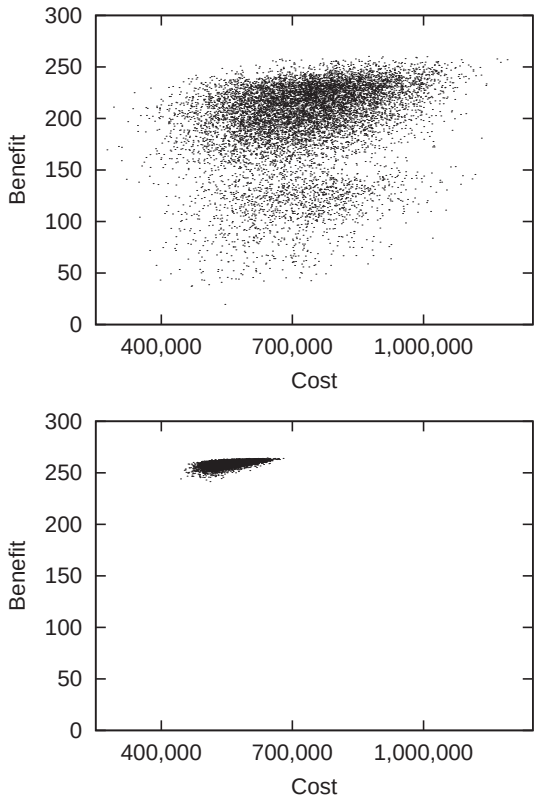

Fig. 1. An example of treatment learning results

Cost	Benefit vvlow	vlow	low	high	vhigh	vvhigh
zero	26	17	10	5	2	1
one	28	19	12	7	4	3
two	30	21	14	9	8	6
three	32	23	16	15	13	11
four	34	25	24	22	20	18
five	36	35	33	31	29	27

TABLE I
CLASS RANKINGS FOR KWIC FRAMEWORK

<combine_logic>	<op>	<arithmetic[op]>
all_of	rand	minimum
any_of	rany	summation
any_one_of	ror	maximum
<contribution>	<value> [contribution]	<arithmetic> [contribution]
helped	mean=1.4	multiply
made	mean=1.8	multiply
unhurt	mean=0.6	multiply
unbroken	mean=0.2	multiply
<priority>	<value> [priority]	<arithmetic> [priority]
veryCritical	mean=2.0	multiply
critical	mean=1.5	multiply
normal	mean=1.0	multiply
<softgoal>	<softgoalType> [softgoal]	<cost> [softgoalType]
operationalizing softgoal	any type	1

Fig. 3. Settings for KWIC framework

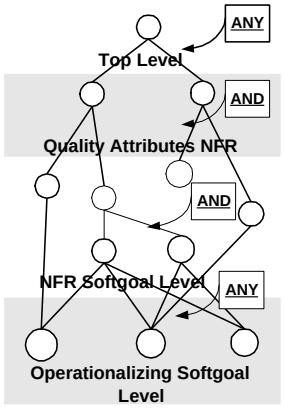

Fig. 4. logic configuration for rigorous quality assurance scheme

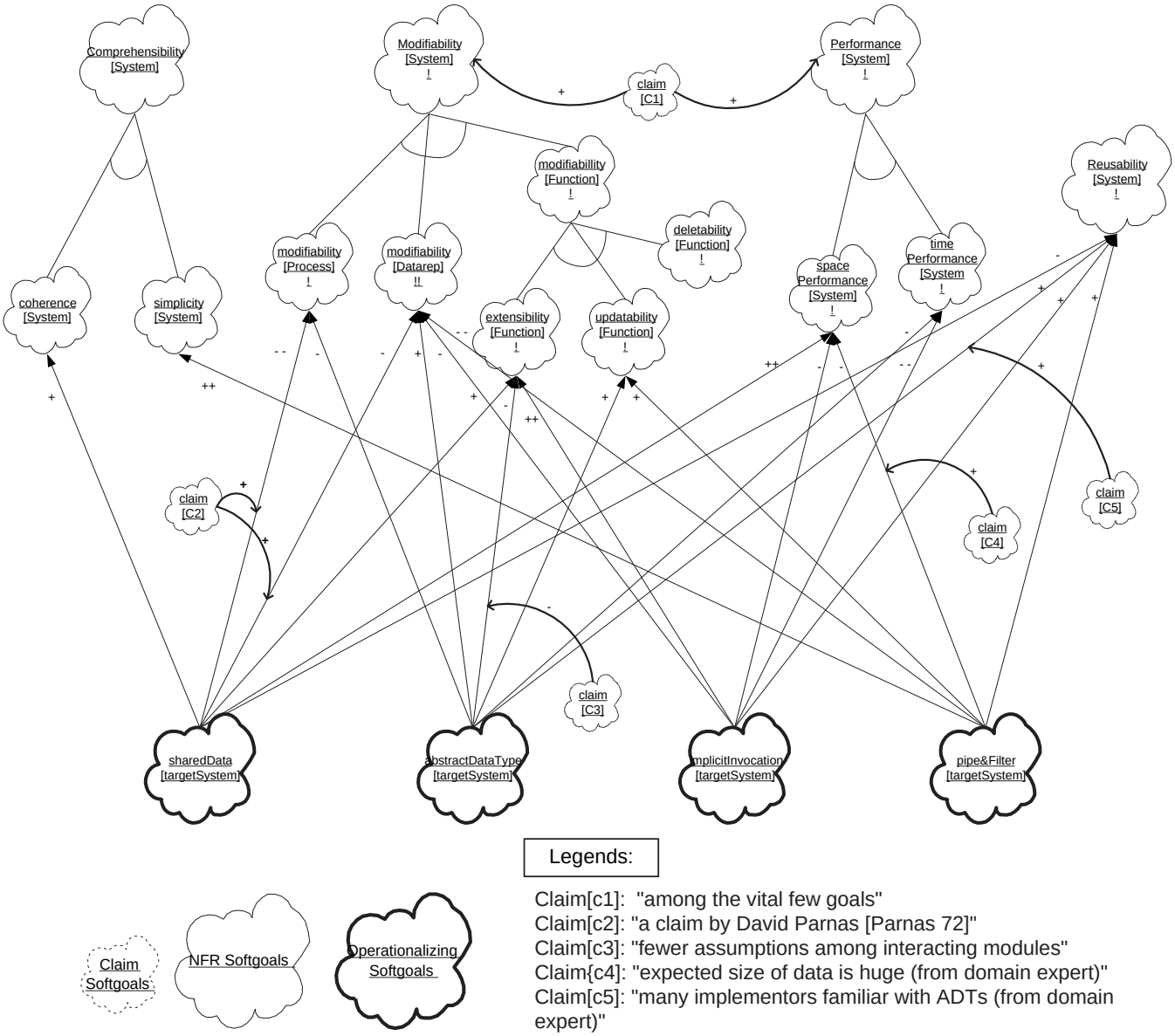

Fig. 2. KWIC framework

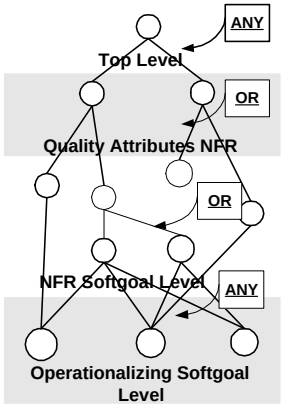

Fig. 5. logic configuration for weak quality assurance scheme

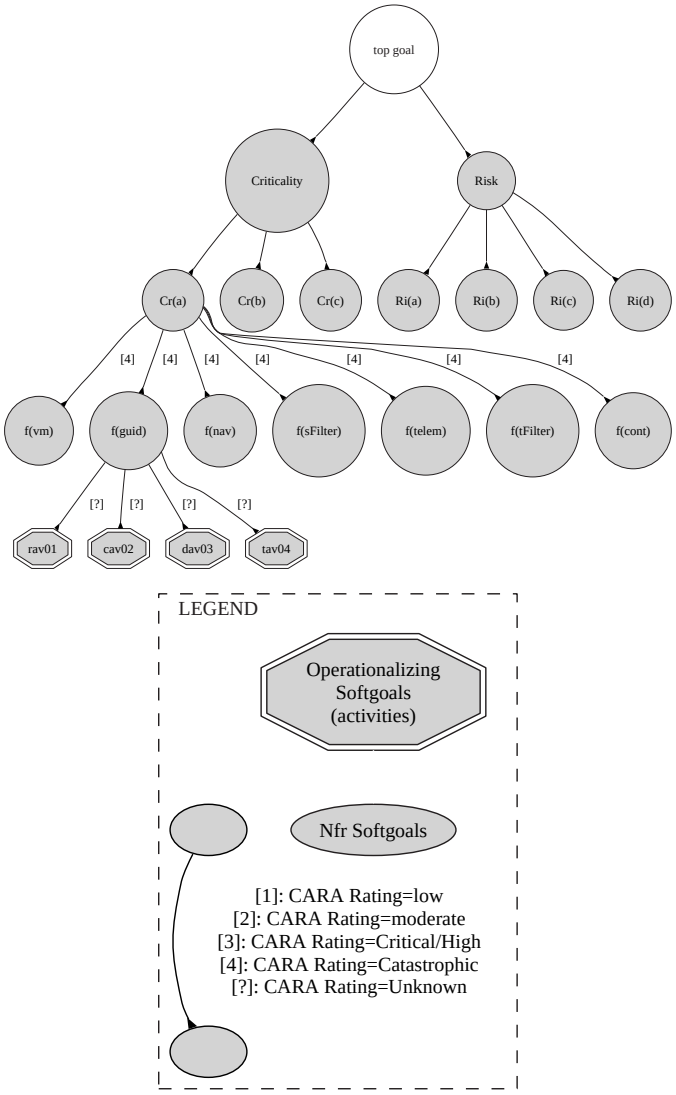

Fig. 6. Segment of the SR-1 framework

Function	Criticality			Risk				Level
	Cr[a]	Cr[b]	Cr[c]	Ri[a]	Ri[b]	Ri[c]	Ri[d]	
f[vm]	4	4	2	3	2	3	3	F
f[guid]	4	4	2	3	2	2	3	F
f[nav]	4	4	2	3	2	2	3	F
f[sFilter]	4	4	2	3	1	2	3	F
f[telem]	4	1	3	3	1	3	2	F
f[tFilter]	4	1	2	3	2	2	3	L
f[cont]	4	4	1	2	1	2	1	L
f[cam]	2	1	1	3	3	2	3	B
f[exInf]	3	2	1	1	1	2	1	N
f[oReqm]	3	3	3	1	2	2	3	F
f[sMode]	3	1	3	3	2	2	3	L
f[aMode]	3	1	3	3	2	2	3	L
f[tMode]	3	1	3	3	2	2	3	L
f[dMode]	3	1	2	3	2	2	3	L
f[sbMode]	1	3	1	1	1	2	2	L
f[pMode]	3	1	1	1	1	2	2	N
f[aexInf]	3	1	1	2	1	2	1	N
f[comm]	3	1	1	1	1	3	1	N

Fig. 7. CARA ratings on SR-1 software functions and corresponding Analysis Level

Cost	Benefit < 5.5	< 11	< 16.5	< 22	< 27.5	< 32	
0							
1	3.86						3.86
2	32.9	0.27					33.17
3	10.01	3.49	0.02				13.52
4	6.66	22.68	5.88	0.45	0.02		35.69
5	1.06	6.74	4.94	0.95	0.07		13.76
total	54.49	33.18	10.84	1.4	0.09		100

TABLE II

ROUND 1 PERCENTAGE DISTRIBUTIONS OF $benefit$S AND $cost$S SEEN IN 10,000 RUNS OF FIG 4; NO TREATMENT

Cost	Benefit < 5.5	< 11	< 16.5	< 22	< 27.5	< 32	
0							
1							
2	27.84						27.84
3	10.71	7.05	0.28				18.04
4	4.26	8.89	1.7	0.11	0.01		14.97
5	2.83	19.2	14.68	2.24	0.19	0.01	39.15
total	45.64	35.14	16.66	2.35	0.2	0.01	100

TABLE III

ROUND 2 CONSTRAINT: $sharedData\ of\ targetSystem = yes$ (RIGOROUS QUALITY ASSURANCE)

Cost	Benefit < 5.5	< 11	< 16.5	< 22	< 27.5	< 32	
0							
1							
2							
3	25.21	2.7					27.91
4	8.86	18.51	2.13	0.04			29.54
5	3.15	21.13	15.5	2.45	0.32		42.55
total	37.22	42.34	17.63	2.49	0.32		100

TABLE IV

ROUND 3 CONSTRAINT: $implicitInvocation\ of\ targetSystem = yes$,$sharedData\ of\ targetSystem = yes$ (RIGOROUS QUALITY ASSURANCE)

Cost	Benefit < 5.5	< 11	< 16.5	< 22	< 27.5	< 32	
0							
1							
2							
3							
4	10.34	24.86	3.52	0.08		‘	38.8
5	4.68	31.01	21.51	3.64	0.34	0.02	61.2
total	15.02	55.87	25.03	3.72	0.34	0.02	100

TABLE V

ROUND 4 CONSTRAINTS: $abstractDataType\ of\ targetSystem = yes$, $c3 = yes$, $implicitInvocation\ of\ targetSystem = yes$,$sharedData\ of\ targetSystem = yes$ (RIGOROUS QUALITY ASSURANCE)

Cost	Benefit < 14.67	< 29.33	< 44	< 58.67	< 73.33	< 87	
0							
1	3.06						3.06
2	6.99	10.36	0.62	0.02			17.99
3	4.18	25.26	11.92	1.41	0.1		42.87
4	1.72	12.88	13.26	3.61	0.31	0.04	31.82
5	0.27	1.57	1.77	0.59	0.06		4.26
total	16.22	50.07	27.57	5.63	0.47	0.04	100

TABLE VI

ROUND 1 PERCENTAGE DISTRIBUTIONS OF $benefit$S AND $cost$S SEEN IN 10,000 RUNS OF FIG 5; (WEAK QUALITY ASSURANCE) NO TREATMENT

Cost	Benefit < 14.67	< 29.33	< 44	< 58.67	< 73.33	< 87	
0							
1	12.34	0.02					12.36
2	9.18	18.66	1.77	0.05			29.66
3	4.71	26.32	16.1	3.24	0.24	0.02	50.63
4	0.5	3.29	2.8	0.7	0.06		7.35
5							
total	26.73	48.29	20.67	3.99	0.3	0.02	100

TABLE VII

ROUND 2 CONSTRAINTS: $c4 = yes$, $pipeAndFilter\ of\ targetSystem = no$ (WEAK QUALITY ASSURANCE)

Cost	Benefit < 14.67	< 29.33	< 44	< 58.67	< 73.33	< 87	
0							
1	11.89	0.01					11.9
2	9.03	18.6	1.95	0.04			29.62
3	4.77	26.17	17.05	3.47	0.29	0.01	51.76
4	0.38	2.77	2.91	0.56	0.1		6.72
5							
total	26.07	47.55	21.91	4.07	0.39	0.01	100

TABLE VIII

ROUND 3 CONSTRAINTS: $c3 = yes$,$c4 = yes$, $pipeAndFilter\ of\ targetSystem = no$ (WEAK QUALITY ASSURANCE)

Cost	Benefit < 14.67	< 29.33	< 44	< 58.67	< 73.33	< 87	
0							
1	20.34	0.05					20.39
2	8.38	28.29	4.62	0.18			41.47
3	1.84	15.66	15.84	4.27	0.48	0.05	38.14
4							
5							
total	30.56	44	20.46	4.45	0.48	0.05	100

TABLE IX

ROUND 4 CONSTRAINTS: $c2 = yes$,$c3 = yes$,$c4 = yes$, $pipeAndFilter\ of\ targetSystem = no$ (WEAK QUALITY ASSURANCE)

Code	Level	Cost
Requirements Analysis Activities		
rav01	B,L,F,C	notHigh
rav02	B,L,F,C	notHigh
rav03	B,L,F,C	notHigh
rav04	B,L,F,C	notHigh
rav05	B,L,F,C	notHigh
rav06	B,L,F,C	notHigh
rav07	B,L,F,C	notHigh
rav08	B,L,F,C	notHigh
rav09	B,L,F,C	notHigh
rav10	F,C	veryHigh
rav11	F,C	veryHigh
rav12	F,C	veryHigh
rav13	F,C	veryHigh
rav14	C	extremelyHigh
Design Analysis Activities		
dav01	L,F,C	high
dav02	L,F,C	high
dav03	L,F,C	high
dav04	L,F,C	high
dav05	L,F,C	high
dav06	L,F,C	high
dav07	L,F,C	high
dav08	L,F,C	high
dav09	L,F,C	high
dav10	F,C	veryHigh
dav11	F,C	veryHigh
dav12	F,C	veryHigh
dav13	F,C	veryHigh
dav14	C	extremelyHigh
Code Analysis Activities		
cav01	L,F,C	high
cav02	L,F,C	high
cav03	L,F,C	high
cav04	L,F,C	high
cav05	L,F,C	high
cav06	L,F,C	high
cav07	F,C	veryHigh
cav08	F,C	veryHigh
cav09	F,C	veryHigh
cav10	F,C	veryHigh
cav11	F,C	veryHigh
cav12	C	extremelyHigh
cav13	C	extremelyHigh
cav14	C	extremelyHigh
Test Analysis Activities		
tav01	B,L,F,C	high
tav02	B,L,F,C	high
tav03	B,L,F,C	high
tav04	B,L,F,C	high
tav05	B,L,F,C	high
tav06	B,L,F,C	high
tav07	B,L,F,C	high
tav08	L,F,C	veryHigh
tav09	L,F,C	veryHigh
tav10	F,C	veryHigh
tav11	F,C	veryHigh
tav12	C	extremelyHigh

Fig. 8. Analysis Activities, applicable Analysis Levels for SR-1's functions, and Cost

Cost	Benefit vlow	low	high	vhigh
vlow	10	5	2	1
low	12	7	4	3
high	14	9	8	6
vhigh	16	15	13	11

TABLE X

CLASS RANKINGS FOR SR-1 FRAMEWORK

Code	Requirements Analysis Activity
Rav01	Verify documentation meets intended purpose, has appropriate detail and all necessary elements.
Rav02	Validate ability of requirements to meet system needs
Rav03	Verify Traceability to and from parent requirements
Rav04	Analyze data/adaptation requirement
Rav05	Analyze Testability, Qualification requirements
Rav06	Analyze Data FnotHigh, Control FnotHigh, moding and sequencing
Rav07	Assess development metrics
Rav08	Analyze development risks/mitigation plans
Rav09	Analyze Timing and Sizing requirements
Rav10	Review developer timing/sizing, loading engineering analysis
Rav11	Perform engineering analysis of key algorithms
Rav12	Review/use developer prototypes or dynamic models
Rav13	Develop alternative static representations (diagrams, tables)
Code	Design Analysis Activity
Dal01	Verify documentation meets intended purpose, has appropriate detail and all necessary elements
Dal02	Validate ability of design to meet system needs
Dal03	Verify Traceability to and from requirements
Dal04	Analyze database design
Dal05	Analyze design Testability, Qualification requirements
Dal06	Analyze design Data FnotHigh, Control FnotHigh, moding, sequencing
Dal07	Analyze control logic, error/exception handling design
Dal08	Assess design development metrics
Dal09	Analyze development risks/mitigation plans
Dal10	Review developer timing/sizing, loading engineering analysis
Dal11	Perform design analysis of select critical algorithms
Dal12	Review/use developer prototypes or dynamic models
Dal13	Develop alternative static representations (diagrams, tables)
Code	Code Aalysis Activity
Cal01	Verify documentation meets intended purpose, has appropriate detail and all necessary elements
Cal02	Verify Traceability to and from design
Cal03	Verify Architectural design compliance (structure, external I/O, and CSCI executive moding, sequencing and control)
Cal04	Verify supportability and maintainability
Cal05	Access code static metrics
Cal06	Verify CSU and CSC level logical structure and control fnotHigh
Cal07	Verify internal data structures and data fnotHigh/usage
Cal08	Verify error and exception handling
Cal09	Verify code and external I/O data consistency
Cal10	Verify correct adaptation data and ability to reconfigure
Cal11	Verify correct operating system and run time libraries
Code	Test Analysis Activity
Tal01	Analyze System level verification requirements to verity that test definition, objectives, plans and acceptance criteria are sufficient to validate system requirements and operational needs associated with CCHR functions
Tal02	Verify Software Test Plan qualification testing methods and plans are sufficient to validate software requirements and operational needs
Tal03	Verify test cases traceability and coverage of software requirements, operational needs and capabilities
Tal04	Verify software STD test case definition inputs, expected results, and evaluation criteria comply with STP plans and testing objectives
Tal05	Analyze correct dispositioning of software test anomalies
Tal06	Validate software test results compliance with test acceptance criteria
Tal07	Verify trace and successful completion of all software test case objectives
Tal08	Verify ability of software test environment plans and designs to meet software testing objectives
Tal09	Verify regression tests are sufficient to determine that the software is not adversely affected by changes
Tal10	Analyze STD procedures for test setup, execution, and data collection; confirm procedures completely and correctly test referenced requirements, confirm inspection and analysis completely verifies referenced requirements
Tal11	Monitor execution of software testing as needed

Fig. 9. Analysis Activities Keys to figure 8

version	1	2
`<notHigh>` (X)	$mean(X) = 1$	$mean(X) = mean(Y) * 0.7$
`<high>` (Y)	$Y = mean(X) * 10$	$mean(Y) = 2$, $0 < Y < 10$
`<veryHigh>` (Z)	$Z = mean(Y) * 10$	$mean(Z) = Y * F$, $mean(F) = 1.2; 1.1 \leq F \leq 1.7$

Fig. 10. Two versions of cost function

`<combine_logic>`	`<op>`	`<arithmetic[op]>`
all_of	`rand`	minimum
any_of	`rany`	summation
any_one_of	`ror`	maximum
`<contribution>`	`<value>` `[contribution]`	`<arithmetic>` `[contribution]`
helped	mean=1.4	multiply
made	mean=1.8	multiply
catastrophically_rated	mean=1.9	multiply
critically_rated	mean=1.4	multiply
highly_rated	mean=1.1	multiply
lowly_rated	mean=0.4	multiply

Fig. 11. Miscellaneous settings for SR-1 framework

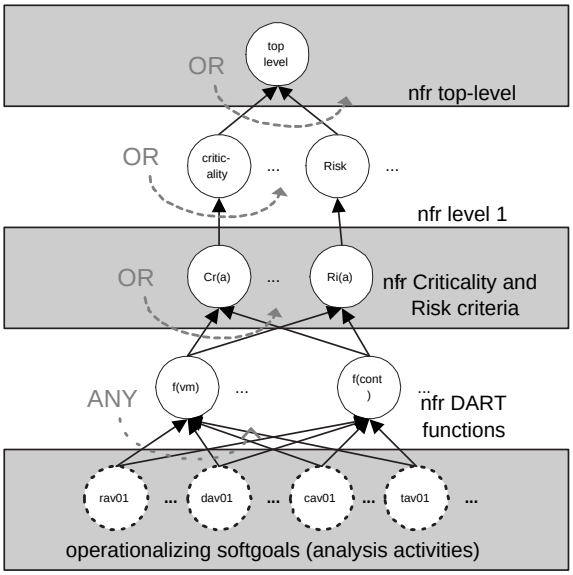

Fig. 12. SR-1 framework: 1

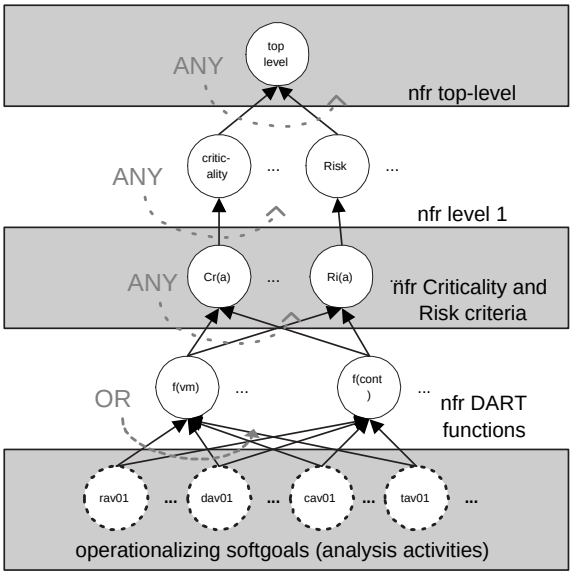

Fig. 13. SR-1 framework: 2

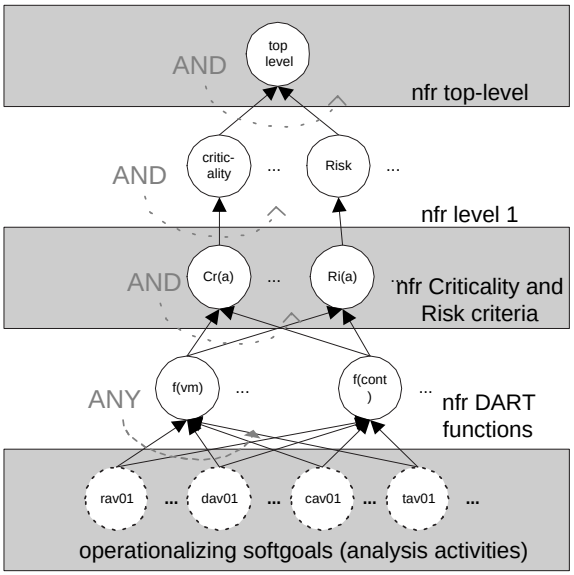

Fig. 14. SR-1 framework: 3

Cost	Benefit vlow	low	high	vhigh	Total
vlow	34.15				34.15
low		4.02	6.26	5.58	15.86
high		6.2	9.98	8.82	25
vhigh		5.64	8.76	10.59	24.99
Total	34.15	15.86	25	24.99	100

TABLE XI

SR-1 FRAMEWORK 1 PERCENTAGE DISTRIBUTIONS OF $benefit$S AND $cost$S SEEN IN 10,000 RUNS OF FIG 12; NO TREATMENT

Cost	Benefit vlow	low	high	vhigh	Total
vlow					
low		4.70	7.74	7.30	19.7
high		9.95	16.0	14.2	40.1
vhigh		9.05	14.1	17.0	40.1
total		23.7	37.8	38.5	100

TABLE XII

MORE PREFERRED SYSTEM: SR-1 FRAMEWORK 1 PERCENTAGE DISTRIBUTIONS OF $benefit$S AND $cost$S SEEN AFTER APPLYING TREATMENTS ($tav09\ of\ tal = y$) FOR A MORE DESIRABLE SYSTEM

Cost	Benefit vlow	low	high	vhigh	Total
vlow					
low					
high		5.16	9.52	8.6	23.27
vhigh		17.32	26.9	32.51	76.73
Total		22.47	36.41	41.11	100

TABLE XIII

LESS PREFERRED SYSTEM: SR-1 FRAMEWORK 1 PERCENTAGE DISTRIBUTIONS OF $benefit$S AND $cost$S SEEN AFTER APPLYING TREATMENTS ($cav10\ of\ cal = y$) FOR A LESS DESIRABLE SYSTEM

Cost	Benefit vlow	low	high	vhigh	Total
vlow	17.63	2.21	2.67	2.5	25.01
low	3.84	8.76	6.16	6.24	25
high	2.48	8	7.12	7.4	25
vhigh	1.06	6.03	9.05	8.85	24.99
Total	25.01	25	25	24.99	100

TABLE XIV

SR-1 FRAMEWORK 2 PERCENTAGE DISTRIBUTIONS OF $benefit$S AND $cost$S SEEN IN 10,000 RUNS OF FIG 13; NO TREATMENT

Cost	Benefit vlow	low	high	vhigh	Total
vlow	25.35	3.13	3.83	3.6	35.91
low	4.88	11.58	8.4	8.66	33.52
high	2.26	7.65	6.67	7.61	24.19
vhigh		1.56	2.16	2.32	6.38
Total	32.84	23.91	21.06	22.18	100

TABLE XV

MORE PREFERRED SYSTEM: SR-1 FRAMEWORK 2 PERCENTAGE DISTRIBUTIONS OF $benefit$S AND $cost$S SEEN AFTER APPLYING TREATMENTS ($dav12\ of\ dal = n$) FOR A MORE DESIRABLE SYSTEM

Cost	Benefit vlow	low	high	vhigh	Total
vlow					
low	3.4	5.69	1.65	2.11	12.86
high	5.51	15.52	7.71	6.98	35.72
vhigh	4.13	12.95	16.71	17.17	50.96
Total	13.22	34.44	26.08	26.26	100

TABLE XVI

LESS PREFERRED SYSTEM: SR-1 FRAMEWORK 2 PERCENTAGE DISTRIBUTIONS OF $benefit$S AND $cost$S SEEN AFTER APPLYING TREATMENTS ($cav07\ of\ cal = y$) FOR A LESS DESIRABLE SYSTEM