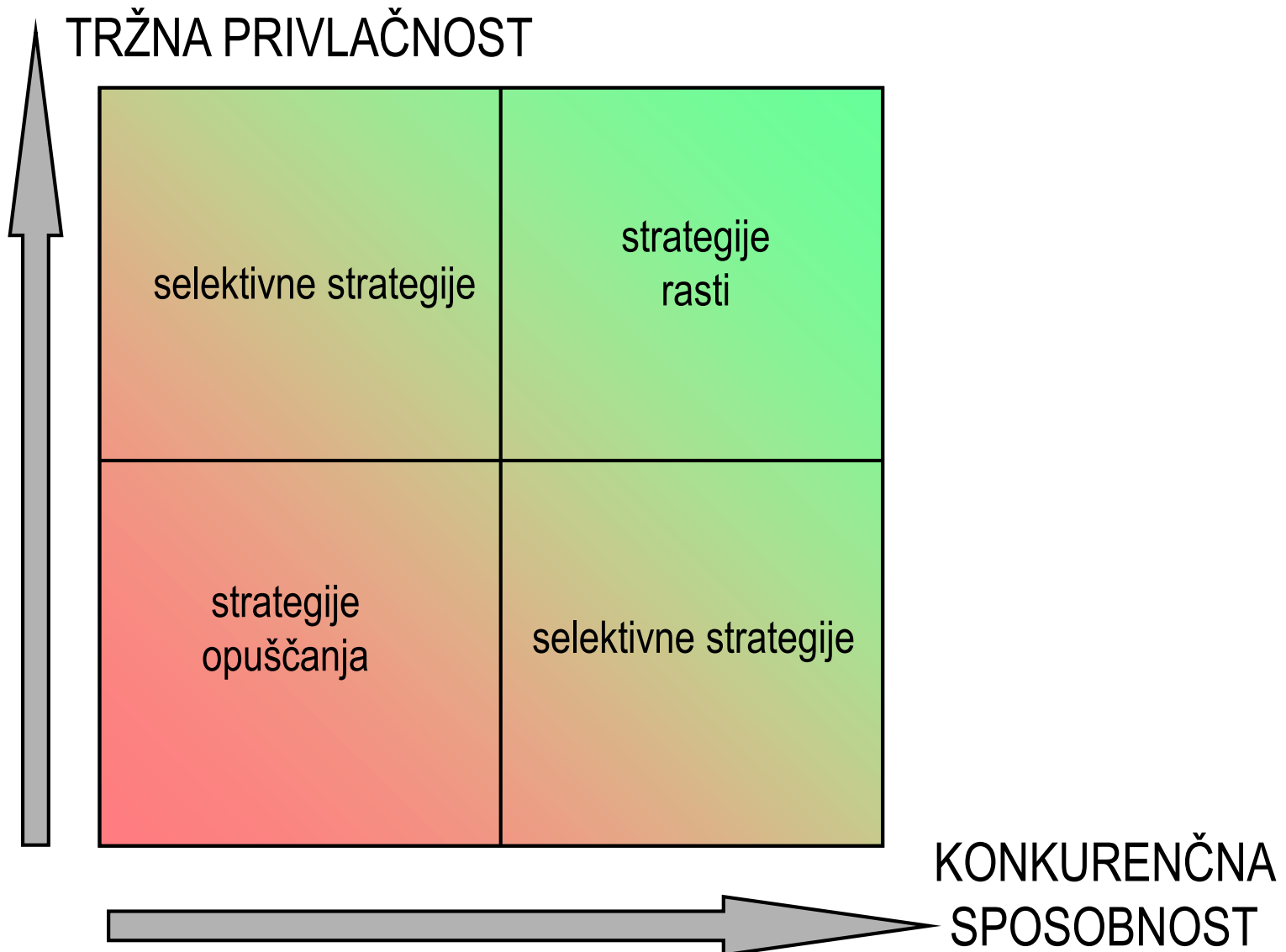
Vrednotenje proizvodnega programa

Problem: "Založba"

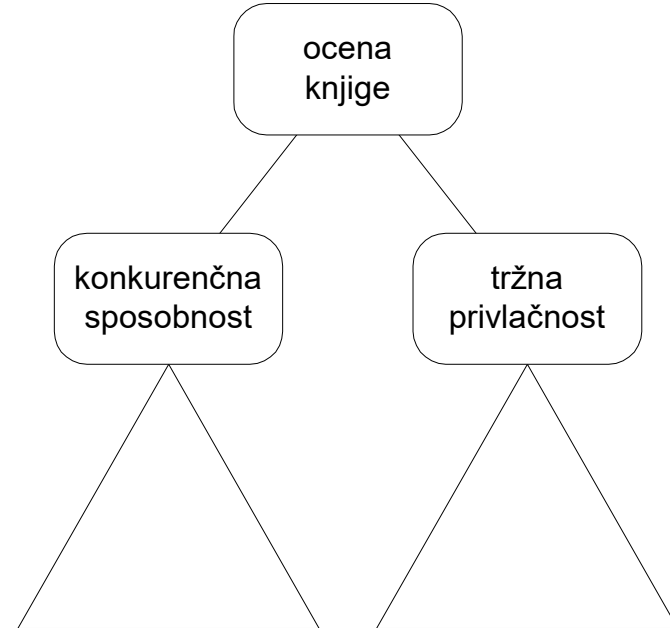
Razviti model za vrednotenje, analizo in spremljanje projektov (učbenikov) na nivoju izdaje posameznih knjig in na nivoju uredniških programov.



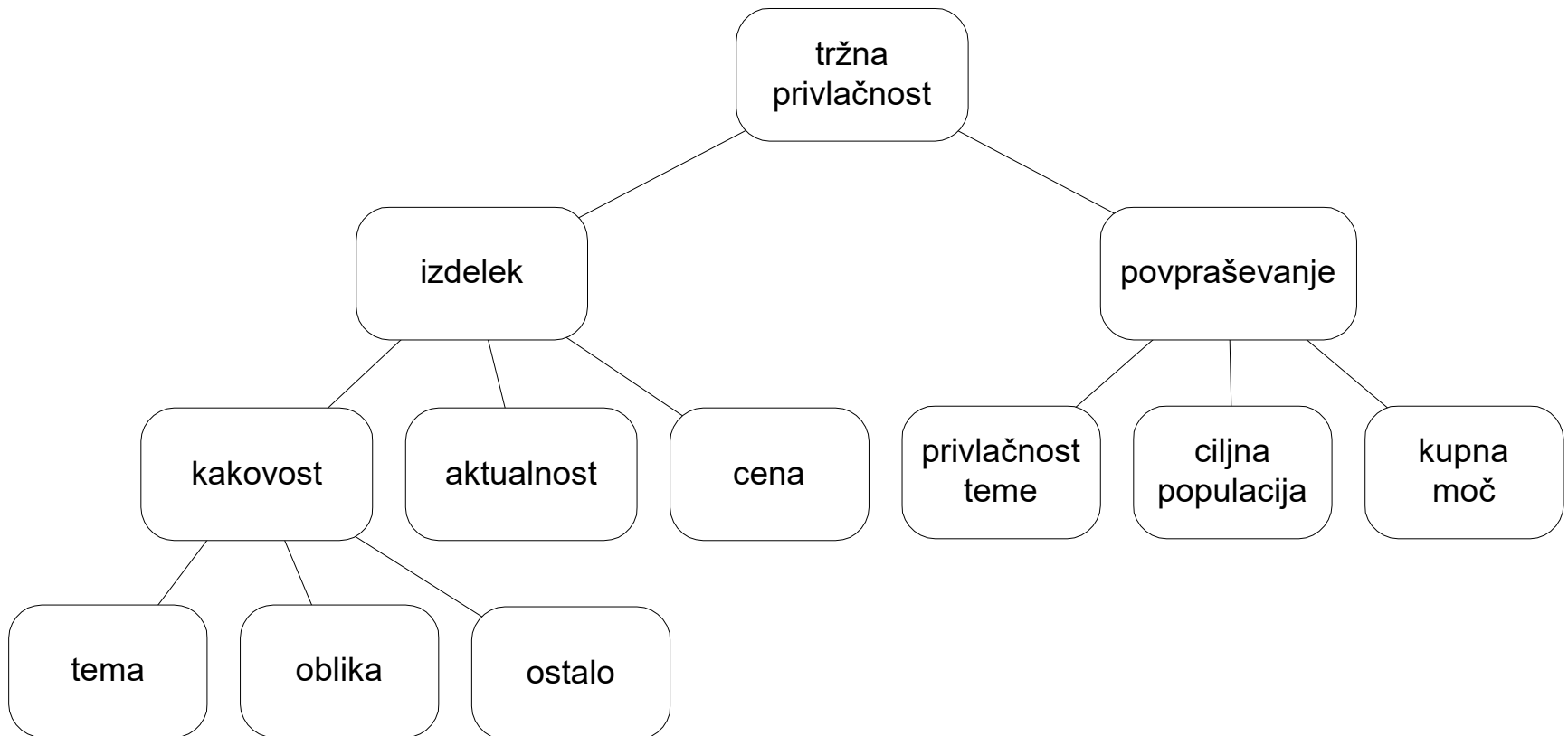
Matrika tržnega premoženja



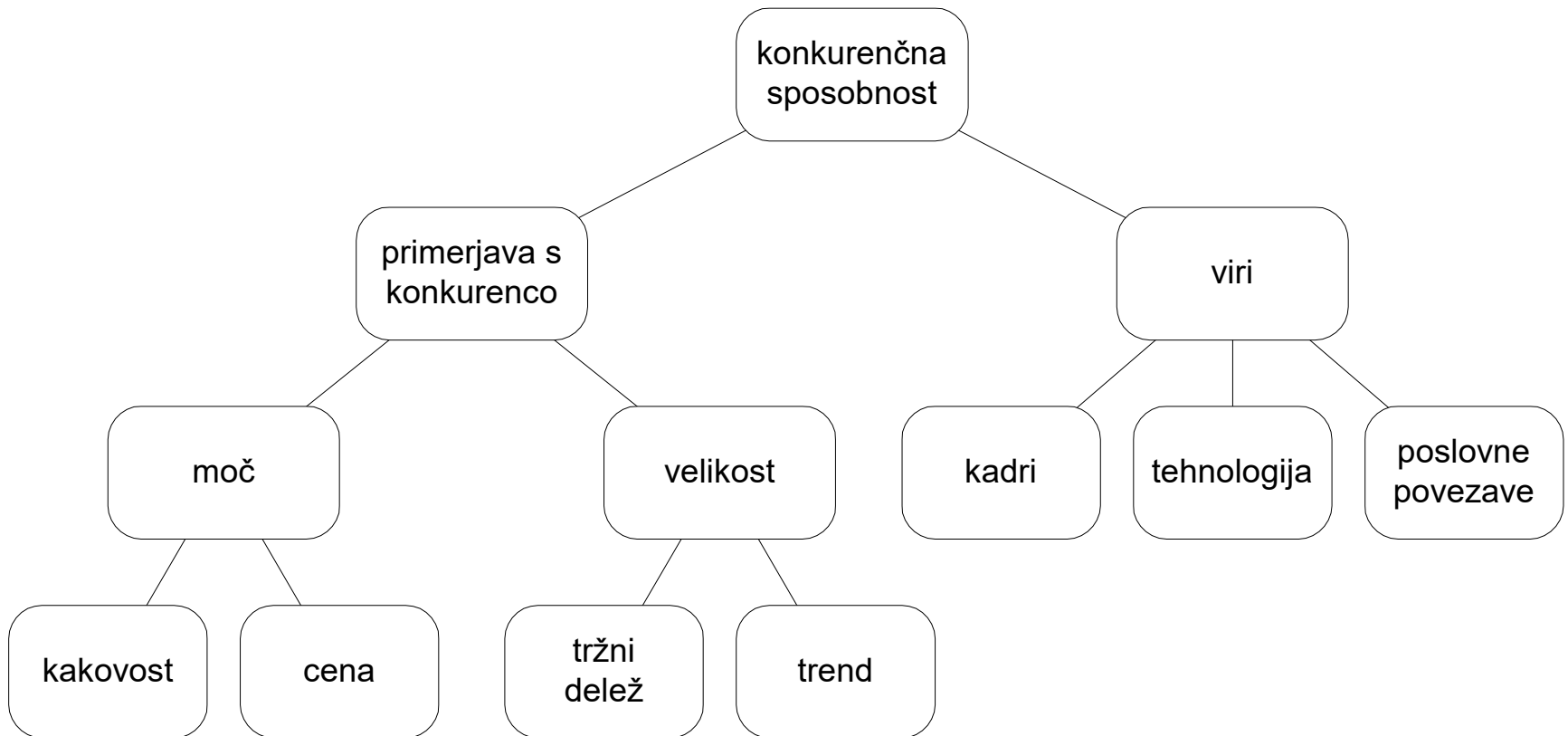
Model vrednotenja



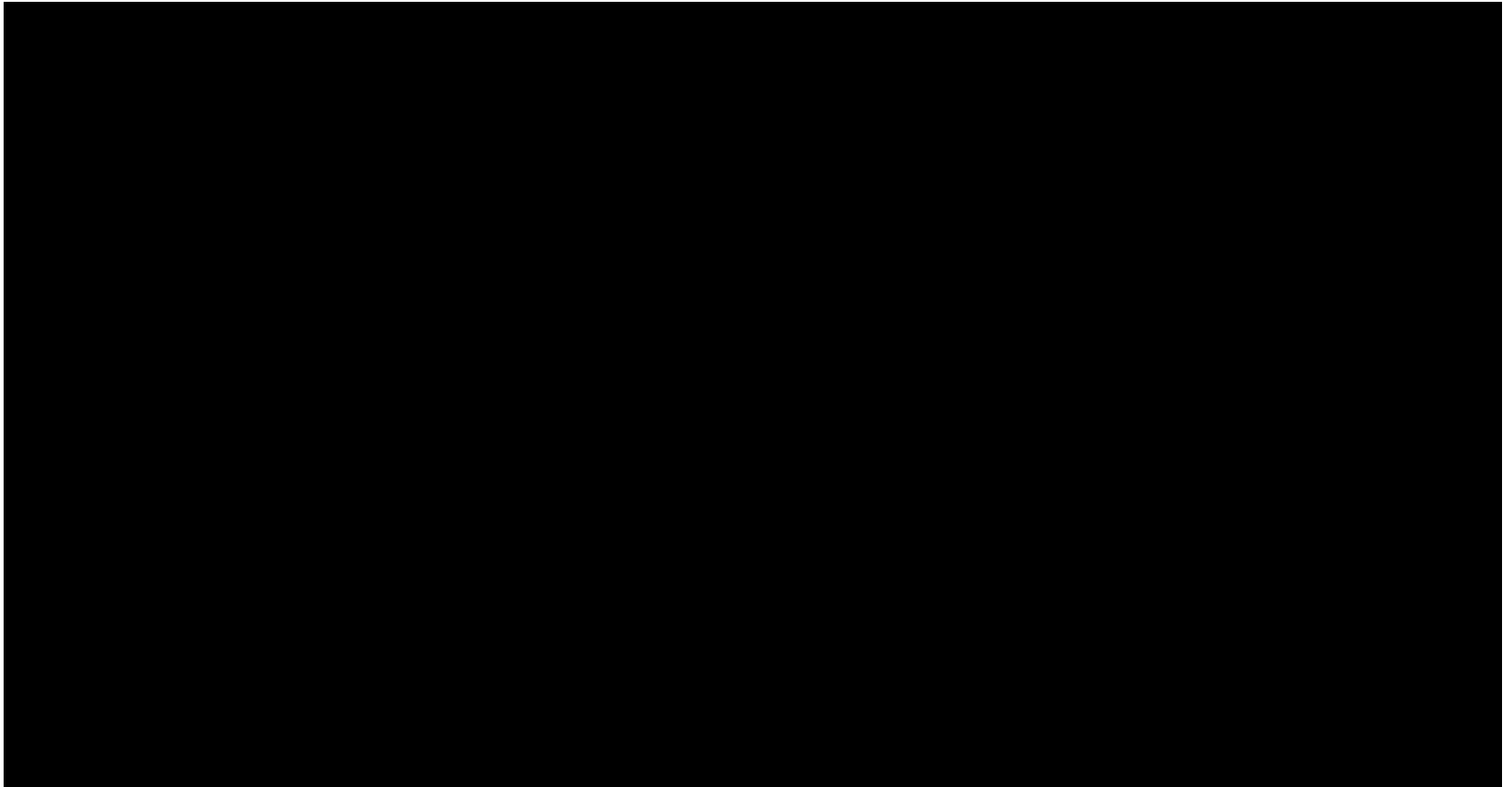
Tržna privlačnost



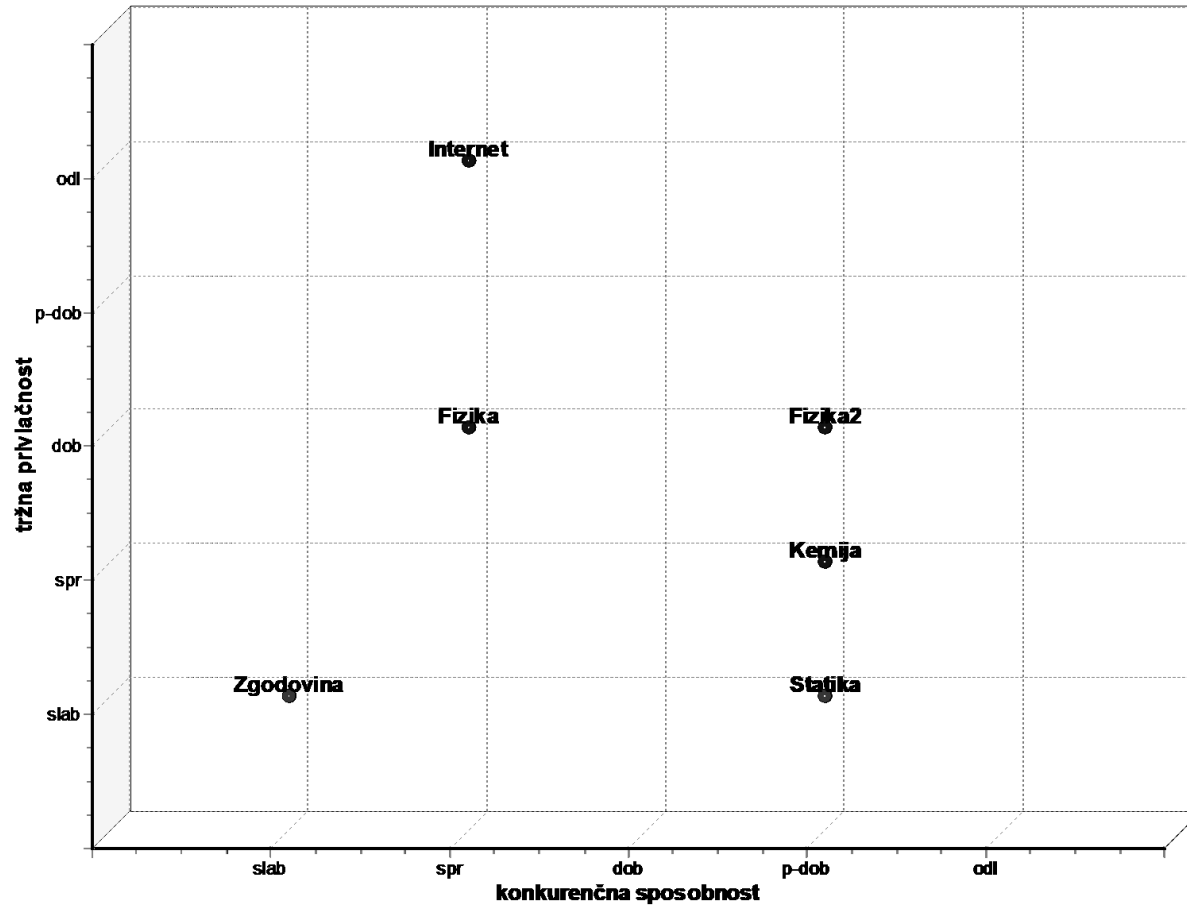
Konkurenčna sposobnost



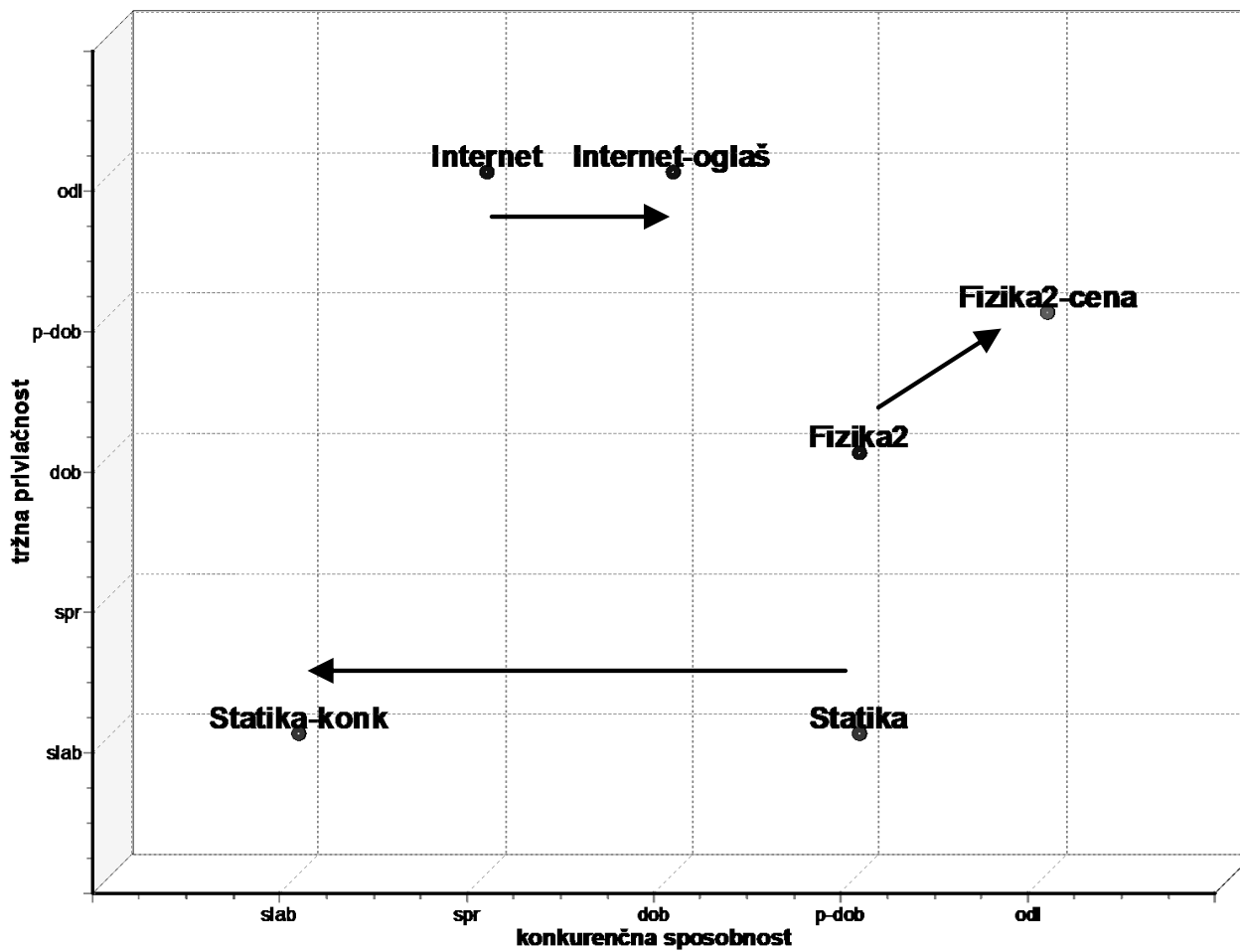
Model DEXi



Vrednotenje: Matrika tržnega premoženja

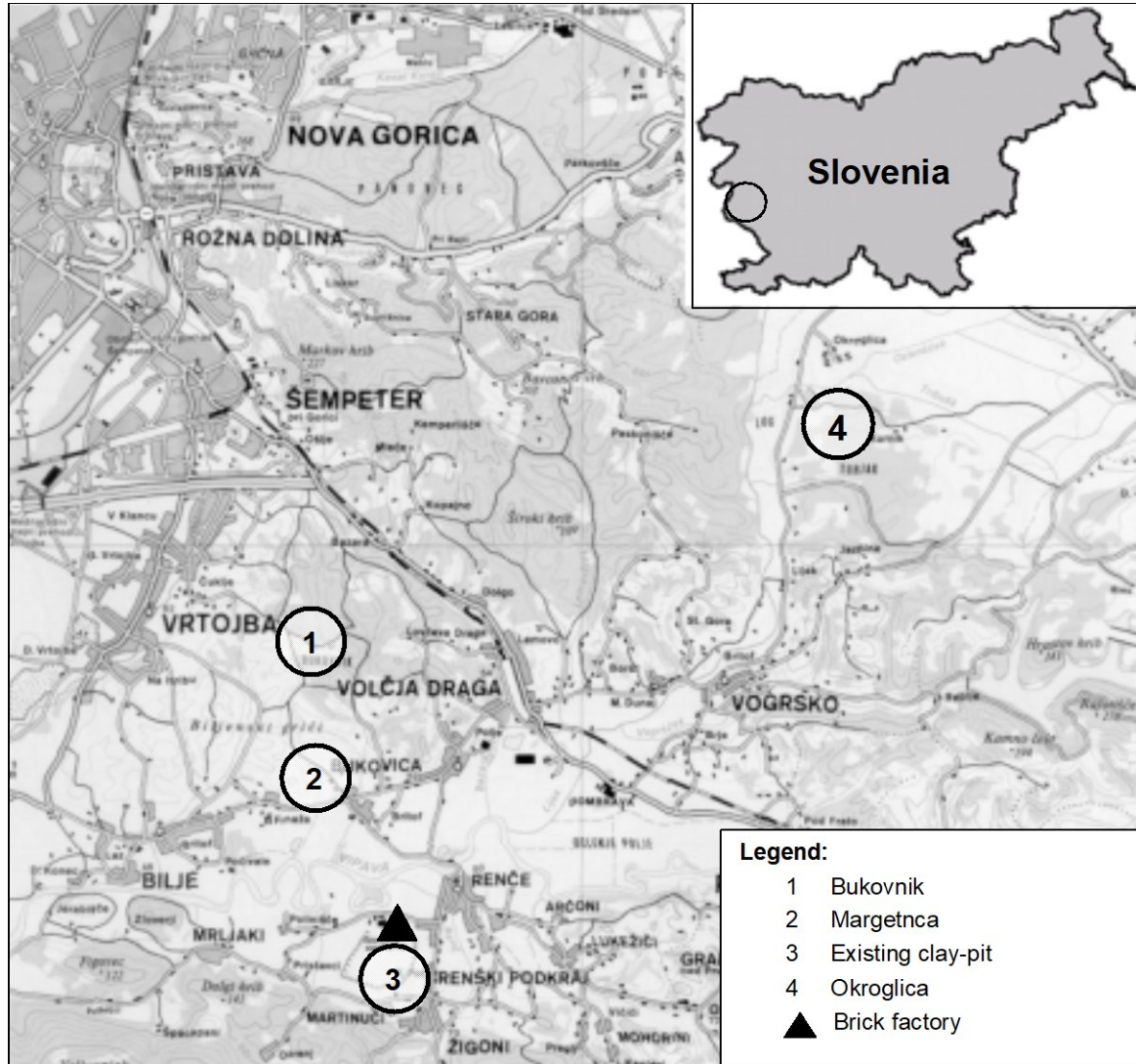


Analiza: Kaj-če?



Goriške opekarne: lokacija glinokopa

Lokacije glinokopa



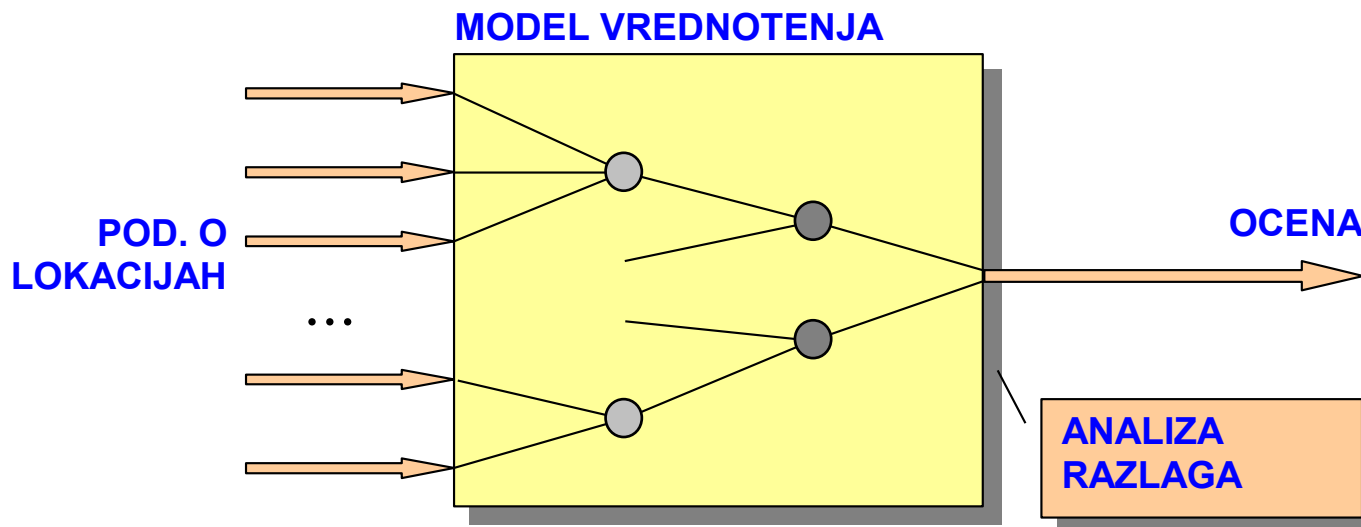
Vrednotenje glinokopov

VARIANTE

LOKACIJA 1

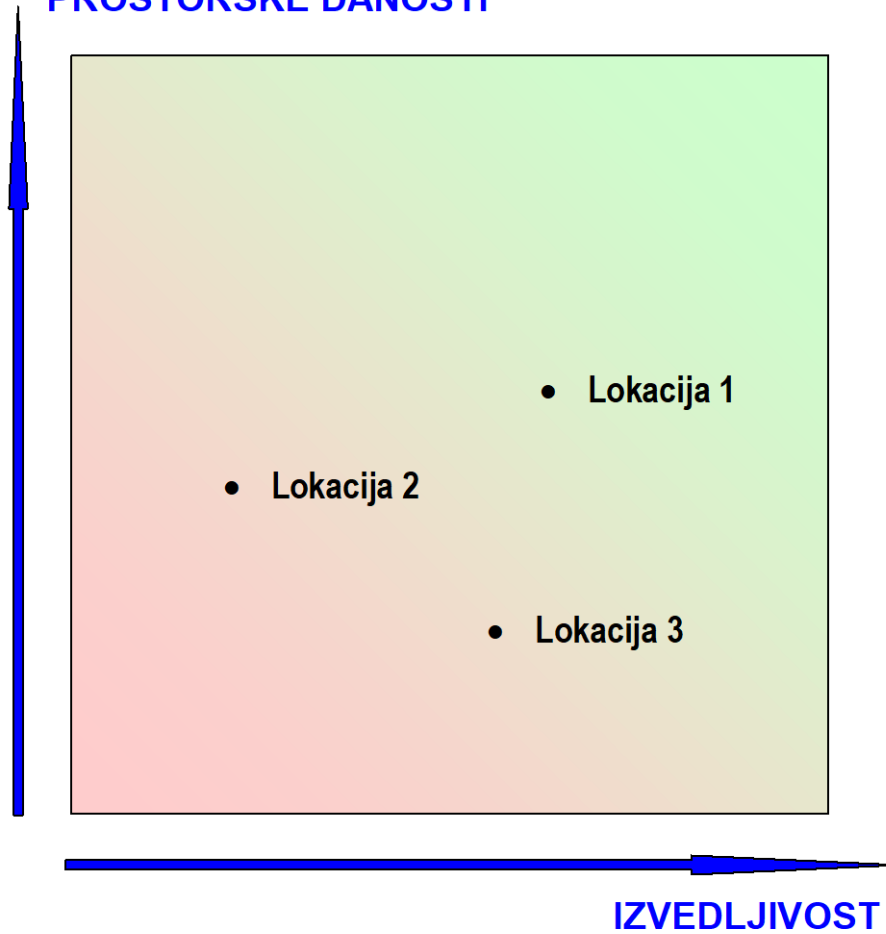
LOKACIJA 2

LOKACIJA 3

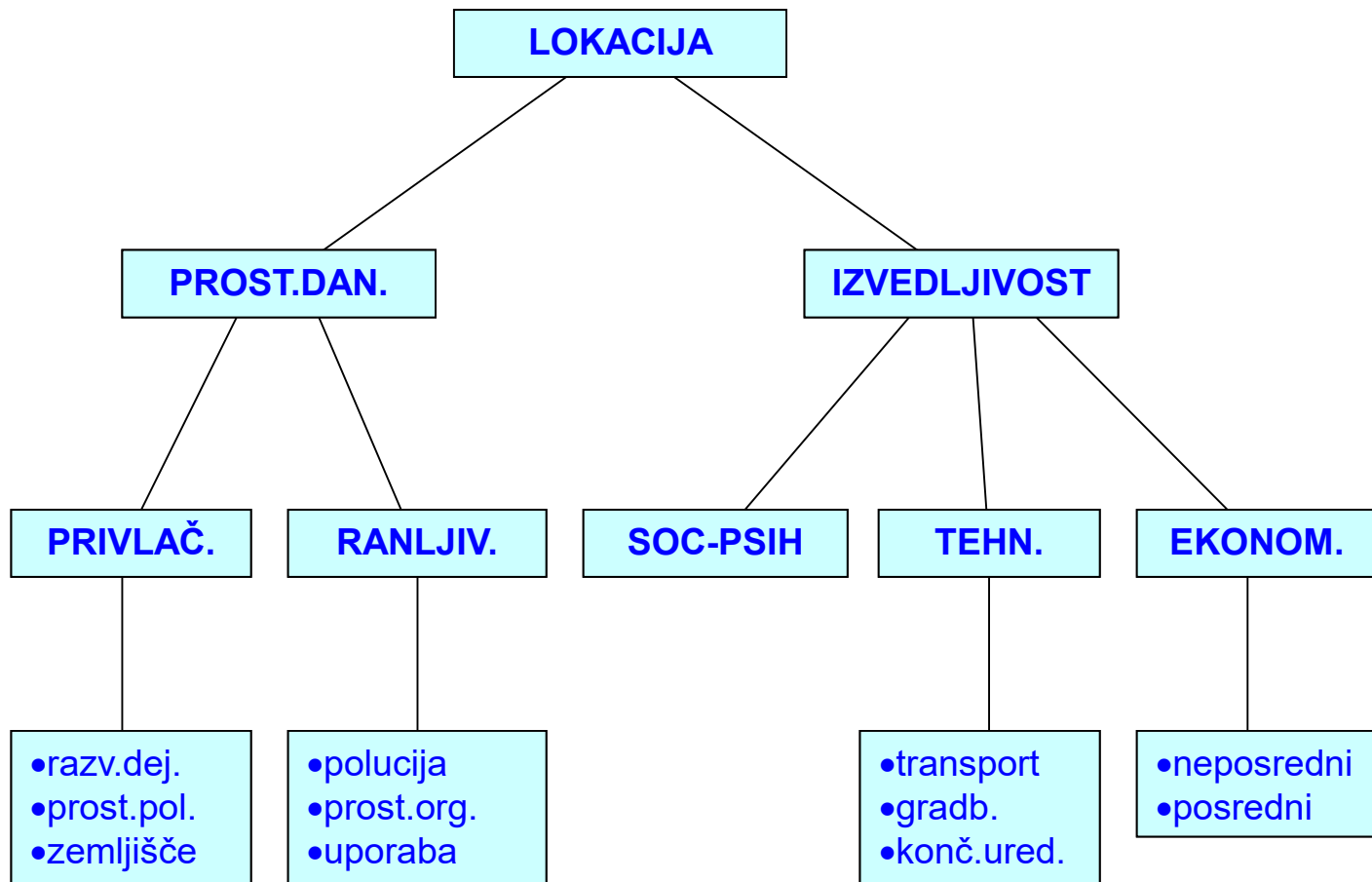


Vrednotenje glinokopov

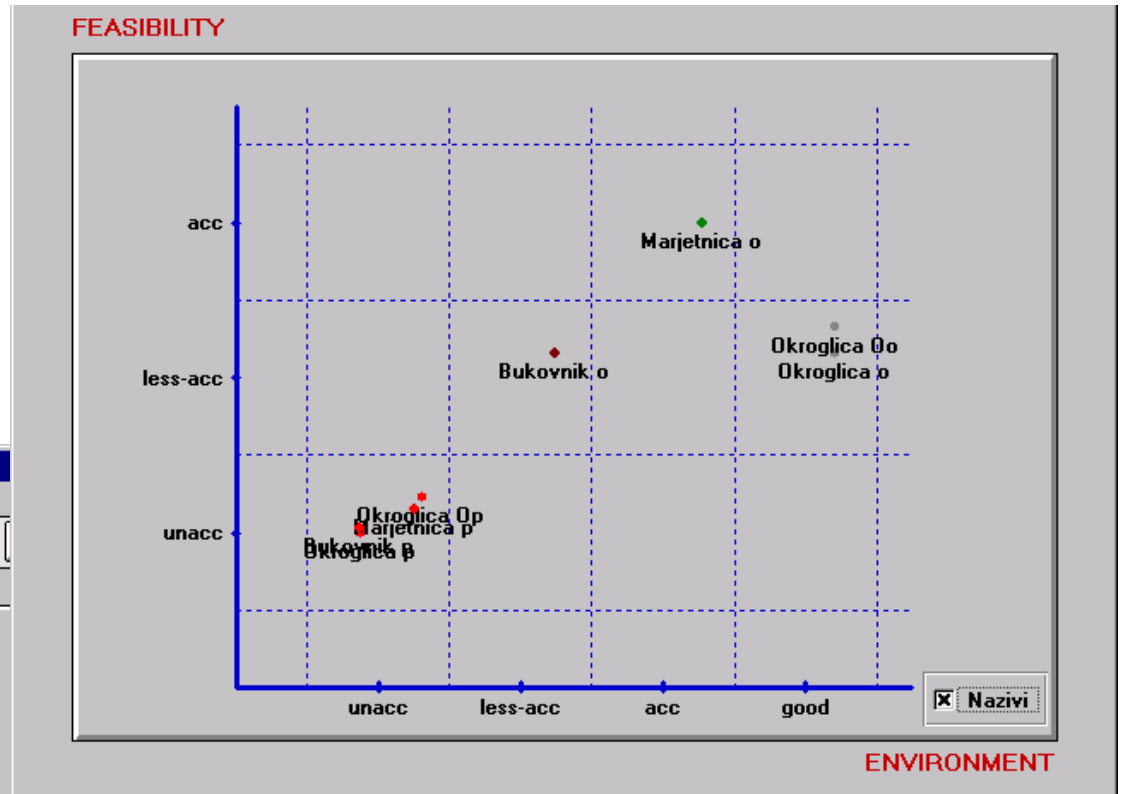
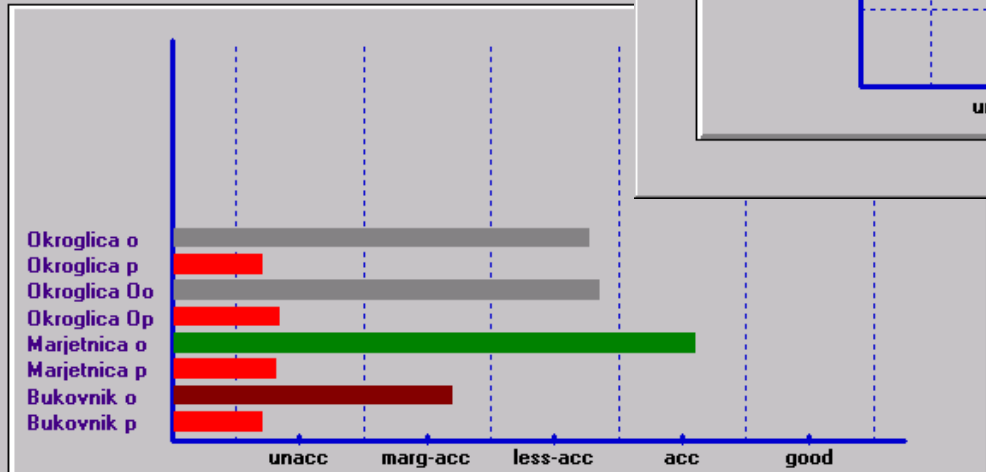
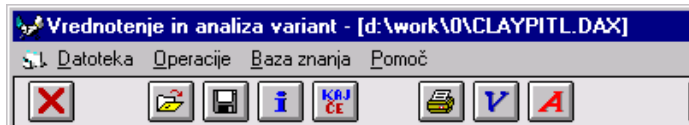
PROSTORSKE DANOSTI



Večkriterijski model vrednotenja



Vrednotenje lokacij

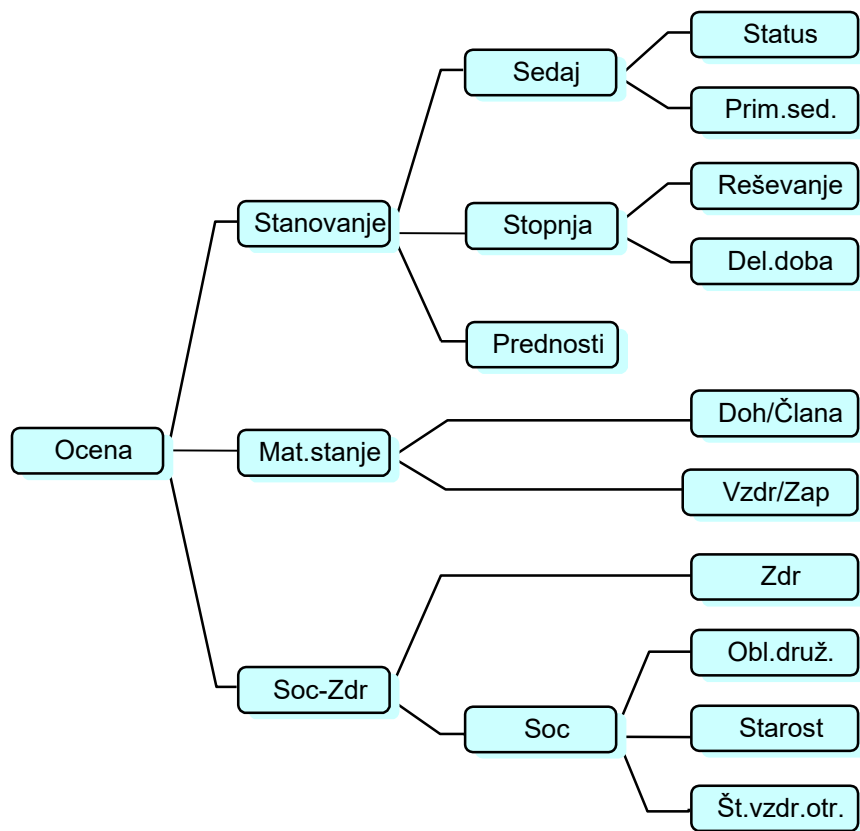


SITE

Dodeljevanje posojil

Dodeljevanje stanovanjskih posojil

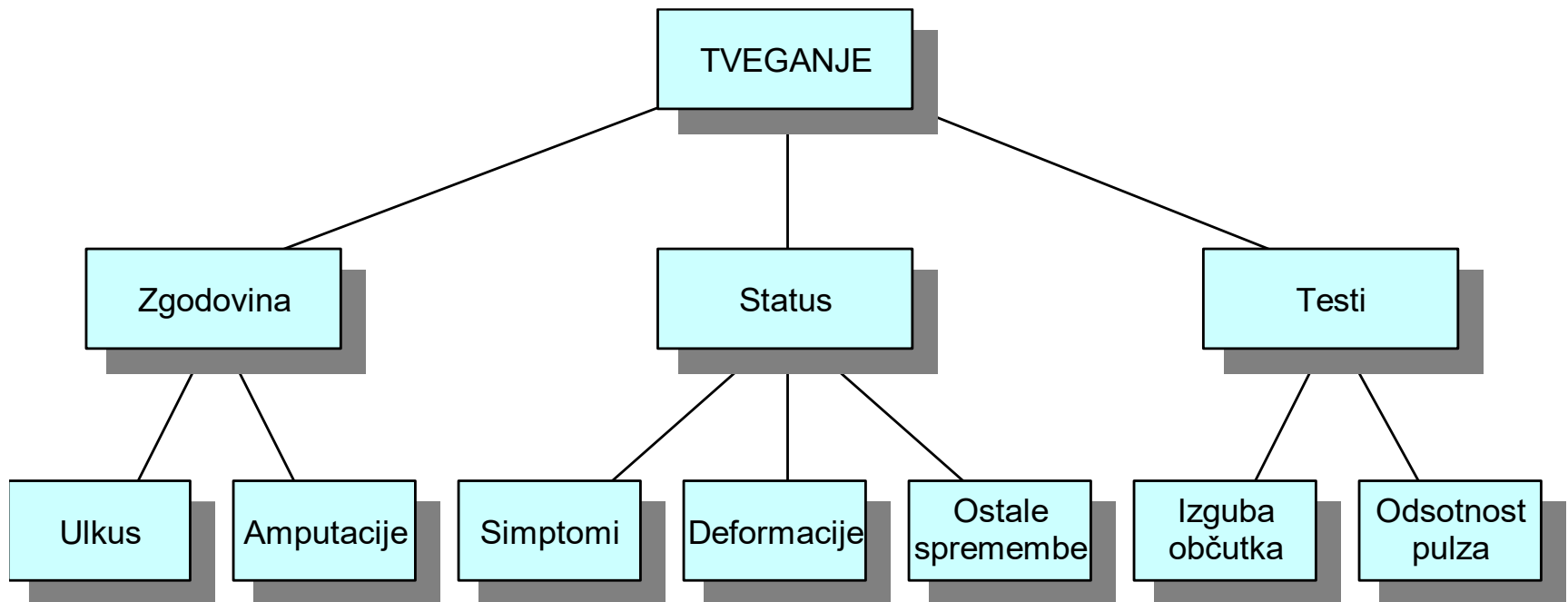
Stanovanjski sklad Republike Slovenije



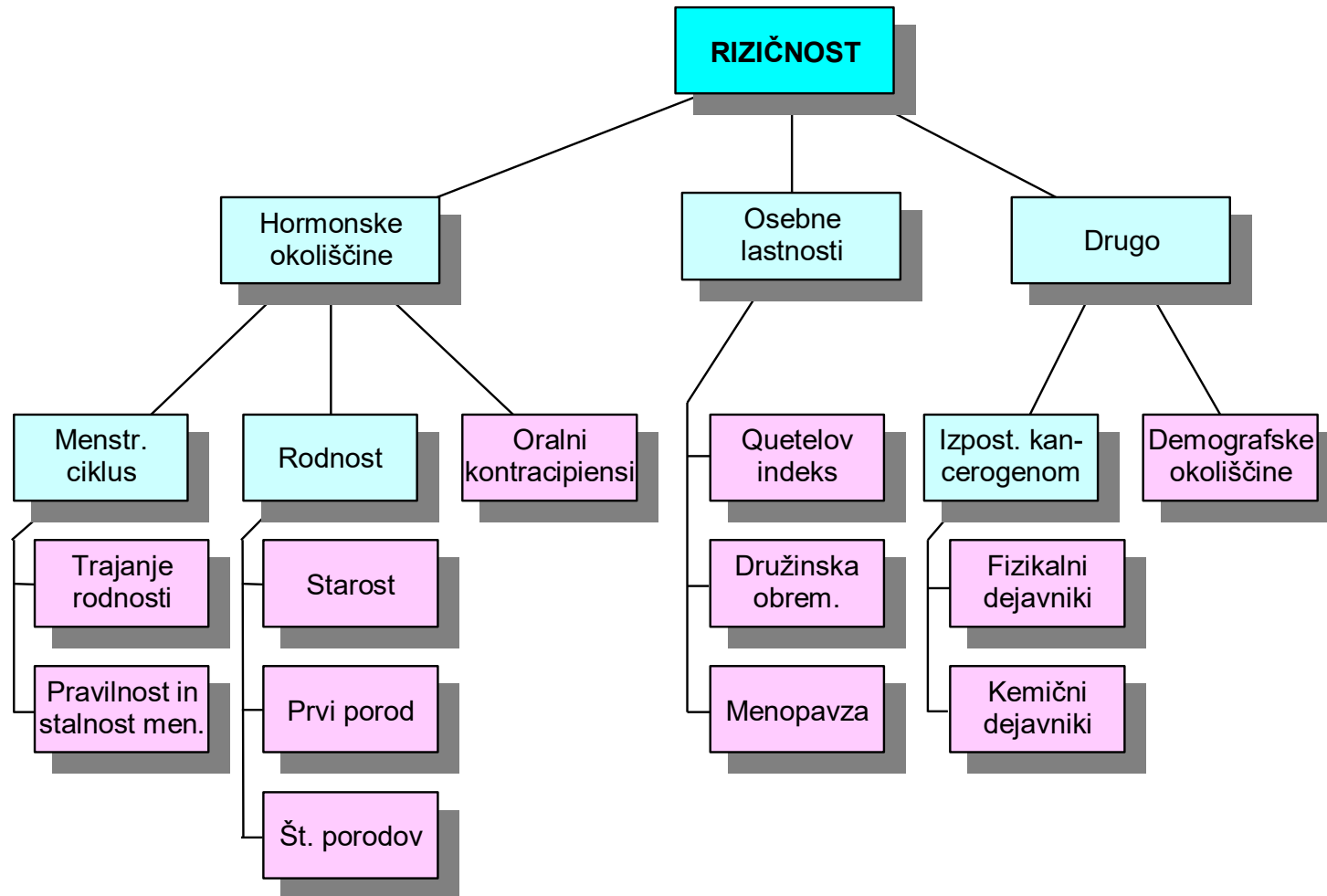
Ocenjevanje tveganja v zdravstvu

Ocena tveganja pri diabetičnem stopalu

Večkriterijski model

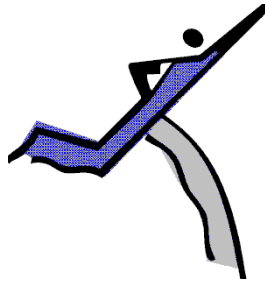


Rak na dojki: ocena rizičnosti



Usmerjanje v športne panoge

Usmerjanje v športne panoge



Sistem Talent

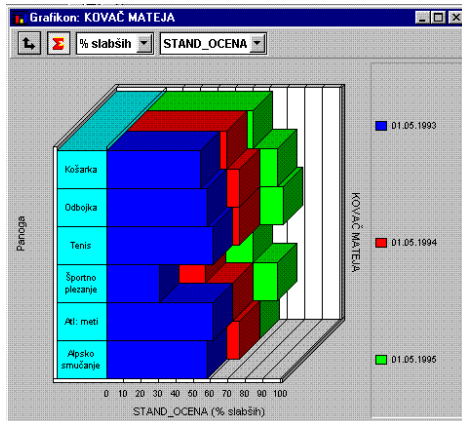


Tabela: KOVAČ MATEJA

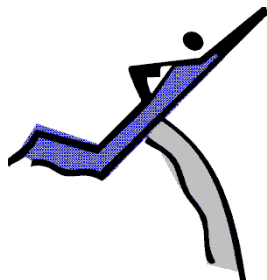
% slabših | STAND_OCENA

	01.05.1993	01.05.1994	01.05.1995
Atletski dolž. skoki	50,00	61,79	*78,81
Atletski kr. dolge proge	57,93	53,98	*78,81
Atletski meti	61,79	61,79	*75,80
Atletski sprint	46,02	57,93	*81,59
Atletski viš. skoki	61,79	65,54	*78,81
Badminton	61,79	72,57	*78,81
Športna gimnastika	30,85	53,98	*65,54
Košarka	53,98	57,93	61,79
Namizni tenis	50,00	65,54	*72,57
Odbojka	57,93	65,54	75,80
Plavalne dolge proge	69,15	61,79	*86,43
Plavalne kr. proge	53,98	53,98	*72,57
Športno plezanje	30,85	46,02	*61,79
Plavalne mešano	38,21	30,85	*86,43

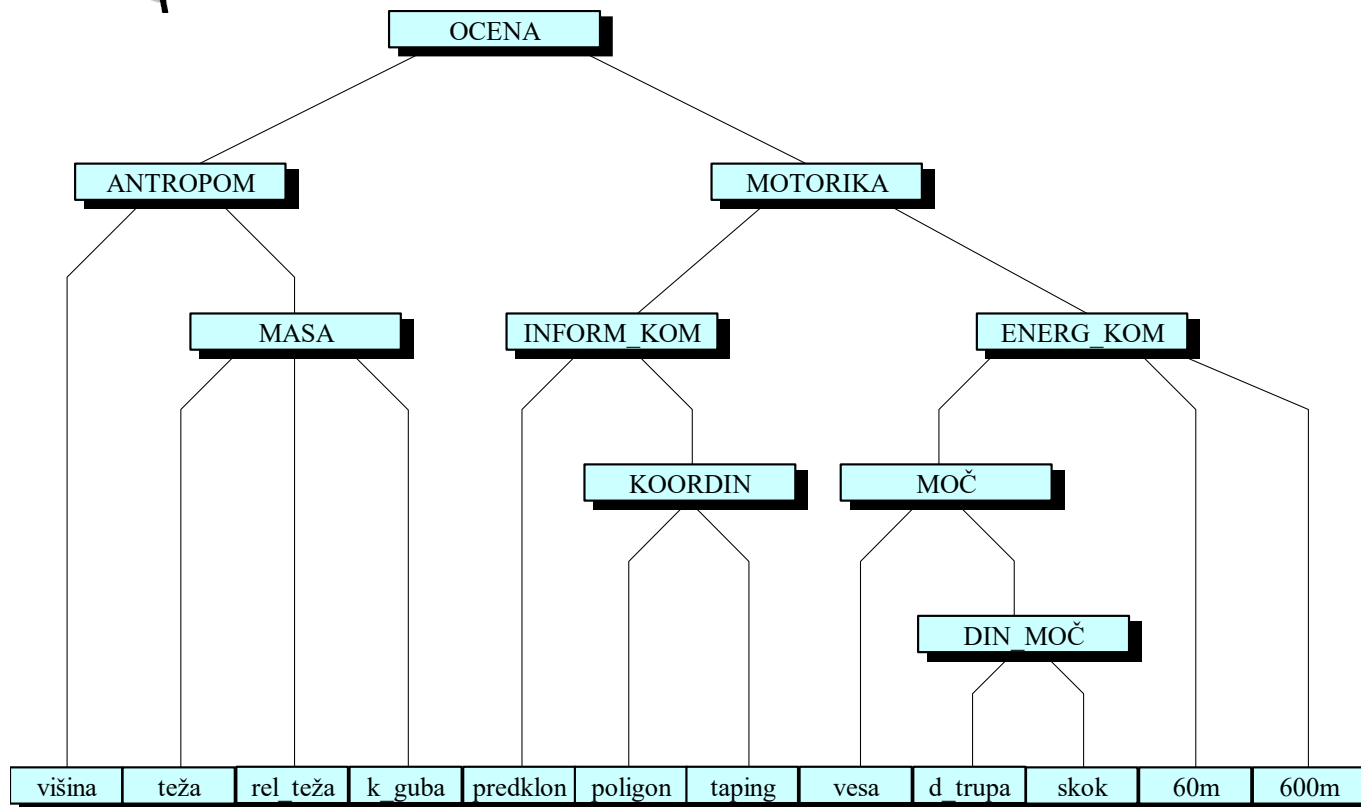
Košarka Model: ND Datum meritve: 26.04.1996

ATRIBUT	test	utež	ideal	T	dT	ocena	opis
STAND_OCENA				58	25	80	dob
OCENA							79%
ANTROPOM		160		49	33	32	spr
visina	120,0	100	82	48	34	26	spr
MASA		60		50	31	42	spr
teža	21,5	40	82	48	36	22	nepr
kožna_guba	8	20	79	58	21	82	odl
MOTORIKA		240		80	19	79	odl
INFORM_KOM		108		52	27	64	dob
KOORDIN		108		52	27	64	dob
poligon	23,3	56	79	54	25	68	dob
taping	21	52	79	50	29	60	dob
ENERG_KOM		132		88	13	90	odl
MOC		60		73	6	100	odl
DIN_MOČ		60		73	6	100	odl
skok_d_m	150	60	79	73	6	100	odl
tek_60m	12,4	52	79	68	11	98	odl
tek_600m	241	20	79	43	36	42	spr

Usmerjanje v športne panoge



Sistem Talent

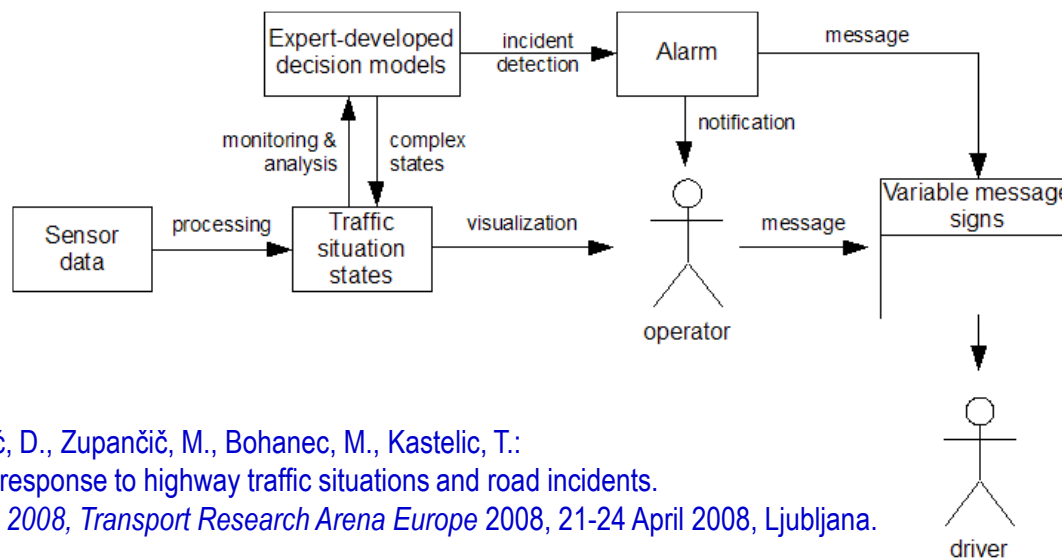


Krmiljenje in nadzorni sistemi

Avtocestni nadzorni center (Dragometlj)



Avtocestni nadzorni center



Omerčević, D., Zupančič, M., Bohanec, M., Kastelic, T.:
Intelligent response to highway traffic situations and road incidents.
Proc. TRA 2008, Transport Research Arena Europe 2008, 21-24 April 2008, Ljubljana.

Podpora odločanju v kmetijstvu

EU projekti: Gensko spremenjeni organizmi



ECOGEN

2003-2006

<http://www.ecogen.dk/>

Soil ecological and economic evaluation of genetically modified crops



SIGMEA

2004-2007

<http://sigmea.dyndns.org/>

Sustainable introduction of genetically modified crops into European agriculture



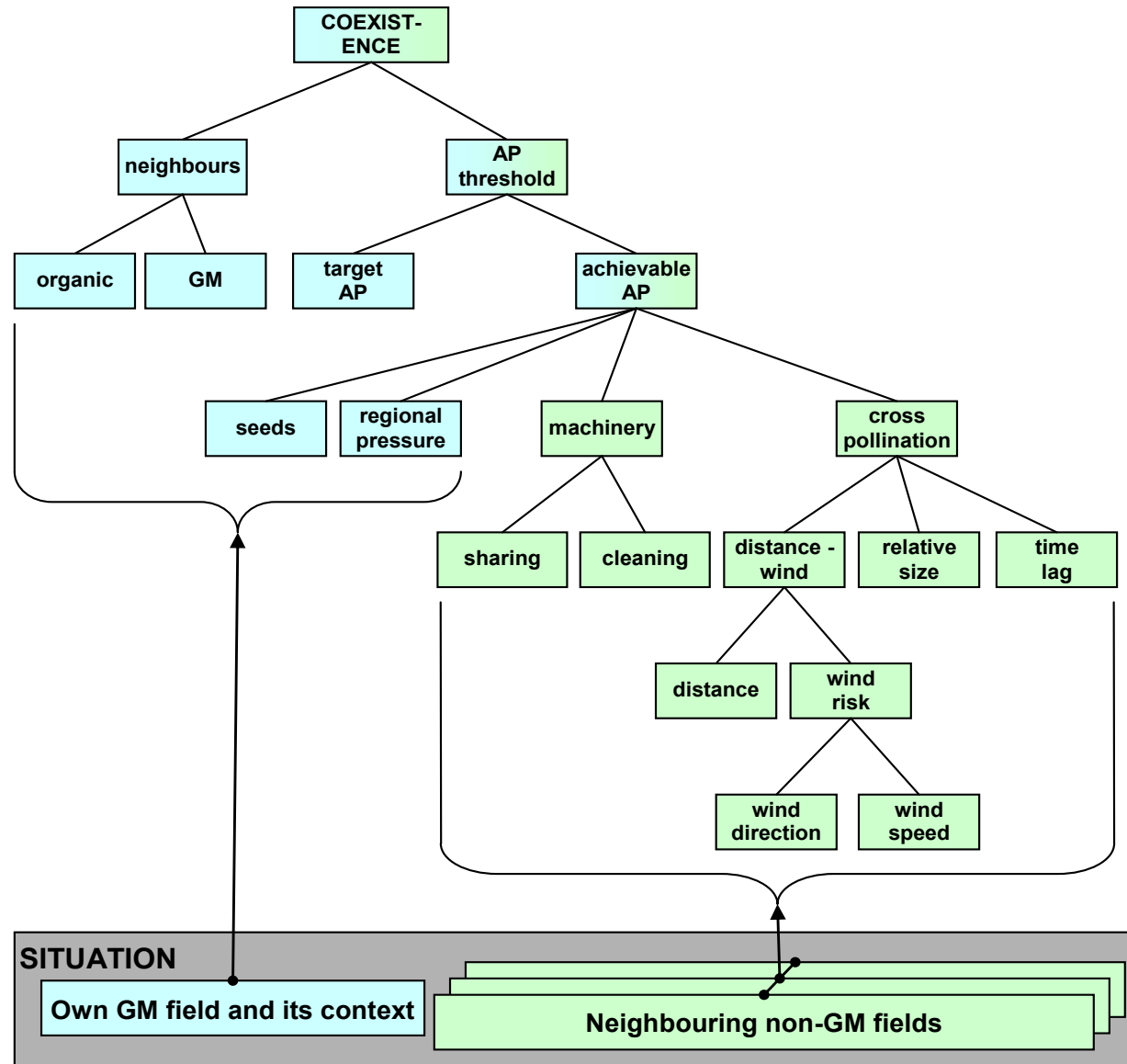
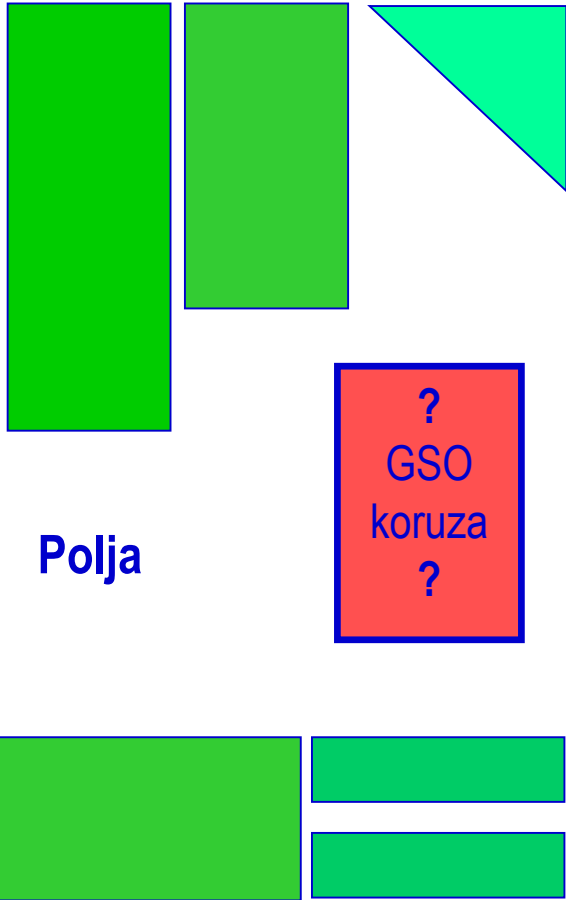
Co-Extra

2006-2009

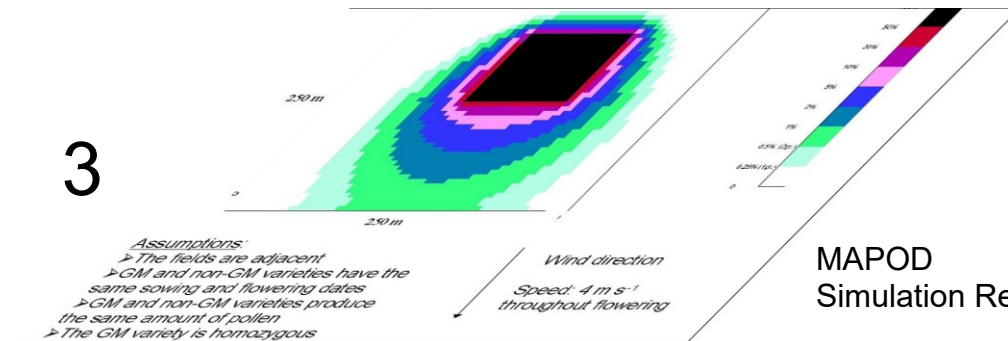
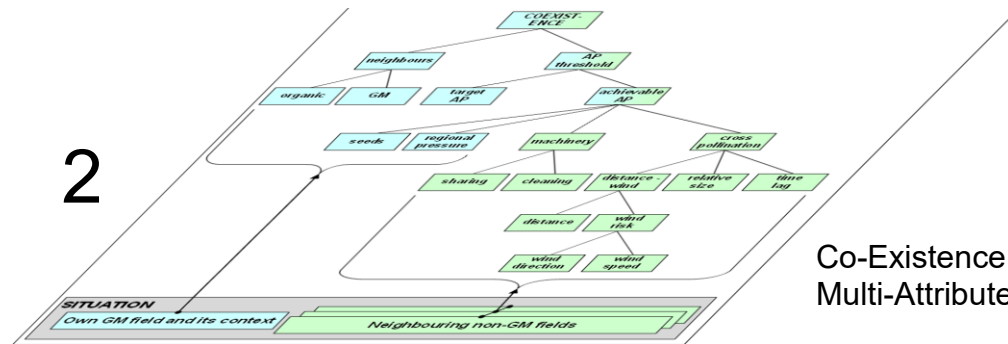
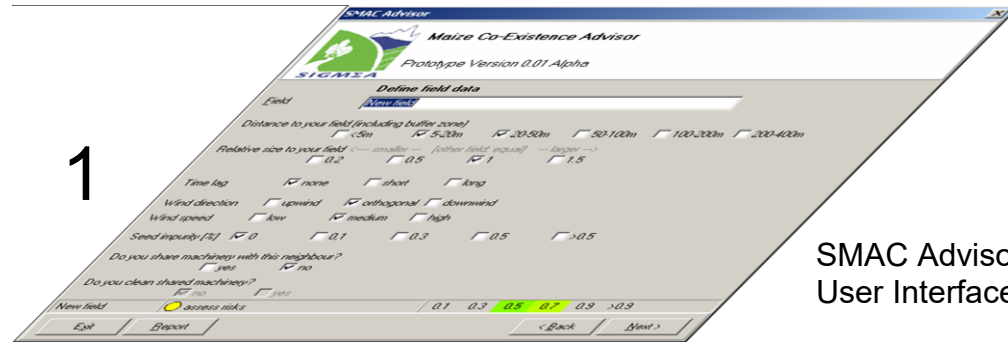
<http://www.coextra.eu/>

Co-existence and traceability of GM and non-GM supply chains

“SMAC Advisor”: Sožitje pri pridelovanju koruze



“SMAC Advisor”: Arhitektura sistema



“SMAC Advisor”: Arhitektura sistema

The screenshot shows the SMAC Advisor software interface with three overlapping windows. The foreground window displays the following information:

Analysis: Sample analysis

target_AP: 0.9

organic: no

GM: no

regional_pressure: 0,1

Overall recommendation: assess risks

Field:

distance: 5-20m

rel_size: 1

time_lag: none, short

wind_dir: orthogonal

wind_speed: medium

seeds: 0

sharing: no

cleaning: no

Achievable AP: 0.1 0.3 **0.5 0.7** 0.9 >0.9

Recommendation: assess risks

Buttons at the bottom: Exit, Browser, Print, < Back, Next >

The middle window shows the 'Define field' section with the following settings:

Field: Neighbouring field 1

Distance to your field (including roads and fences): <5m

Relative size to your field (A_1/A_2): 0.2

Time lag: none

Wind direction: upwind

Wind speed: low

Seed impurity [%]: 0

Do you share machinery with neighbours: yes

Do you clean shared machinery: no

Neighbouring field 1: assess risks

Buttons at the bottom: Exit, Report

The background window shows the 'Define your analysis' section with the following settings:

Analysis: Sample analysis

Description: [Empty text box]

Is there an organic farm in 1km radius: yes

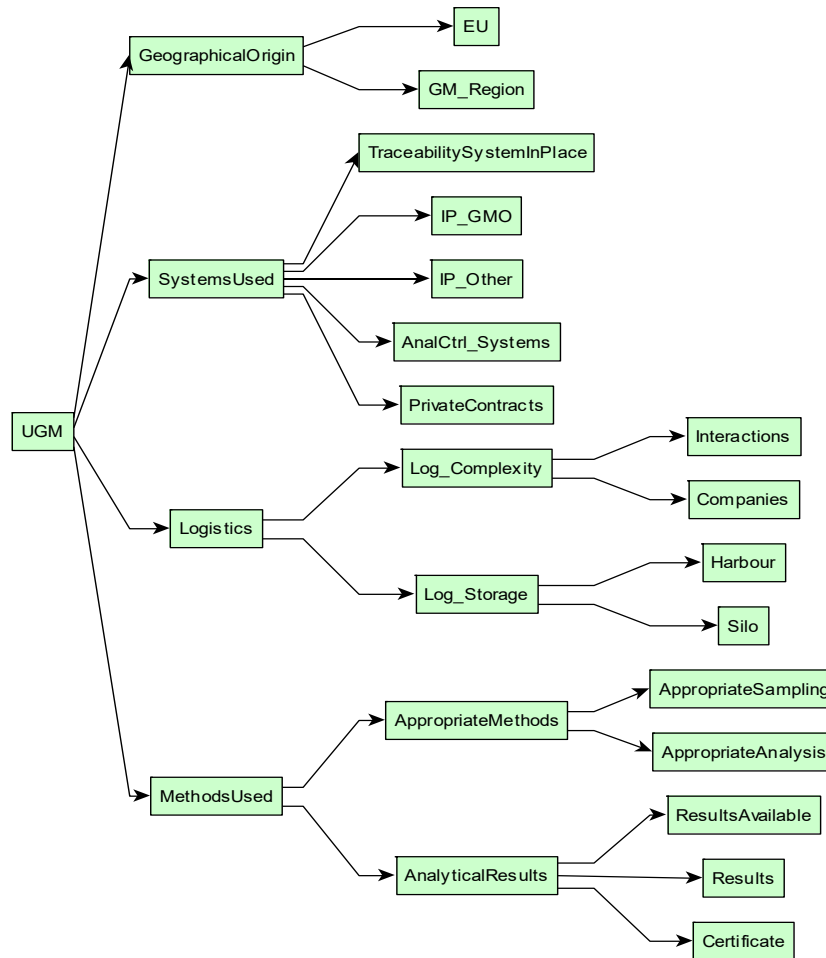
Is there another GM-maize field in 1km radius: no

What is your target advantage [%]: 0.1

What is the regional GM-pollen pressure [%]: 0

Buttons at the bottom: Exit, Report

Odkrivanje nedovoljenih GSO na osnovi prometnih podatkov



	GeographicalOrigin	SystemsUsed	Logistics	MethodsUsed	UGM
	28%	28%	17%	27%	
1	high	high	*	*	v-high
2	high	<=med	high	*	v-high
3	high	*	high	high	v-high
4	*	high	high	high	v-high
5	high	>=med	>=med	high	high
6	<=med	med	>=med	high	high
7	high	low	high	med	high
8	>=med	high	high	>=med	high
9	med	<=med	>=med	high	high
10	>=med	high	>=med	high	high
11	med	med	*	high	high
12	med	>=med	high	high	high
13	>=med	med	high	high	high
14	high	med	med	>=med	med
15	high	>=med	med	med	med
16	<=med	med	med	med	med
17	high	low	high	low	med
18	med	high	>=med	>=med	med
19	med	<=med	med	med	med
20	>=med	high	>=med	med	med
21	med	med	<=med	med	med
22	med	>=med	high	med	med
23	>=med	med	high	med	med
24	>=med	low	>=med	high	med
25	low	>=med	>=med	high	med
26	low	low	*	high	med
27	<=med	>=med	low	>=med	low
28	<=med	low	>=med	low	low
29	med	>=med	*	low	low
30	med	low	>=med	>=med	low
31	low	high	>=med	low	low
32	low	med	med	med	low
33	low	low	high	med	low
34	low	>=med	*	low	v-low
35	low	>=med	low	>=med	v-low
36	low	low	>=med	>=med	v-low

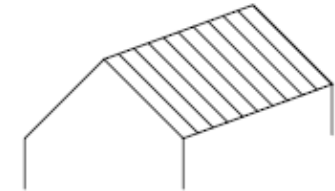
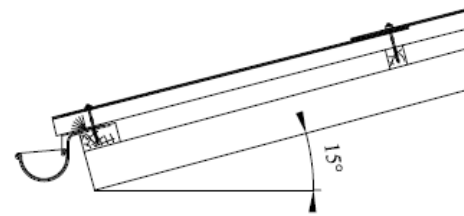
Vrednotenje strešnih kritin (v kontekstu)

Vrednotenje strešnih kritin

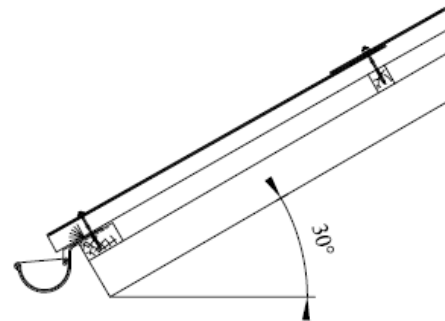
Strešne kritine



Kontekst



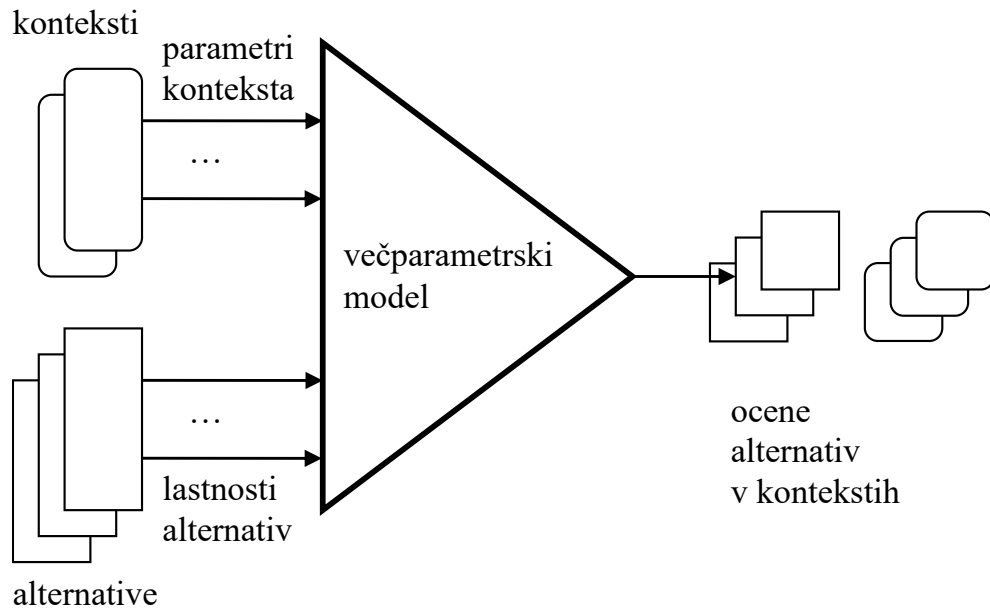
Dvokapna streha



Štirikapna streha

Večparametrsko modeliranje in kontekst

Pristop s parametriziranjem konteksta



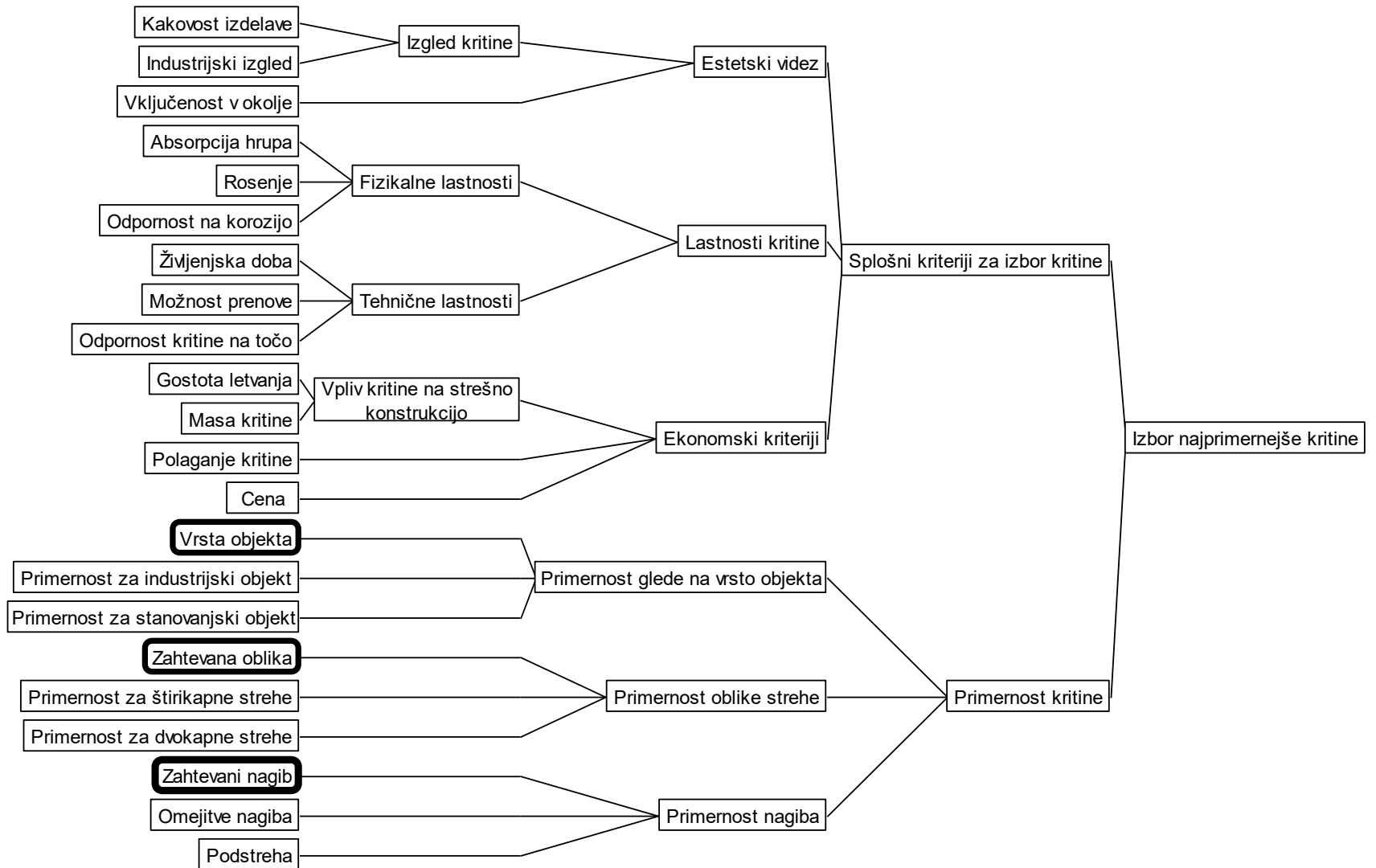
Prednosti

- eksplicitno modeliranje konteksta
- en sam model
- lažje vzdrževanje

Slabosti

- potrebno je zajeti tudi kontekst
- večji, zahtevnejši model

Večkriterijski model



Vrednotenje tehnologij za proizvodnjo električne energije

Kontić, B., Kontić, D., Zagorc, S., Matko, M., Dermol, U., Bohanec, M., Trdin, N. (2014):
Ocena vzdržnosti za razvoj energetike v Sloveniji do leta 2030 s poudarkom na jedrski tehnologiji, Knjiga 1,
IJS delovno poročilo DP-11583.

Kontić, B., Bohanec, M., Kontić, D., Trdin, N., Matko, M.: Improving appraisal of sustainability of energy options - A
view from Slovenia. *Energy Policy* 90, 154-171, 2016.

Bohanec, M., Trdin, N., Kontić, B.: A qualitative multi-criteria modelling approach to the assessment of electric
energy production technologies in Slovenia. *Central European Journal of Operations Research*, 1-15, 2016.

Metode vrednotenja

1. Model za vrednotenje posameznih tehnologij

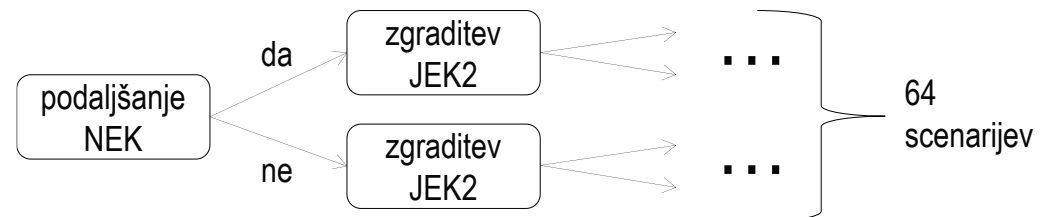
- Kvalitativni večkriterijski model
- Tehnologije: *hidro, premog, kurilno olje, plin, jedrska energija, bio, sončna, vetrna, (uvoz)*

2. Model za vrednotenje mešanic tehnologij

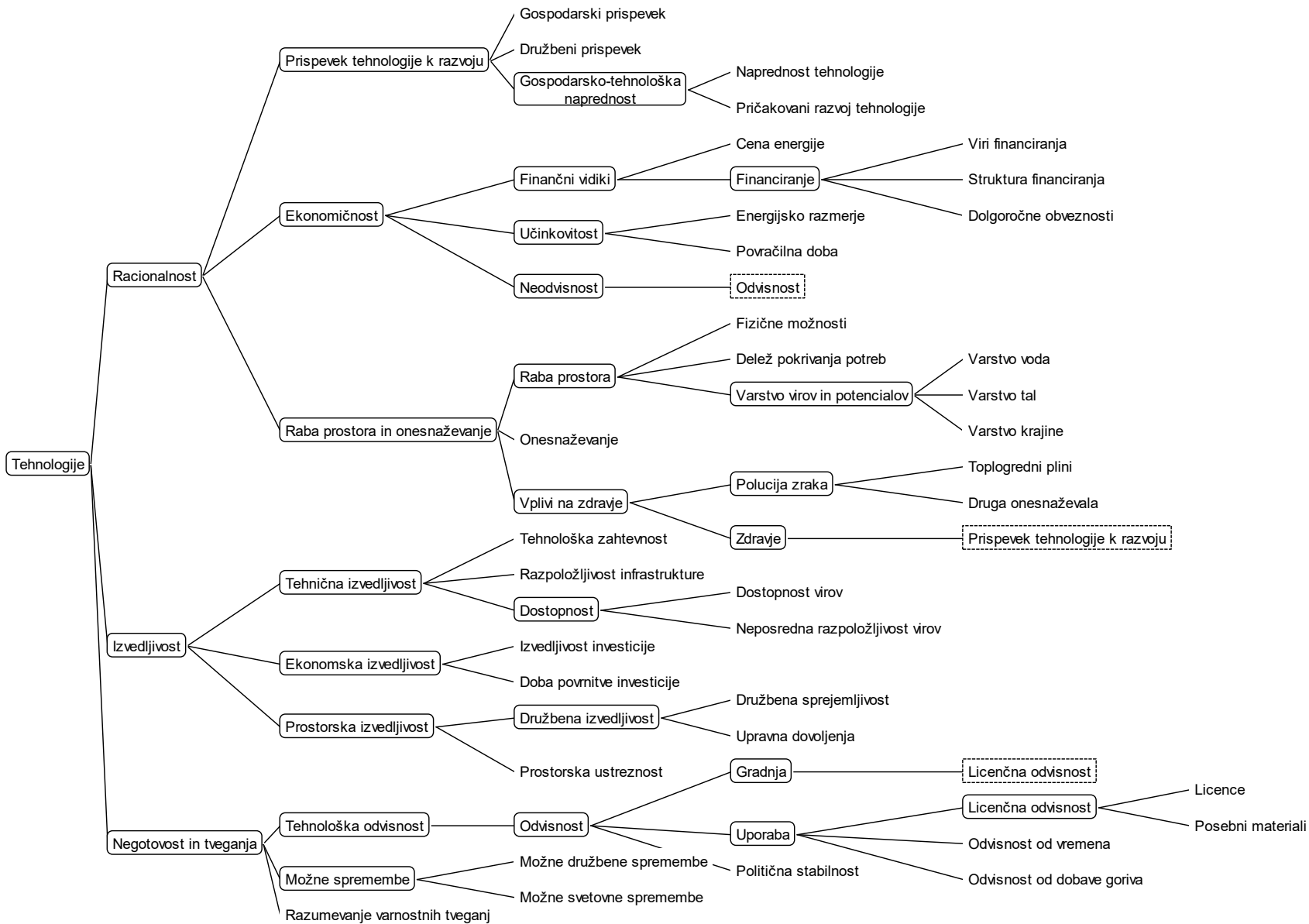
- Kvalitativni večkriterijski model
- Delež tehnologije v mešanici: instalirana moč
- Tehnologija prispeva k proizvedeni energiji skladno s svojo razpoložljivostjo (letnim obratovalnim časom).

3. Vrednotenje scenarijev

- Vrednotenje mešanic v obdobju 2013–2050
- Upoštevajoč dogodke



1. Vrednotenje posameznih tehnologij



Rezultati vrednotenja tehnologij

Hidro: manj ustr – zelo ustr

Premog: neustr

Kur.olje: neustr

Plin: še ustr – ustr

Jedrska: še ustr – zelo ustr

Bio: neustr

Sončna: neustr

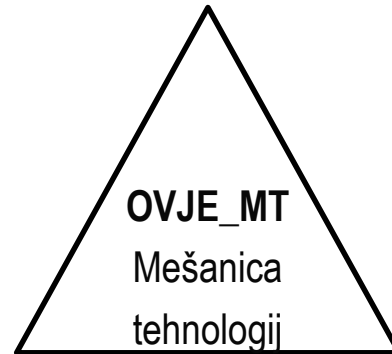
Vetrna: neustr

Uvoz: neustr

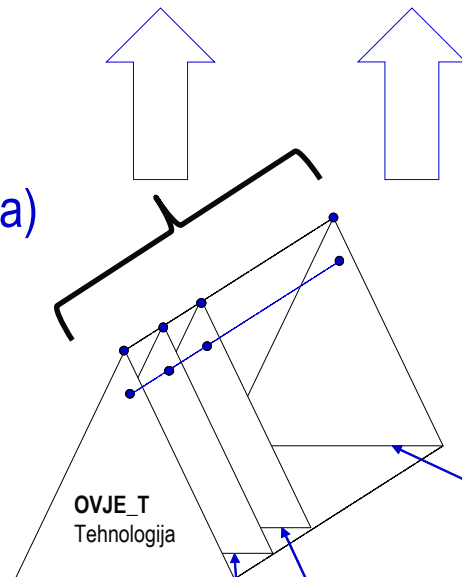
2. Vrednotenje mešanic tehnologij

ocena mešanic tehnologij

3. vrednotenje mešanic



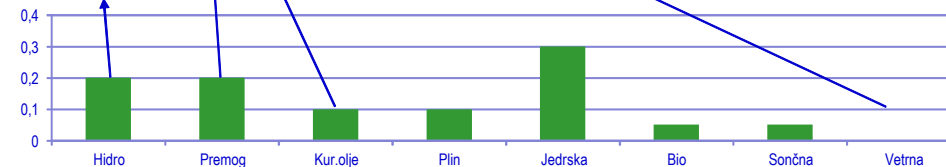
2. združevanje (agregacija)



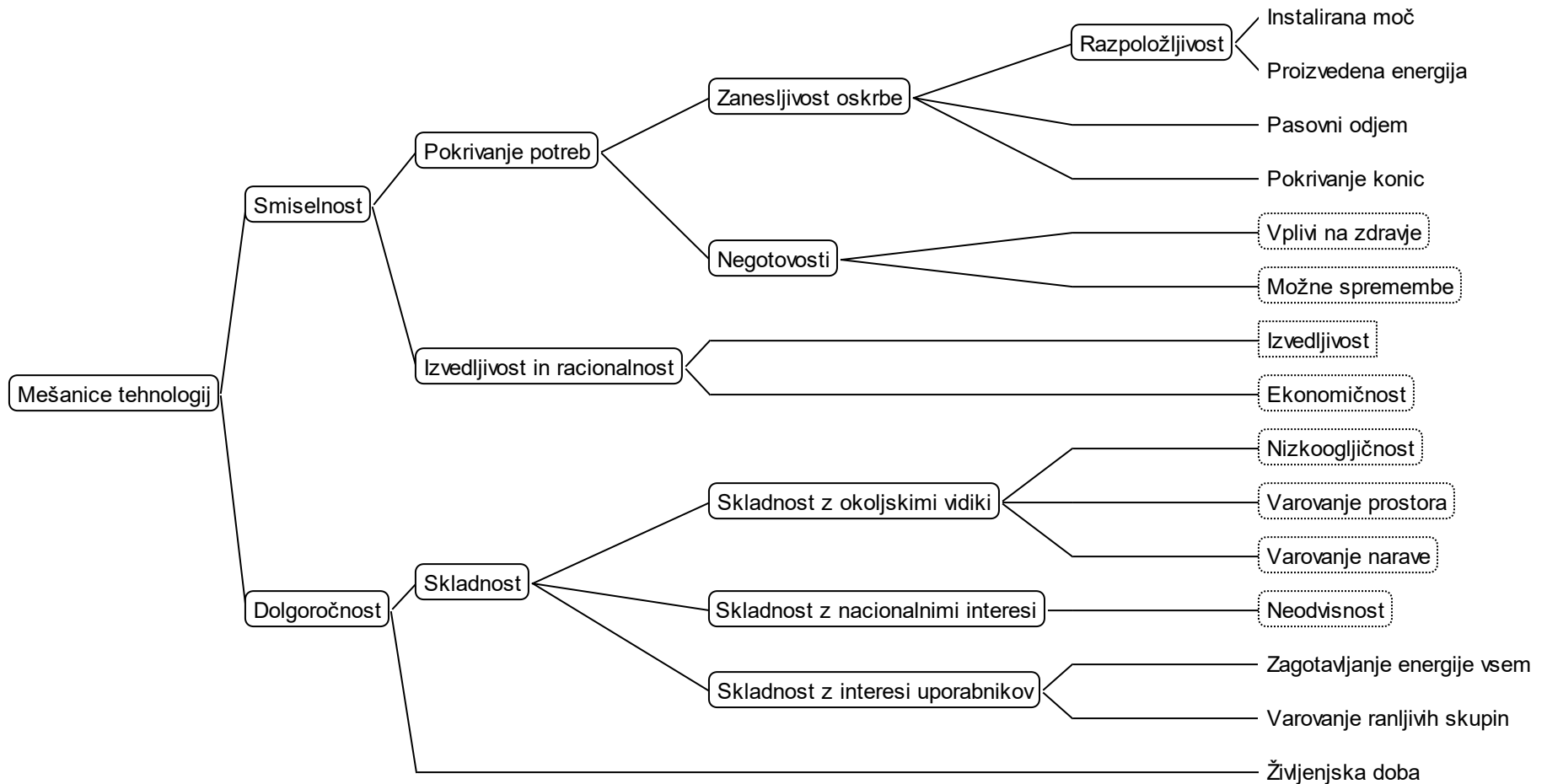
lastnosti mešanice kot celote

- instalirana moč
- prostorska izvedljivost
- finančna zahtevnost/racionalnost
- skladnost z nacionalnimi in nadnacionalnimi odločitvami/smernicami
- zanesljivost oskrbe z energijo
- razpoložljivost za pasovni odjem
- cena proizvedene energije
- razpoložljivost infrastrukture (npr. daljnovodi)
- skupne negotovosti/tveganje težkih zdravstvenih in družbenih posledic

1. vrednotenje tehnologij



2. Vrednotenje mešanic tehnologij



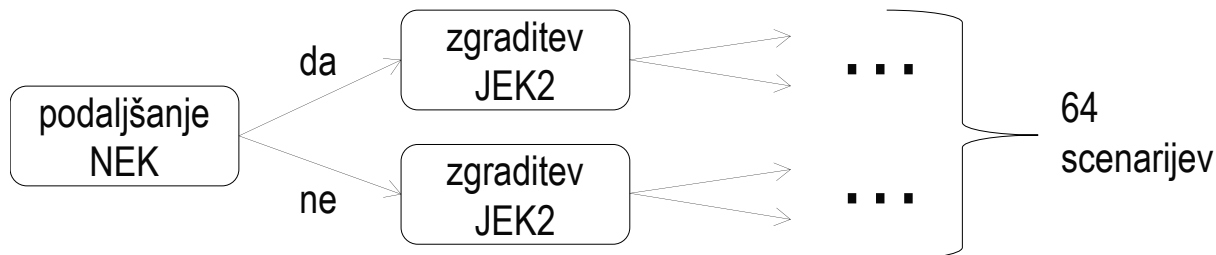
3. Vrednotenje scenarijev

Scenarij: Časovni potek odločanja oz. izvedbe rešitev

Scenarij je opredeljen z zaporedjem dogodkov

Dogodek: Realizacija enega od dveh možnih izidov

Dogodek	Leto
Ustavitev TEŠ5 2027 (namesto 2023)	2027
Ne podaljšamo NEK	2023
Zgraditev JEK2	2025
HE Srednja Sava	2035
HE Spodnja Sava	2025
Plinske elektrarne	2025

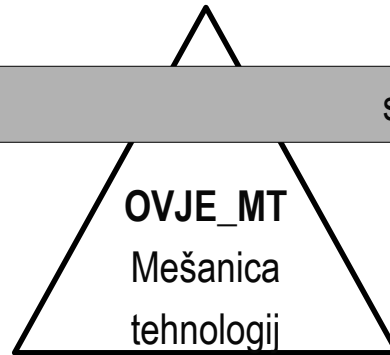


3. Vrednotenje scenarijev

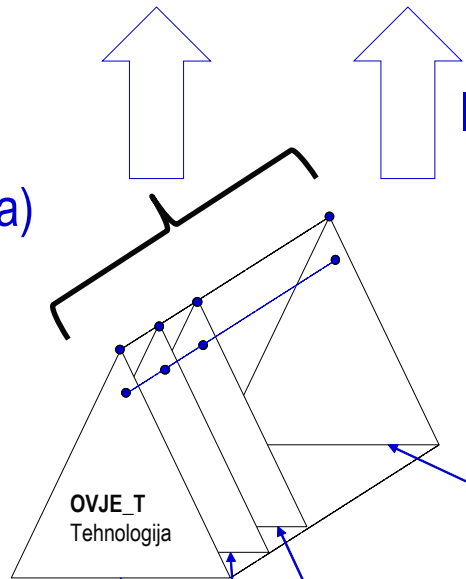
ocena mešanic tehnologij ob upoštevanju scenarijev



3. vrednotenje mešanic



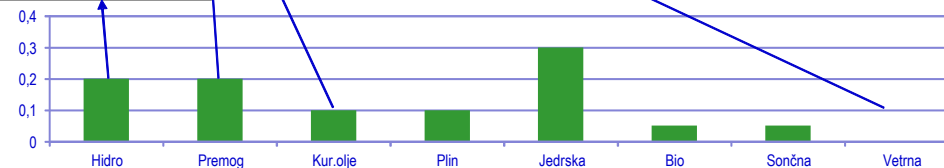
2. združevanje (agregacija)



lastnosti mešanice kot celote

- instalirana moč
- prostorska izvedljivost
- finančna zahtevnost/racionalnost
- skladnost z nacionalnimi in nadnacionalnimi odločitvami/smernicami
- zanesljivost oskrbe z energijo
- razpoložljivost za pasovni odjem
- cena proizvedene energije
- razpoložljivost infrastrukture (npr. daljnovodi)
- skupne negotovosti/tveganje težkih zdravstvenih in družbenih posledic

1. vrednotenje tehnologij



Dinamično vrednotenje scenarijev

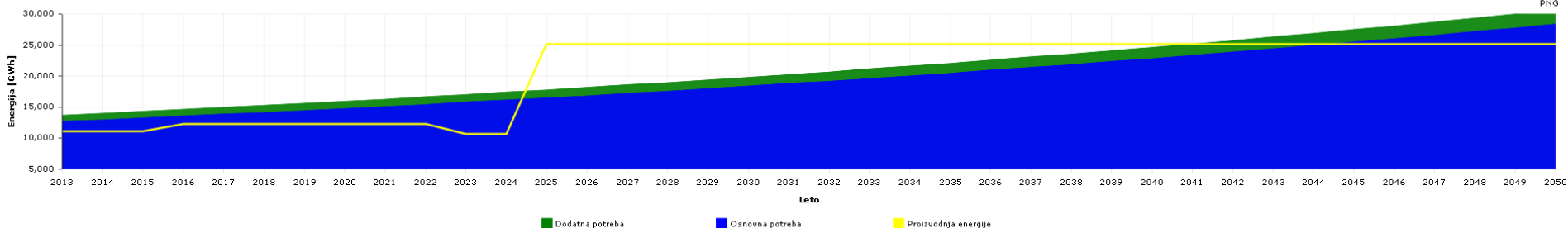
<https://kt.ijs.si/MarkoBohanec/ovje/ovje.html>

Delovanje TES 5 do leta 2027 Ne podaljšamo NEK Zgraditev JEK2 HE Srednja Sava HE Spodnja Sava Plinske elektrarne

Zgraditev JEK 2
Plinske elektrarne

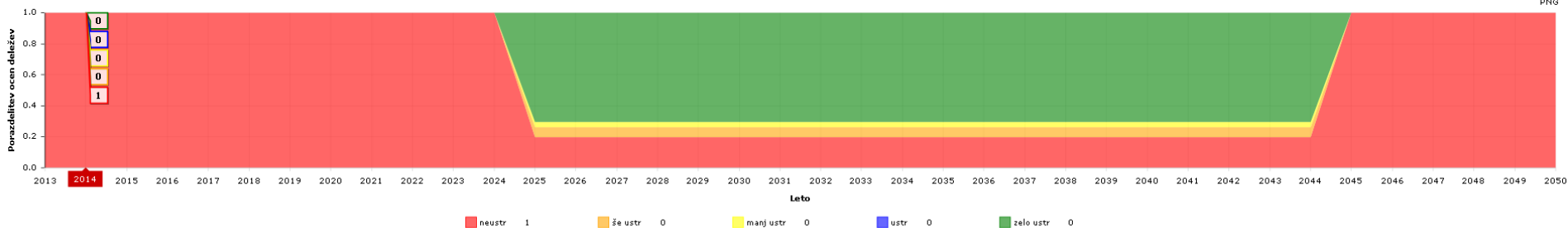
Gibanje potreb in proizvodnje energije skozi čas

PNG



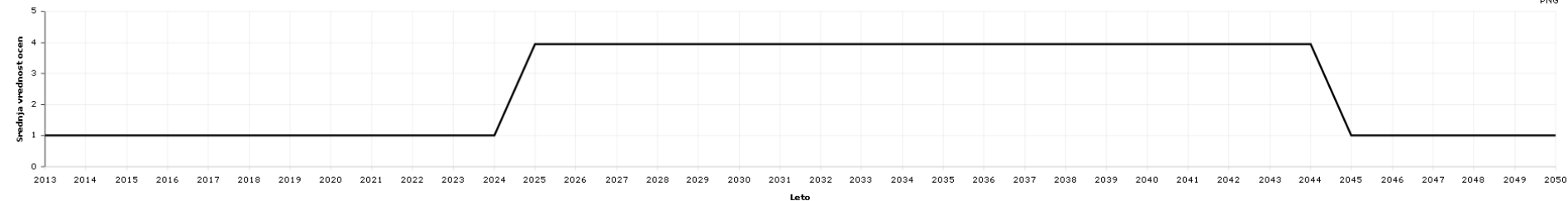
Gibanje porazdelitve ocen skozi čas

PNG



Gibanje srednje vrednosti ocen skozi čas

PNG



Sprememba terapije pri parkinsonovi bolezni

Marko Bohanec, et al.(2018) A decision support system for Parkinson disease management: Expert models for suggesting medication change, *Journal of Decision Systems*, 27:sup1, 164-172, DOI: 10.1080/12460125.2018.1469320

Mileva Boshkoska, et al.: Decision support for medication change of Parkinson's disease patients. *Computer Methods and Programs in Biomedicine* 196, 105552., 2020.

Projekt PD_manager



PD_manager: *mHealth platform for Parkinson's disease management*

Projekt Evropske skupnosti, program Horizon 2020



Trajanje: 2015-2018

Sodeluje 11 partnerjev iz Italije, Grčije, Velike Britanije, Španije, Nemčije in Slovenije

Koordinator:

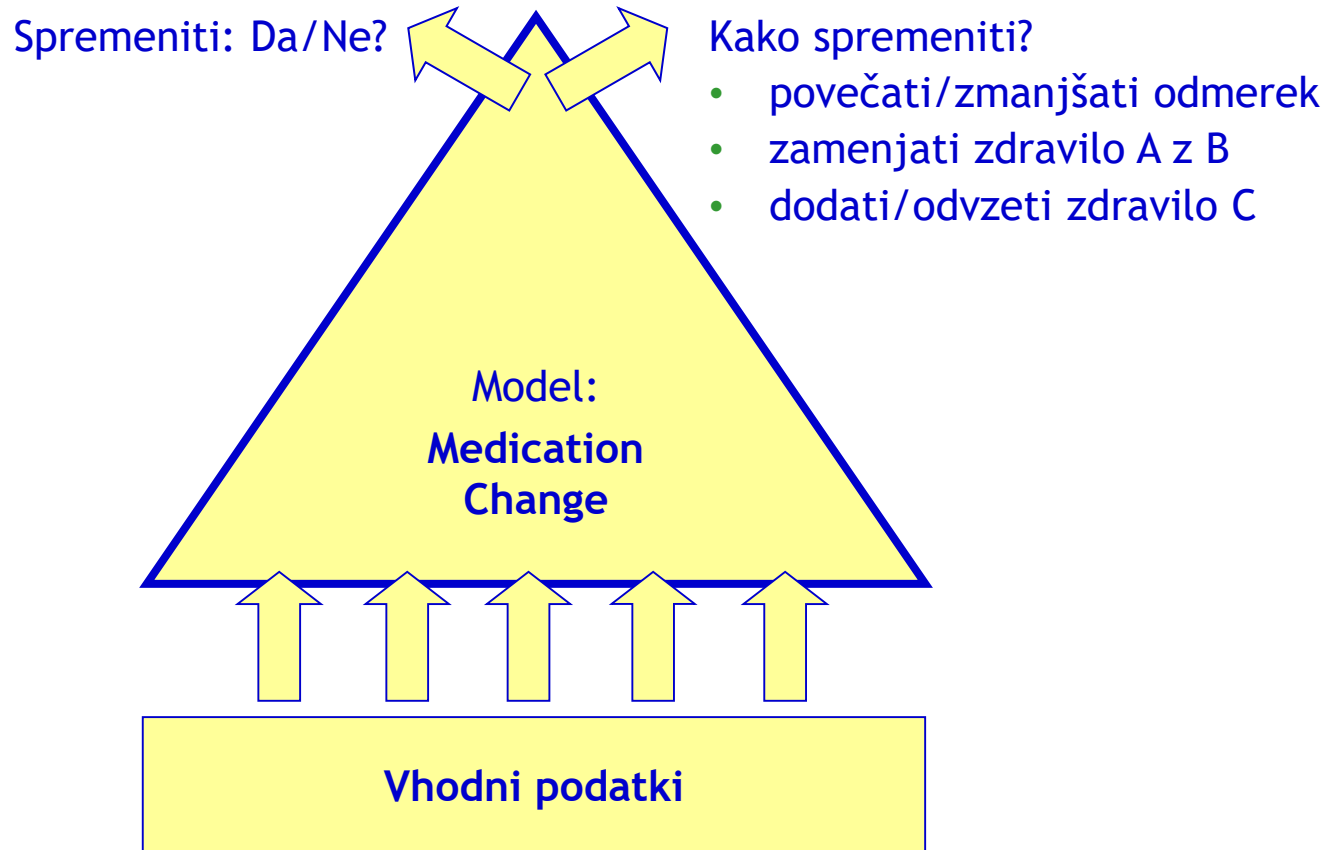
Institut Jožef Stefan, Odsek za tehnologije znanja
dr. Dragana Miljković



Druga dva **slovenska partnerja:**

Institut Jožef Stefan, Odsek za računalniške sisteme
Univerzitetni rehabilitacijski institut RS - Soča

Modeli za svetovanje o spremembi terapije



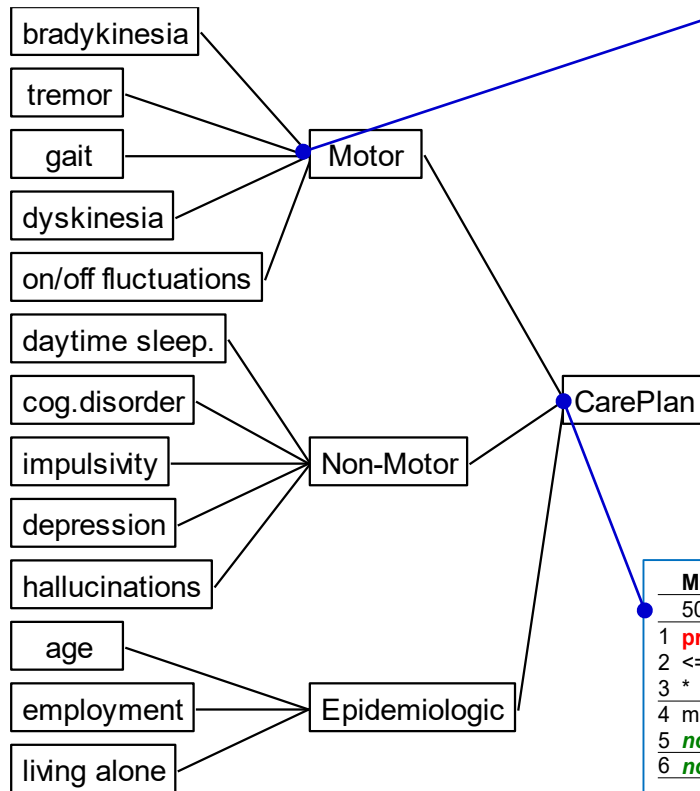
Vhodni podatki:

Vsi podatki o pacientu, ki so na voljo v sistemu PD_manager v določeni časovni točki.

Pretežno so to obdelani podatki o simptomih in njihovi zgodovini.

Odločitvena pravila: Model B

Struktura



Odločitvena pravila

	bradykinesia	tremor	gait	dyskinesia	on/off fluctuations	Epidemiologic	Motor
	19%	19%	24%	13%	15%	10%	
1	problematic	problematic	*	*	*	*	problematic
2	problematic	*	*	<=problematic	*	*	problematic
3	problematic	*	*	*	problematic	*	problematic
4	problematic	*	*	*	*	active	problematic
5	*	problematic	*	<=problematic	*	*	problematic
6	*	problematic	*	*	problematic	*	problematic
7	*	problematic	*	*	*	active	problematic
8	*	*	problematic	*	*	*	problematic
9	*	*	*	severe	*	*	problematic
10	*	*	*	*	problematic	active	problematic
11	problematic	normal	normal	normal	normal	passive	maybe
12	normal	problematic	normal	normal	normal	passive	maybe
13	normal	normal	normal	problematic	*	passive	maybe
14	normal	normal	normal	>=problematic	problematic	passive	maybe
15	normal	normal	normal	problematic	normal	*	maybe
16	normal	normal	normal	normal	normal	*	normal

	Motor	Non-Motor	Epidemiologic	CarePlan
	50%	50%	0%	
1	problematic	*	*	change
2	<=maybe	<=maybe	*	change
3	*	problematic	*	change
4	maybe	normal	*	maybe
5	normal	maybe	*	maybe
6	normal	normal	*	no change

Uporaba modelov

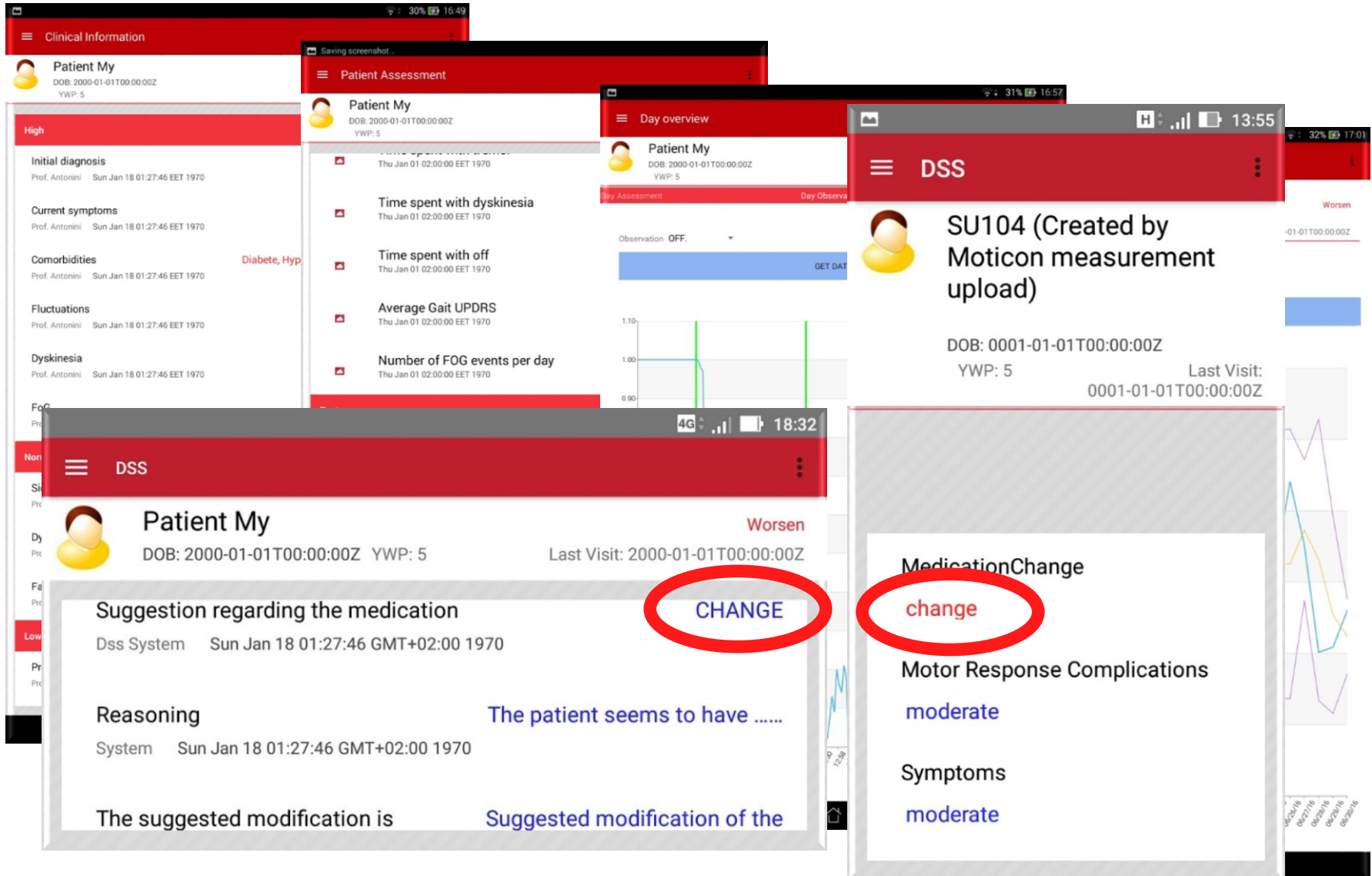
Kot opozorilo,
oznaka



Z razlago: pregledovanje v globino

Attribute	Model A	Model B	Model C
CarePlan	maybe	change	change
Motor	maybe	problematic	problematic
bradykinesia	<i>normal</i>	<i>normal</i>	<i>normal</i>
tremor	<i>normal</i>	<i>normal</i>	<i>normal</i>
gait	problematic	problematic	problematic
dyskinesia	problematic	problematic	problematic
on/off fluctuations	<i>normal</i>	<i>normal</i>	<i>normal</i>
Epidemiologic	[not used]	<i>passive</i>	<i>passive</i>
Non-Motor	<i>normal</i>	problematic	problematic
daytime sleep.	<i>normal</i>	<i>normal</i>	<i>normal</i>
cog.disorder	<i>normal</i>	<i>normal</i>	<i>normal</i>
impulsivity	<i>normal</i>	<i>normal</i>	<i>normal</i>
depression	problematic	problematic	problematic
hallucinations	<i>normal</i>	<i>normal</i>	<i>normal</i>
Epidemiologic	[not used]	<i>passive</i>	<i>passive</i>
Epidemiologic	<i>passive</i>	<i>passive</i>	<i>passive</i>
Epidemiologic	<i>passive</i>	<i>passive</i>	<i>passive</i>
age	<i>older</i>	<i>older</i>	<i>older</i>
employment	<i>unemployed</i>	<i>unemployed</i>	<i>unemployed</i>
living alone	<i>no</i>	<i>no</i>	<i>no</i>
disease duration	[not used]	<i>long</i>	<i>long</i>

Informacijski sistem za zdravnika



Clinical Information

Patient My
DOB: 2000-01-01T00:00:00Z
YWP: 5

High

Initial diagnosis
Prof. Antonini Sun Jan 18 01:27:46 EET 1970

Current symptoms
Prof. Antonini Sun Jan 18 01:27:46 EET 1970

Comorbidities
Prof. Antonini Sun Jan 18 01:27:46 EET 1970
Diabete, Hyp

Fluctuations
Prof. Antonini Sun Jan 18 01:27:46 EET 1970

Dyskinesia
Prof. Antonini Sun Jan 18 01:27:46 EET 1970

Patient Assessment

Patient My
DOB: 2000-01-01T00:00:00Z
YWP: 5

Time spent with dyskinesia
Thu Jan 01 02:00:00 EET 1970

Time spent with off
Thu Jan 01 02:00:00 EET 1970

Average Gait UPDRS
Thu Jan 01 02:00:00 EET 1970

Number of FOG events per day
Thu Jan 01 02:00:00 EET 1970

Observation: OFF

Day overview

Patient My
DOB: 2000-01-01T00:00:00Z
YWP: 5

DSS

SU104 (Created by Moticon measurement upload)

DOB: 0001-01-01T00:00:00Z
YWP: 5
Last Visit: 0001-01-01T00:00:00Z

DSS

Patient My
DOB: 2000-01-01T00:00:00Z YWP: 5
Last Visit: 2000-01-01T00:00:00Z

Suggestion regarding the medication

Dss System Sun Jan 18 01:27:46 GMT+02:00 1970

Reasoning
System Sun Jan 18 01:27:46 GMT+02:00 1970

The suggested modification is

The patient seems to have

Suggested modification of the

CHANGE

change

MedicationChange

Motor Response Complications
moderate

Symptoms
moderate

Podpora odločanju pri resnih nezgodah v nuklearnih elektrarnah

Bohanec, M., Vrbanić, I., Bašić, I., Debelak, K., Štrubelj, L.: A decision-support approach to severe accident management in nuclear power plants.
Journal of Decision Systems, 2020.



Prototipni program Severa

A DSS for Severe Accident Management in Nuclear Power Plants

Interpretacija, diagnostika, napovedovanje

MONITORING and INTERPRETATION									DIAGNOSIS					PROGNOSIS
8 System Parameters									Barrier States					Progress
Input Parameters Current State Actions Systems User Input Evaluation Test														
New Load ... Save ... View Settings + -														
Time [min]	CET [°C]	SGL [%]	RPVL [%]	PrCs [MPa]	Pcont [MPa]	TCont [°C]	Loont [m]	H2 [%]	SAGs	Seq Type	Core State	RCS State	Cont State	Possible Progressions
90	354	0.0	67.2	17.03	0.153	76	1.1	0.00			OK	OK	OK	
100	354	0.0	56.5	17.11	0.176	84	1.1	0.00			OK	OK	OK	
110	423	0.0	37.1	17.09	0.178	85	1.2	0.00			OK	OK	OK	
120	677	0.0	27.5	17.08	0.173	82	1.2	0.00	1, 2, 3	High	OK	OK	OK	
130	1.074	0.0	23.8	17.08	0.168	80	1.6	0.00	1, 2, 3	High	OK	OK	OK	
140	1.786	0.0	20.3	17.07	0.183	86	1.6	0.01	1, 2, 3	High	OX	IP	OK	CD, RCSdepr, CH, DCH, Bypass
150	1.525	0.0	13.1	17.15	0.189	87	1.6	0.03	1, 2, 3	High	OX	IP	OK	CD, RCSdepr, CH, DCH, Bypass
160	1.410	0.0	13.1	17.23	0.196	89	1.6	0.03	1, 2, 3	High	CD & OX	IP	OK	RPVmelt, RCSdepr, CH, DCH, Bypass
170	1.531	0.0	12.5	17.20	0.195	89	1.6	0.03	1, 2, 3	High	CD & OX	IP	OK	RPVmelt, RCSdepr, CH, DCH, Bypass
180	1.612	0.0	9.0	17.09	0.194	89	1.6	0.03	1, 2, 3	High	CD & OX	IP	OK	RPVmelt, RCSdepr, CH, DCH, Bypass
▶ 190	607	0.0	6.6	16.44	0.189	87	1.6	0.03	1, 2, 3	High	CD & OX	IP	OK	RPVmelt, RCSdepr, CH, DCH, Bypass
200	179	0.0	33.0	0.30	0.294	113	1.6	0.03	1	Low	CD & OX	IFD	OK	RPVmelt, CH, MCCI
210	1.617	0.0	16.3	0.28	0.284	111	1.6	0.03	1, 3	Low	CD & OX	IFD	OK	RPVmelt, CH, MCCI
220	1.747	0.0	12.7	0.27	0.274	109	1.6	0.03	1, 3	Low	CD & OX	IFD	OK	RPVmelt, CH, MCCI
230	1.843	0.0	11.4	0.27	0.265	107	1.6	0.02	1, 3	Low	CD & OX	IFD	OK	RPVmelt, CH, MCCI

Eden od modelov DEX v Severi

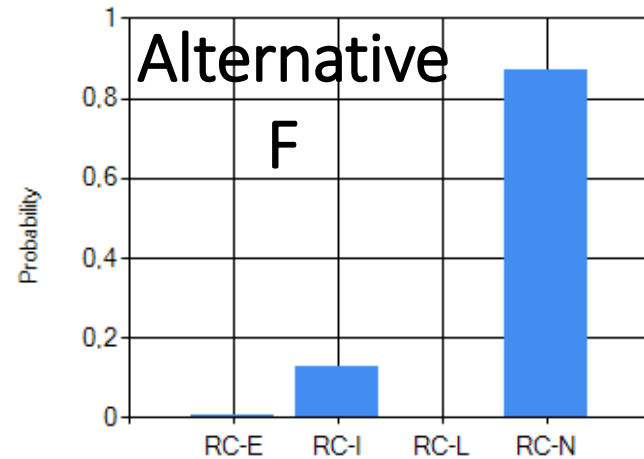
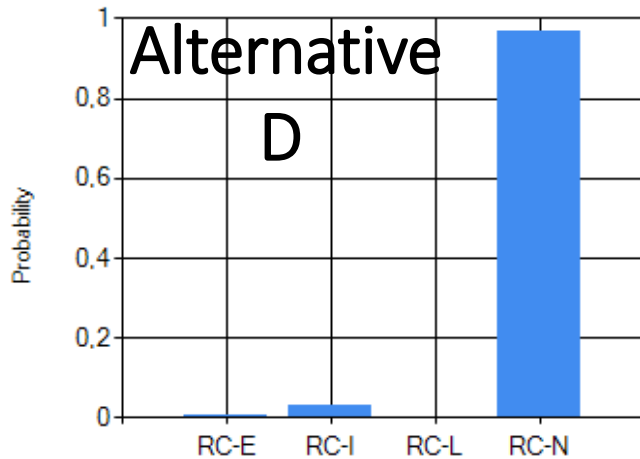
Attribut	Descriptio	Scal
BarriersStates &		
Barrier	Barrier States and Accident Progressions without operator action	<i>yes;no</i>
Cor	Sub-model for determining barrier states	<i>yes;no</i>
CoreStat	Core	<i>yes;no</i>
O	Cladding	CD & OX ;CD,OX,REC,OK
L CET650>10mi	Duration of (CET > 650 degC) > 10min	<i>yes;no</i>
RPVL<TA	RPVL <	<i>yes;no</i>
C	Core	<i>yes;no</i>
L CET1093>10mi	Duration of (CET > 1056 degC) > 10min	<i>yes;no</i>
RPVL<TA	RPVL <	<i>yes;no</i>
O	O	<i>no;recovered;yes</i>
CET>354deg	CET > 354	<i>yes;no</i>
QuenchedCooled	Is reactor quenched and cooled?	<i>no;yes</i>
L CET650>10mi	Duration of (CET > 650 degC) > 10min	<i>yes;no</i>
CoreProgressio	Core	<i>yes;no</i>
toC	Progression to Core	<i>yes;no</i>
toC	Progression to Containment	<i>yes;no</i>
toRPVmel	Progression to RPV melt-	<i>yes;no</i>
RCS	Reactor Cooling	<i>yes;no</i>
RcsStat	RCS	IP;IFD,OK
Intact	Intact	<i>yes;no</i>
RcsTim	Temperature & Time	<i>yes;no</i>
L CET650>10mi	Duration of (CET > 650 degC) > 10min	<i>yes;no</i>
L CET1093>0mi	Duration of (CET > 1093 degC) > 0min	<i>yes;no</i>
PrCs>3MP	PrCs >	<i>no;yes</i>
IntactFailed	Intact/Failed	<i>yes;no</i>
RcsTim	Temperature & Time	<i>yes;no</i>
PrCs>3MP	PrCs >	<i>no;yes</i>
O	O	<i>no;yes</i>
CET>354deg	CET > 354	<i>yes;no</i>
QuenchedCooled	Is reactor quenched and cooled?	<i>no;yes</i>
RCS	RCS	<i>yes;no</i>
RcsProgressio	Progression to RCS sudden depressurization -> containment bypass or containment challenge	<i>yes;no</i>
toRCSdep	Progression to Containment	<i>yes;no</i>
toC	Progression to Containment	<i>yes;no</i>
toBypas	Progress to Containment	<i>yes;no</i>
toDC	Progress to direct containment heating, steam explosion potential	<i>yes;no</i>
toMCC	Potential containment basement melt-	<i>yes;no</i>
Containmen	Containmen	<i>yes;no</i>
Containmen	Containment	Intact & CH ;Intact;Bypassed & CH ;Bypassed;OK
ContStat	Containment	<i>yes;no</i>
Intac	Intact	<i>no;yes</i>
Pcont>0.2MP	Pcont >	<i>no;yes</i>
QuenchedCooled	Is reactor quenched and cooled?	<i>no;yes</i>
Bypasse	Bypassed	<i>yes;no</i>
Pcont>0.2MP	Pcont >	<i>no;yes</i>
QuenchedCooled	Is reactor quenched and cooled?	<i>no;yes</i>
C	Containment	<i>yes;no</i>
Pcont>0.3MP	Pcont >	<i>no;yes</i>
Tcont>127deg	Tcont >	<i>no;yes</i>
Pcont<0.15MP	Pcont <	<i>no;yes</i>
H2>4	H2 >	<i>no;yes</i>
O	O	<i>no;yes</i>
Pcont>0.3MP	Pcont >	<i>no;yes</i>
H2>4	H2 >	<i>no;yes</i>
QuenchedCooled	Is reactor quenched and cooled?	<i>no;yes</i>
ContProgressio	Containment	<i>yes;no</i>
toC	Progression to Containment	<i>yes;no</i>
toE	Progression to Environmental	<i>yes;no</i>
toC	Progression to Containment	<i>yes;no</i>
AccidentProgression	Accident progressions without operator action	<i>yes;no</i>
CoreProgression	Core	<i>yes;no</i>
toC	Progression to Core	<i>yes;no</i>
CoreStat	Core	CD & OX ;CD,OX,REC,OK
RcsProgression	RCS	<i>yes;no</i>
toRPVmel	Progression to RPV melt-	<i>yes;no</i>
CoreStat	Core	CD & OX ;CD,OX,REC,OK
RcsStat	RCS	IP;IFD,OK
toRCSdep	Progression to RCS sudden depressurization -> containment bypass or containment challenge	<i>yes;no</i>
RcsStat	RCS	IP;IFD,OK
ContainmentProgression	Containment	<i>yes;no</i>
toC	Progression to Containment	<i>yes;no</i>
CoreStat	Core	CD & OX ;CD,OX,REC,OK
RcsStat	RCS	IP;IFD,OK
ContStat	Containment	Intact & CH ;Intact;Bypassed & CH ;Bypassed;OK
toDC	Progression to Direct Containment Heating, steam explosion potential	<i>yes;no</i>
RcsStat	RCS	IP;IFD,OK
ContStat	Containment	Intact & CH ;Intact;Bypassed & CH ;Bypassed;OK
toMCC	Potential containment basement melt-	<i>yes;no</i>
RcsStat	RCS	IP;IFD,OK
ContStat	Containment	Intact & CH ;Intact;Bypassed & CH ;Bypassed;OK
toC	Progression to Containment	<i>yes;no</i>
ContStat	Containment	Intact & CH ;Intact;Bypassed & CH ;Bypassed;OK
toBypas	Progression to Containment	<i>yes;no</i>
RcsStat	RCS	IP;IFD,OK
toE	Progression to Environmental	<i>yes;no</i>
ContStat	Containment	Intact & CH ;Intact;Bypassed & CH ;Bypassed;OK



Severa

A DSS for Severe Accident Management in Nuclear Power Plants

Vrednotenje alternativ (aktivnosti za zmanjšanje posledic nesreče)



RC-E: Early release (hours)
RC-I: Intermediate (~ 1 day)
RC-L: Late (several days)
RC-N: Long-term concern

Izkušnje (1/2)

- DEXi se je uveljavil za pomoč pri odločanju na številnih področjih doma in v tujini ...
- ... in pri izobraževanju na gimnazijah in univerzah.
- Kaj ponuja?
 - modeli vrednotenja, razviti na osnovi ekspertnega znanja, kjer prevladuje presoja
 - preprostost, “lahkotnost”, relativno hiter razvoj modelov
 - možnost integracije različnih področij (npr. ekologija in ekonomija)
 - podpira komuniciranje med eksperti
 - rezultat razvoja modelov: *eksplicitno formulirano znanje* s problemskega področja ter možnost *vrednotenja* in *analize* odločitvenih alternativ
 - možnost realizacije orodij (sistemov) za podporo pri odločanju (namenski programi, spletne storitve)

Izkušnje (2/2)

- Slabosti, pasti, problemi:
 - modeli so kvalitativni, torej tudi nenatančni, približni
 - možna je (pre)slaba ločljivost modela
 - “plitva” (vzročno-posledična) pravila, brez globljih zakonitosti modeliranega sistema
- Omejitve programa DEXi: (izboljšave DEXiWin)
 - težavno obravnavanje pravih hierarhičnih modelov
 - slabše podprto povezovanje z zbirkami podatkov
 - podpira le kvalitativne spremenljivke, ne pa tudi numeričnih
 - omejitve pri izražanju nepopolnega in nenatančnega znanja oz. podatkov (npr. verjetnostne porazdelitve)
- Potrebe po razširitvi metodologije ter razvoju splošnih in namenskih orodij