

Using @RISK in Project Risk Assessments at Infineon

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Never stop thinking

Why Risk Management?



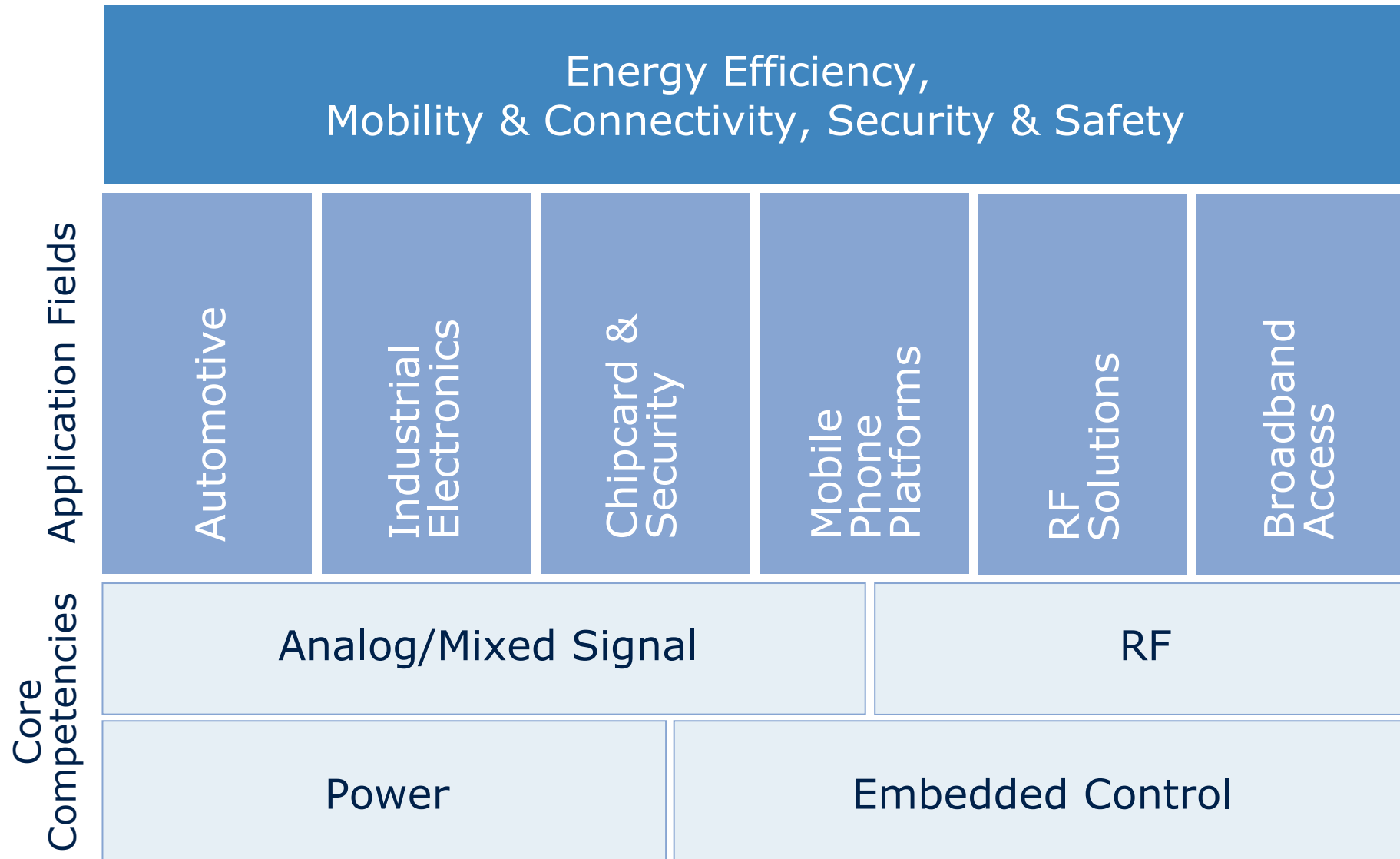
Agenda

- Intro on Infineon
- Risk Management at Infineon
- Risk Analysis in R&D Projects
- Risk Analysis of Business Plans
- Roll out
- Experience

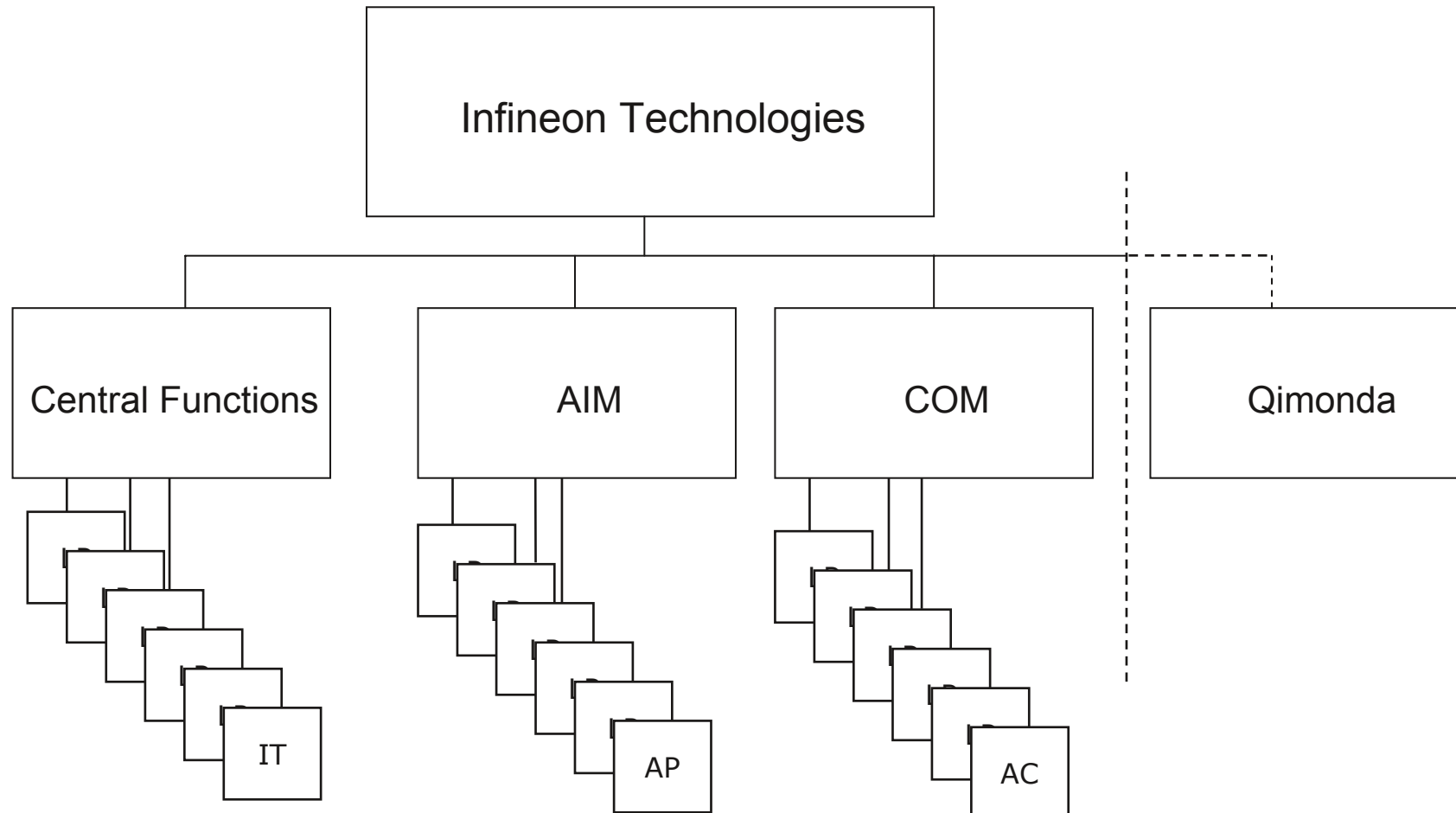
The "New" Infineon at a Glance

- More than EUR 4 bn in revenues in the fiscal year 2006, EUR 958 m in the first quarter of the fiscal year 2007
- Approx. 30,000 employees (incl. 6,000 R&D staff) as of December 31, 2006
- Strong technology portfolio with about 22,900 patents and applications; more than 35 major R&D locations worldwide
- Focus on Energy Efficiency, Mobility & Connectivity, Security & Safety
- Majority holding of Qimonda

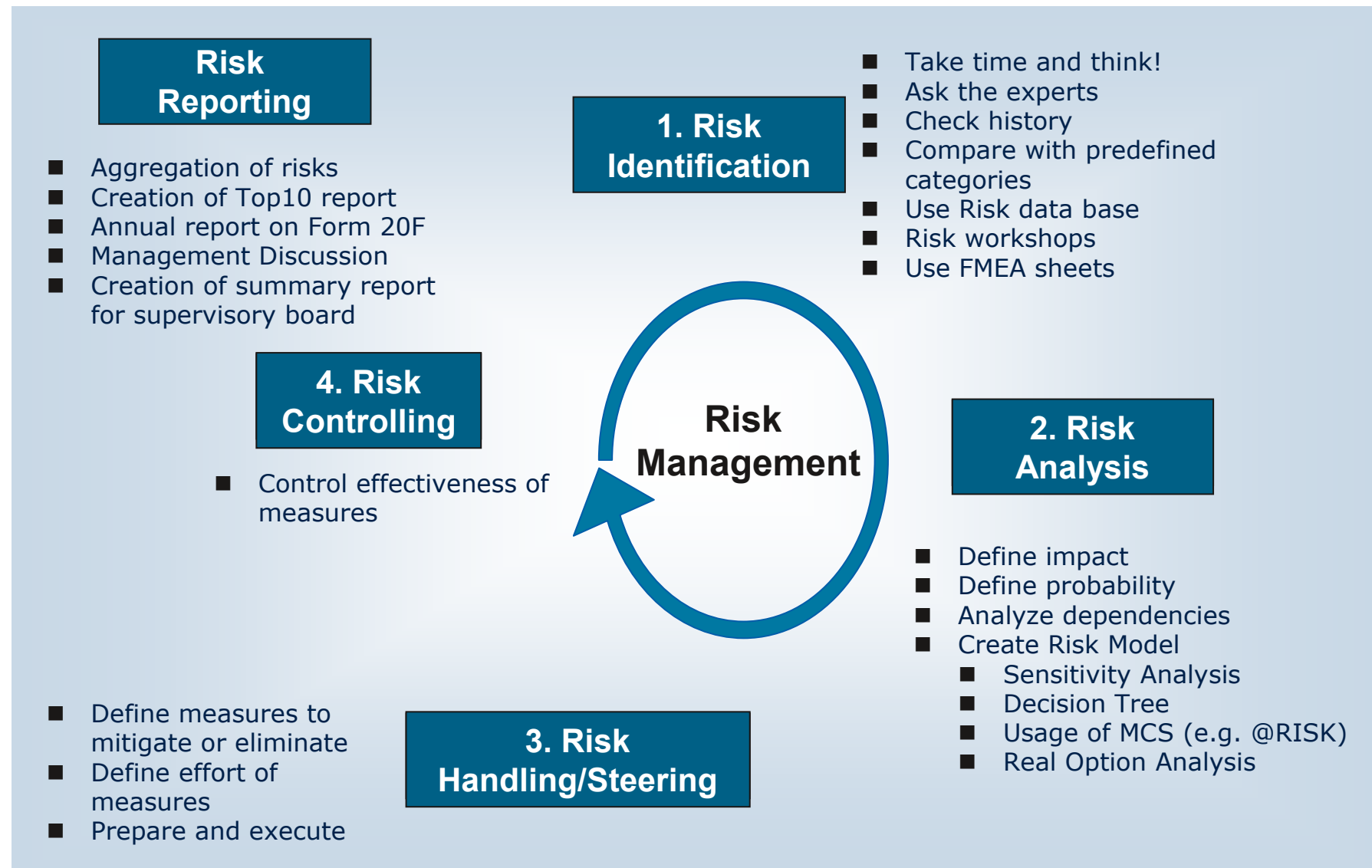
Our "New" Infineon Competencies



Organizational Structure



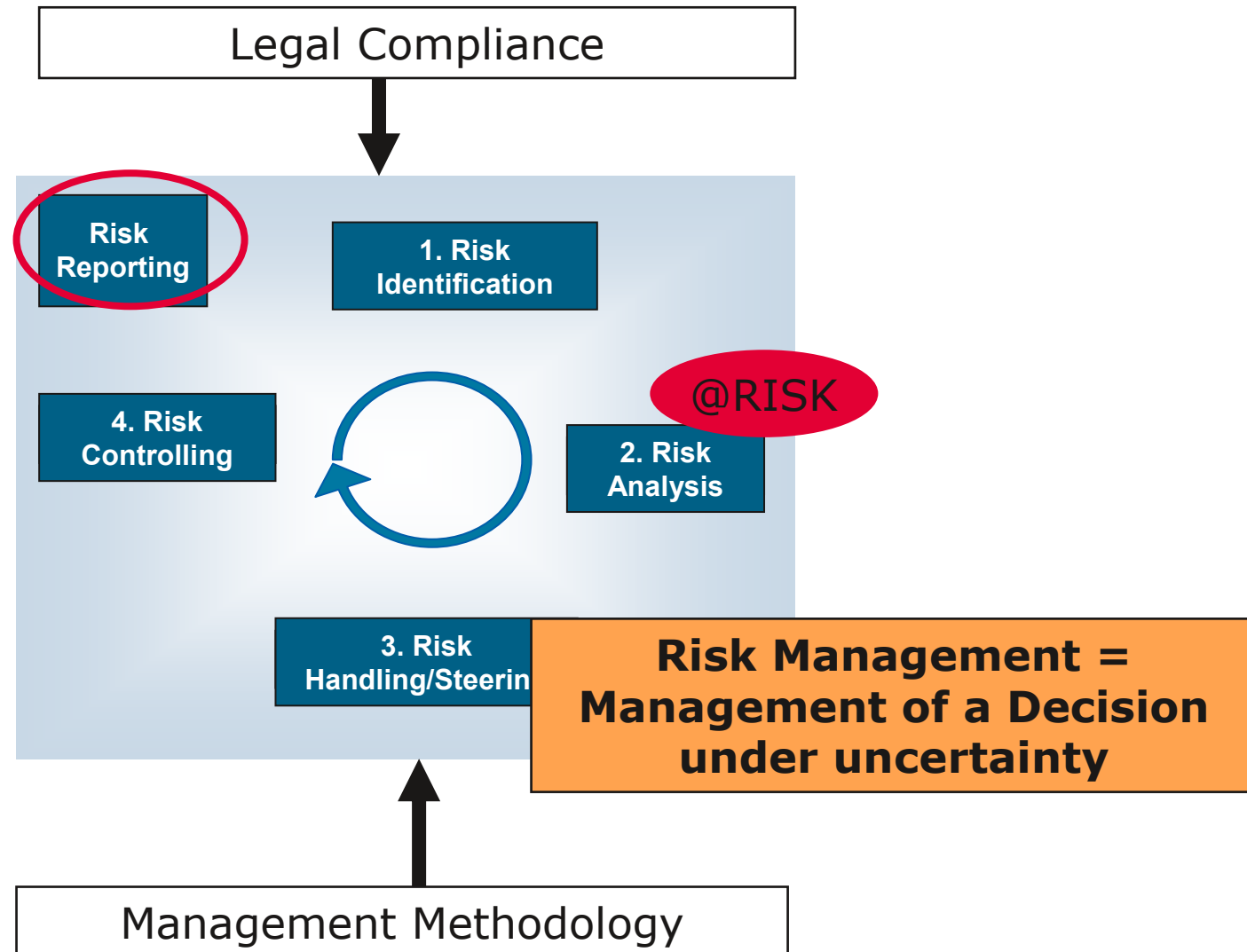
The Base: Risk Management (sub-) process



Infineon's expectation towards Risk Management



- KonTraG (1998)
- TransPubG (2002)
- BilReG (2004)
- SOX (2002)



Risk Management System

■ AR RM responsibility

- Definition of objectives and rules
- IFX Risk Reporting
- Support on process implementation
 - Risk Assessments

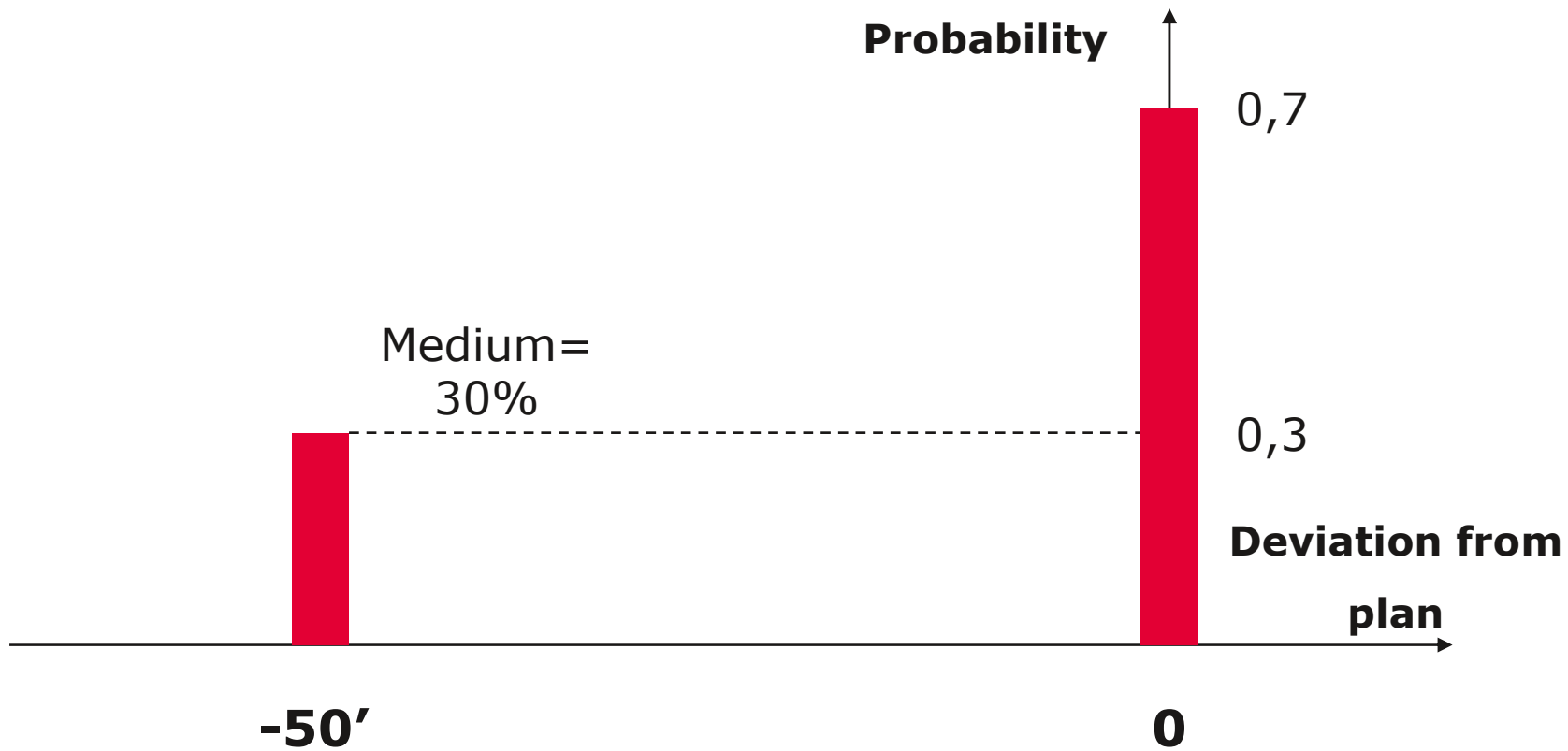
■ BG responsibility

- BG Risk Reporting
- BG related process implementation

Details on Risk Reporting

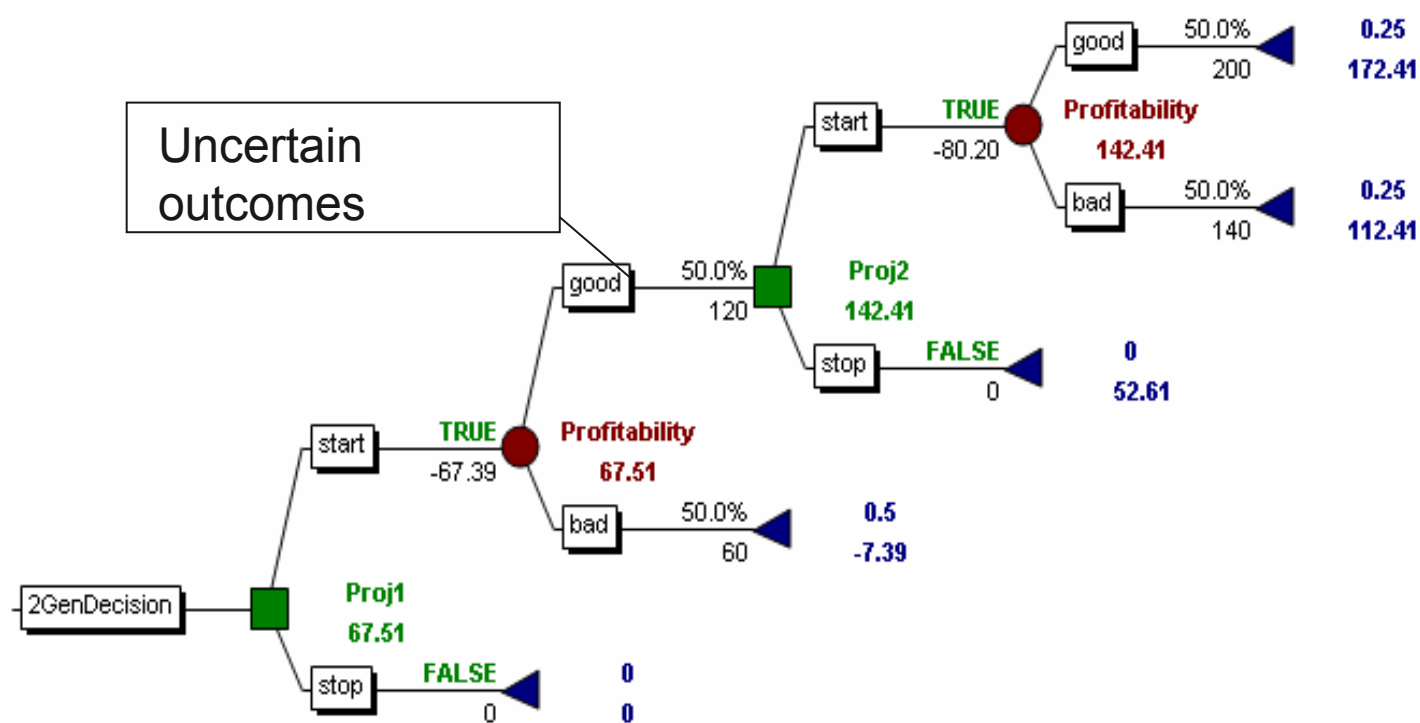


Quantification of Risk Events



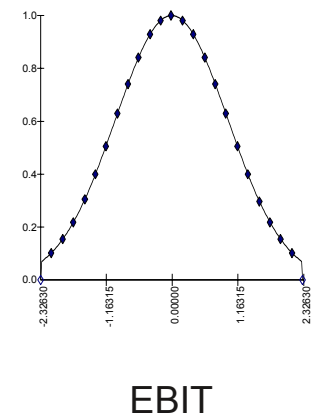
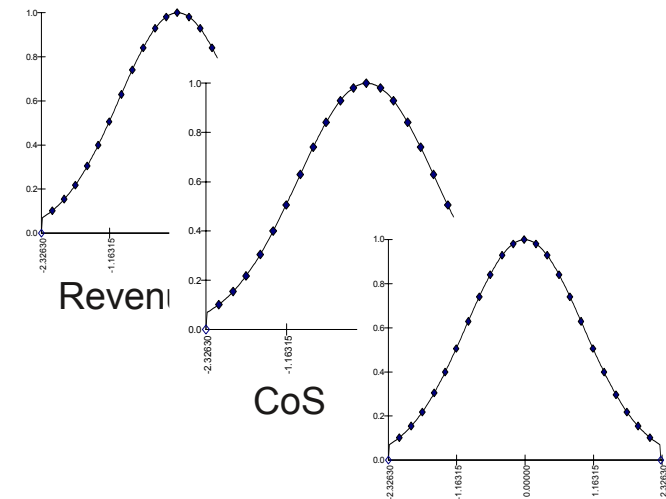
Decision Making Process

- Using *PrecisionTree*: Risks are described as good case or bad case



Risk Analysis: @RISK

- A more sophisticated evaluation technique by using probability distributions
- Uncertainty is defined by a range of values and associated estimated probabilities
- Monte Carlo simulations are used to aggregate and analyze effects on a certain parameter
- Application fields for Infineon:
 - Schedule analysis in MSP
 - Financial calculations
- In 2002 Infineon selected @RISK because of the product “@RISK for Project”



Risk Analysis in Projects (1)

Methodology:

STEP1

- Identification of Top 10-20 Risks within a project

No
specific
tool

STEP2

- Mapping of the risk's to the project
- documentation of implemented risks

MS
project

STEP3

- Modeling & Simulation using @Risk for MSP

@Risk

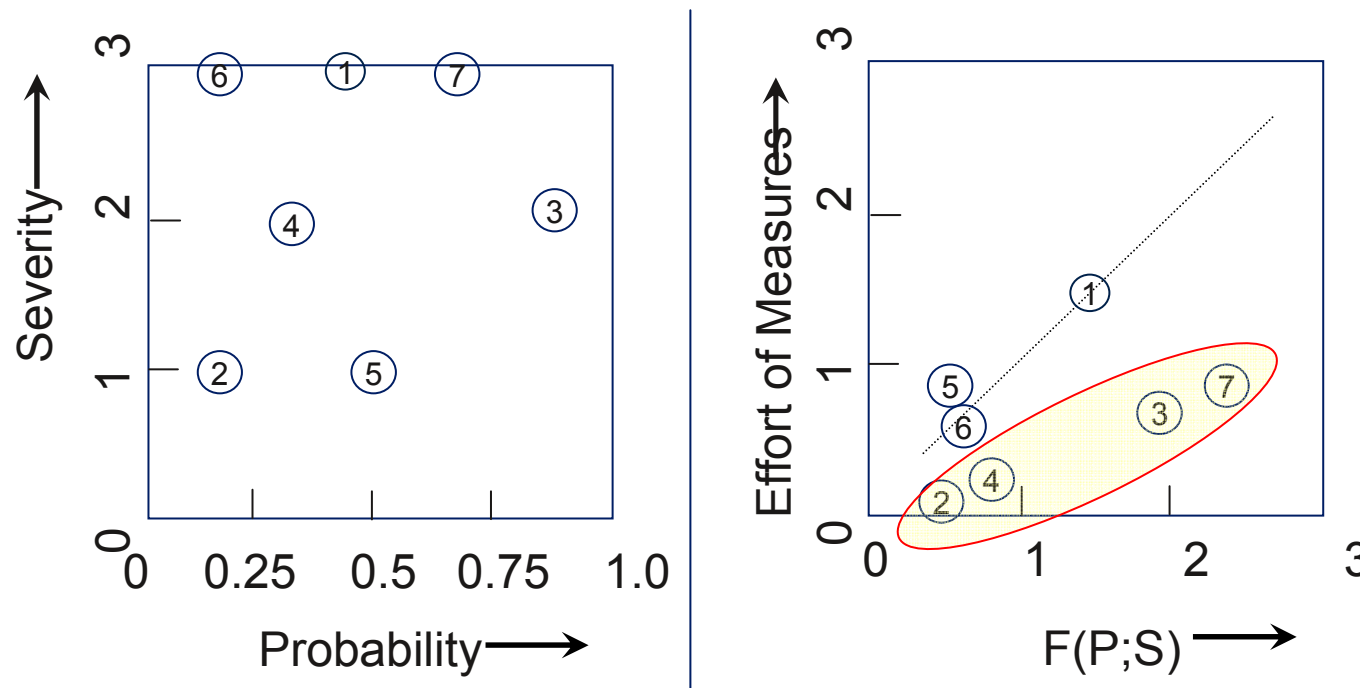
STEP4

- Involve the team to check your first estimates and refine these
- Prepare the transparent management presentation

No
specific
tool

Workflow: STEP 1

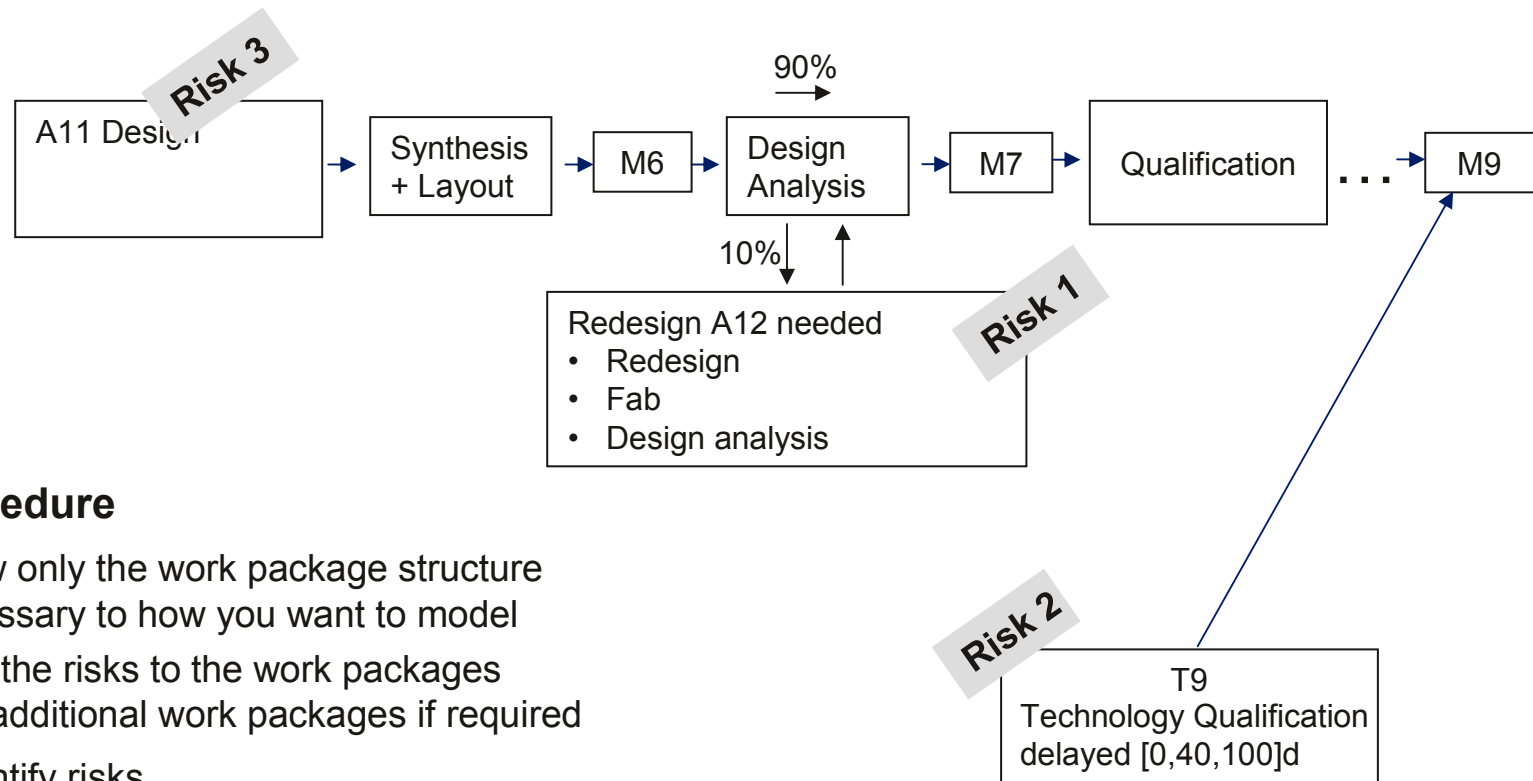
- Identification of Top 10-20 Risks within your project and map these on a high level to your project



- 1: Team not fully staffed
- 2: IP delivery delayed
- 3: bottleneck in verification equipment
- 4: Analog Expert not avail.
- 5: Design errors
- 6: Testing not possible (Probe card)
- 7: GOX reliability

Workflow: STEP 2

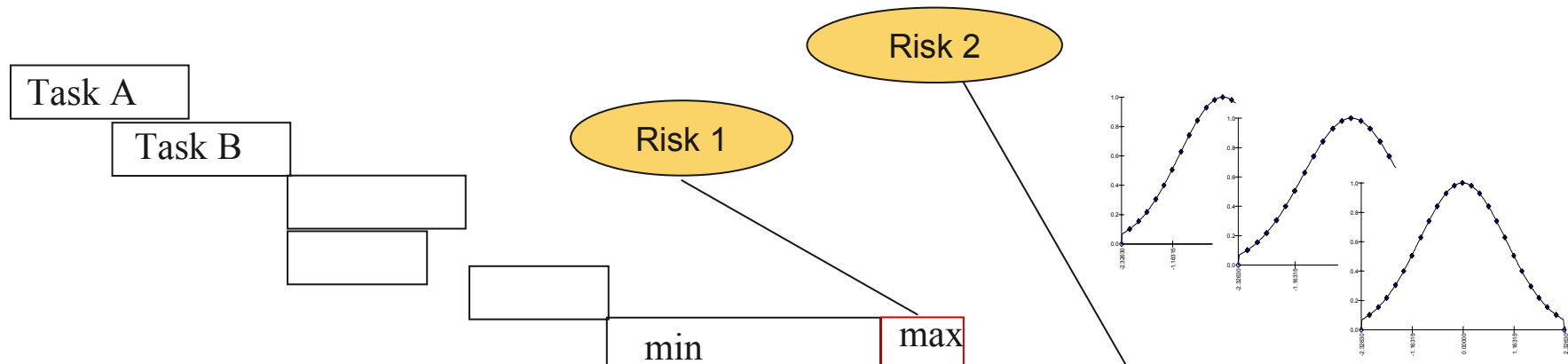
- Create a Mapping chart for your MSP plan



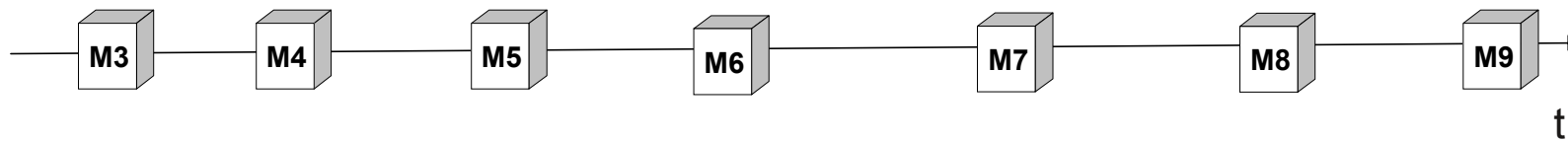
Procedure

- 1) Draw only the work package structure necessary to how you want to model
- 2) Map the risks to the work packages add additional work packages if required
- 3) Quantify risks

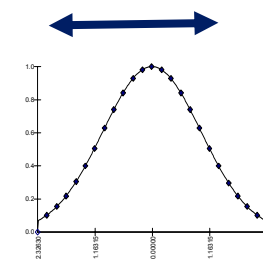
Workflow: STEP 3 is in Projects



- Employ uncertainties in the project plan by using @Risk's distributions



- A single milestone date gets a distribution of possible finalization dates



Workflow: STEP 4

- Involve the team to check your first estimates and rework the model

- Prepare the **Risk Presentation**
 - Tracking of risks (i.e. Risk Lite)
 - Explanation of modeling
 - Separation of committed and target date
 - List of measures/decisions to make

5. Weekly reporting...

Workflow => STEP 1

Identified Risks and Measures to be taken confidential Status: 2003-07-29

Issue	Planned resolution Measure	Date
Retention after Cycling	POR, AC sensing, algorithm?	2004 ?
Second bit effect / RAC	New Vth settings	E07/03 ✓
Power cycling	Vdd detector	E11/03
BL disturb	stepped BL, longer Leff	E11/03
Killer pattern / PBE	Algorithm change	E07/03 ✓
AC timing parameters	design optimization, spec change	E11/03

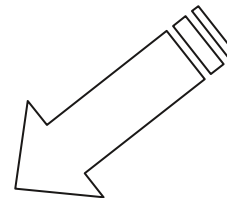
Main Objective



Separation of

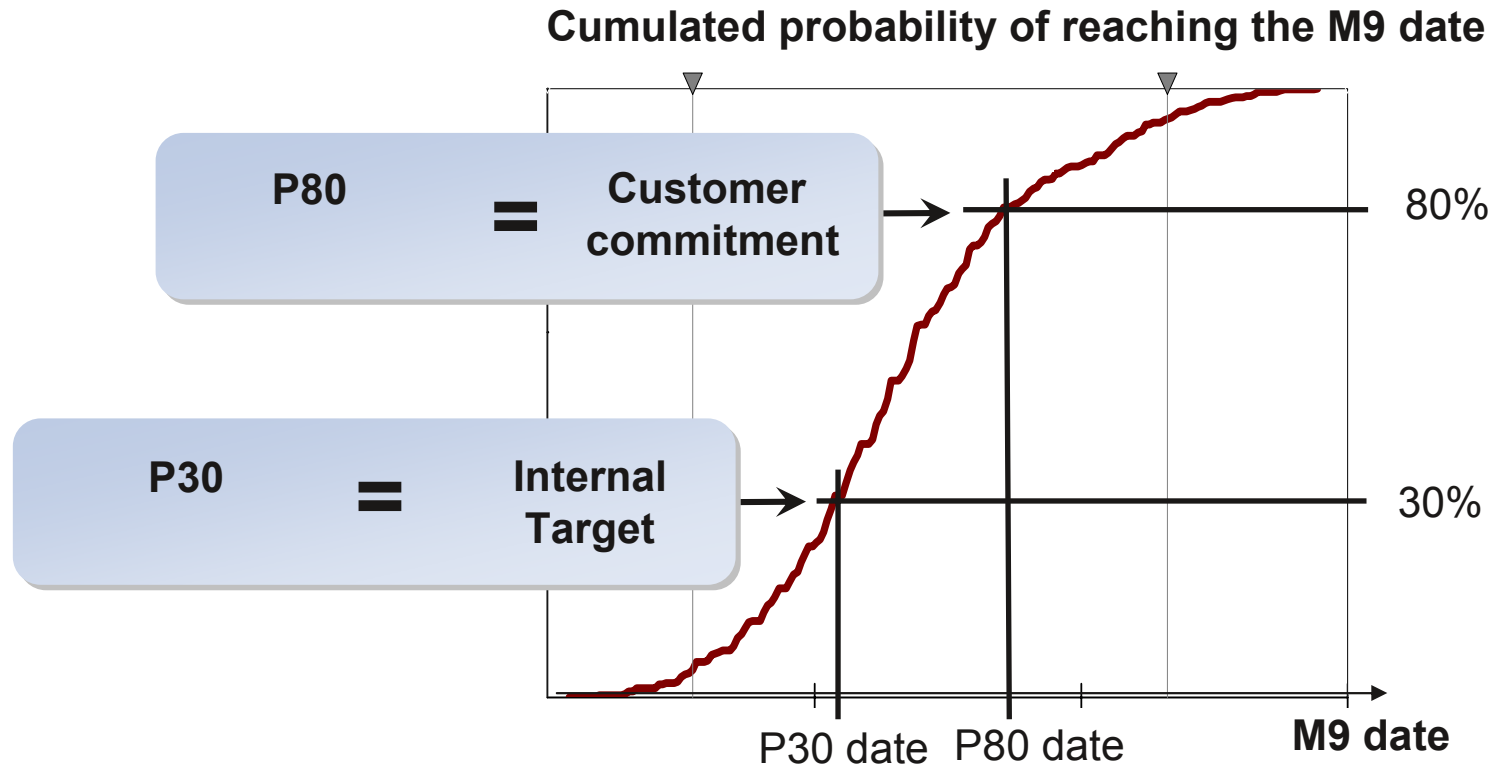
- Date **committed** to the customer
- Internal **target** dates

..by using explicit numbers of likelihood



Keep customer committed date
(Delay=0)

Infineon regulations



Mandatory for important R&D projects

Standard Product Plan (PPL)

Discrete numbers for

- Revenue (S x V)
- CoS
 - wafer cost
 - chip area
 - yield
 - package costs
- R&D costs

$$\text{“NPV”} = \sum_{n=0}^N \frac{\text{Ebit}_n}{(1+15\%)^n}$$

I. Revenue				
		03/04	04/05	05/06
Year end date		30.09.04	30.09.05	30.09.06
Sales price	€/pc		8,30	8,50
Sales Volume	kpc		800	1800
Revenue	k€		6.640	15.300

II. CoS / Production Costs				
		03/04	04/05	05/06
Wafer Production (FAB)				
Costs per Wafer	€/wafer		1500,00	1400,00
Wafer diameter	mm		200	200
Chip area	mm ²		30	30
Chips/Wafer			911	911
YF	%		100%	100%
Wafer Testing (SORT)				
Tester costs per sec FE	€/sec		0,04	0,04
Test time FE	sec		2	2
Temperature Factor FE			1	1
YFB	%		100%	100%
YB	%		70,00%	75,00%
Assembly (ASSY)				
Package costs	€		1,80	1,70
YM	%		100%	100%
Backend Testing (TEST)				
Tester costs per sec BE	€/sec		0,01	0,01
Test time BE	sec		6	6
Temperature Factor BE			1	1
YP1	%		95%	95%
Mark/Scan/Pack (MSP)				
Costs MSP per chip	€		0,01	0,01
Total Production Cost	€		4,56	4,13
ZUK Factor			1,15	1,15
Total Production Cost incl. ZUK	€		5,25	4,75

III. R & D Costs				
		03/04	04/05	05/06
Manmonths	m m o	50	40	30
Avg. Cost per Manmonth	k€/m m o	80	80	80
R & D Manmonth Costs	k€	4.000	3.200	2.400
Tape-out Costs	k€	100		
Redesign Costs	k€			
Subtotal Masks + Wafer	k€	100	0	
External Material	k€			
Consulting	k€			
R & D Costs Total	k€	4.100	3.200	2.400

IV. Gross Margin				
		03/04	04/05	05/06
Total Production Costs per Unit incl.	€/pc	0,00	5,25	4,75
Total Production Costs	k€	0,00	4199,51	8553,68
Sales IFX	k€	0	6.640	15.300
Gross Margin per unit	€/pc	0,00	3,05	3,75
Gross Margin total	k€	0	2.440	6.746
Gross Margin in % of sales	%	0%	37%	44%
Factor Overhead Costs			1,5	1,5

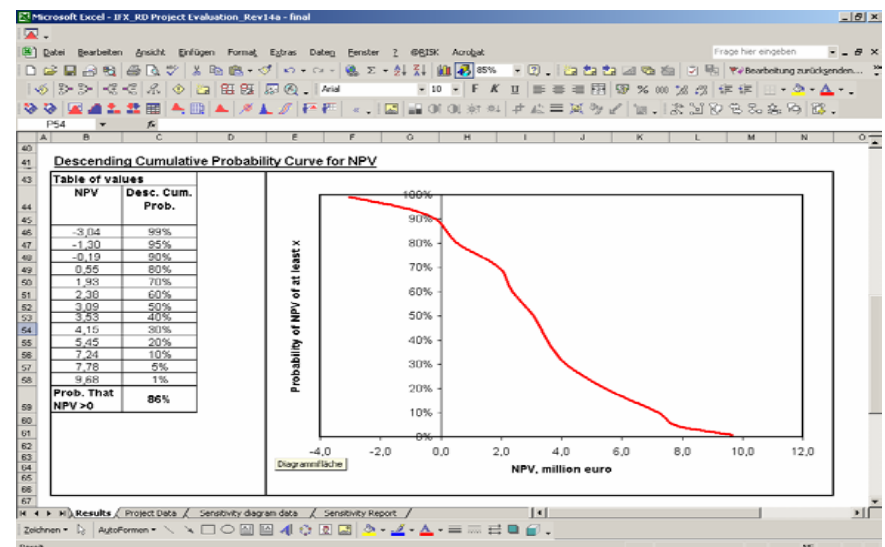
V. EBIT, NPV & Payoff Period				
		03/04	04/05	05/06
Counter Years		1	2	3
EBIT	M €	-4,10	-2,86	0,07
Cumulative EBIT	M €	-4,10	-6,96	-6,89
Pay-off Year		0	0	0
Discount Rate	%	15%		
Pay-off period	yr	5		
NPV	M €	0,24		
NPV target	M €	2,00		

Quantitative Risk Analysis of Business Plans

Details

- Uncertainties in sales price, volume, R&D and production costs are defined by using @Risk's distribution functions
- The EBIT is changing from a single number to a certain distribution
- Predefined templates visualize the probability function of the Net Present Value (NPV)

		02/03	03/04	04/05	05/06	06/07	07/08	Total Years	Ass
Sales Price & Volume									
70	Year end date	30.09.03	30.09.04	30.09.05	30.09.06	30.09.07	30.09.08		
71	Sales price	€/pc	32,71	27,74	24,20	21,08	18,98		CLM
72	Price for P95 Milestone	€/pc		24,30	21,87	19,88	17,71	15,94	Ente vaba
73	Price for P80 Milestone	€/pc		27,00	24,30	21,87	18,98	17,71	Ente vaba
74	Price for P50 Milestone	€/pc		33,75	27,95	24,06	20,67	18,60	Ente vaba
75	Sales Volume	pc		388.489	804.825	725.550	946.475	846.475	CLM
76	Sales Vol. for P95 Milestone	pc		210.000	300.000	360.000	420.000	420.000	Ente the f
77	Sales Vol. for P80 Milestone	pc		300.000	500.000	800.000	700.000	700.000	Ente the f
78	Sales Vol. for P50 Milestone	pc		390.000	850.000	780.000	910.000	910.000	Ente the f
Margins and Profit									
82	Total Production Costs per Unit	€/pc		15,47	13,08	12,66	11,81	11,01	
83	Sales I/FX	€		11.988.752	18.789.524	17.555.713	17.850.358	18.085.322	80.227.870
84	Gross Margin per unit	€/pc		17,23	13,64	11,54	9,28	7,97	
85	Gross Margin total	€		8.315.874	8.389.109	8.371.030	7.953.711	8.744.447	37.663.971
86	Gross Margin in % of sales	%		53%	50%	48%	44%	42%	
87	Factor Overhead Costs			1,7	1,6	1,5	1,4	1,4	Ente G&L



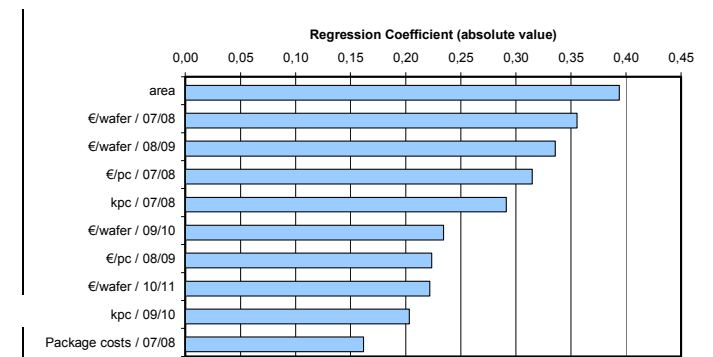
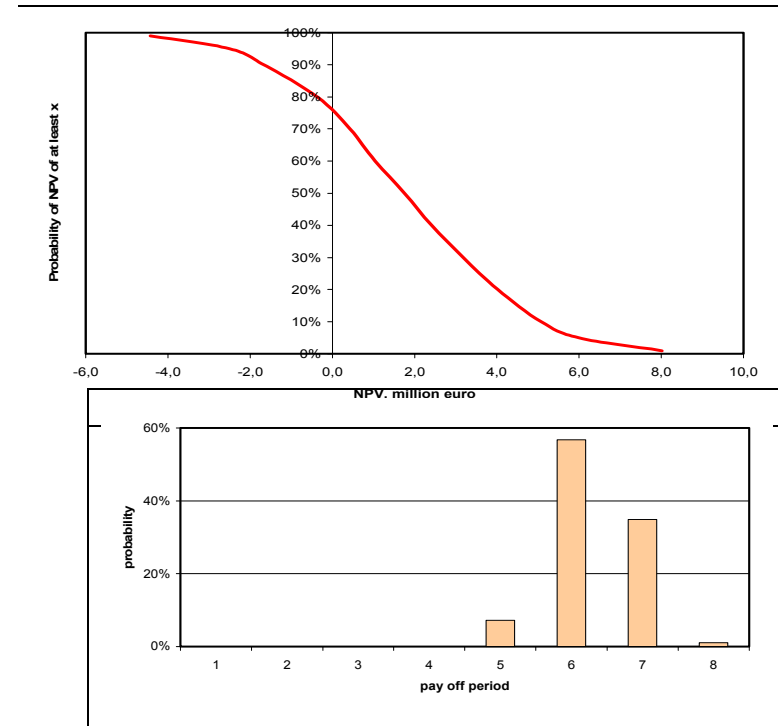
"Financial @RISK"

■ Standardized Outputs

□ NPV

□ POP

□ Regression coefficients
(impact of each input on NPV distribution)





Templates provided by Central Risk Management

Risk Management [back](#)

- ▶ About Us
- ▼ Risk Analysis
 - [@Risk Information](#)
 - [@Risk Templates](#)
- ▶ Risk Reporting
- ▶ Risk Management System Analysis
- ▶ Quarterly Risk Forums
- ▶ Regulations

@Risk Templates

@RISK - Quantitative Risk Analysis

@Risk Model Library:
(@RISKModelList_v3.xls)

01	@RISK for Excel training examples
02	Contract Management
03	Forecasting
04	HVCMOS
05	IFX_StockOptionPricing
06	Investment
07	M&A
08	misc
09	R&D projects
10	Options & Real Options
11	SixSigma

Rules & Guidelines within Infineon (1)

- R&D projects whose budget exceed given limit
 - Project Plan Analysis
 - A quantitative risk analysis of the project schedule has to be applied using "@Risk for Project".
 - Financial Analysis
 - profitability to be assessed using "released Excel-Templates" based on @Risk for Excel

- Investment projects (above given limit)
 - Before those investments can be approved, a quantitative risk analysis using the "Investment template" has to be applied

Rules & Guidelines within Infineon (2)

- 1-day training is mandatory
 - @RISK
 - Basics on Statistics
 - @ RISK First Steps
 - @RISK Advanced Features
 - Business Plan Analysis
 - @RISK for Project
 - @RISK for Project
 - Risk Management Methodology
 - Basics on Statistics
 - @RISK Demonstration & Exercise
 - Case Study
 - Project Business Plan Analysis

- Training organization
 - Bi-monthly courses in Munich (Headquarter)
 - Successful cooperation with Palisade since 2005
 - E-Learning courses for APAC and US
 - Courses for sites on demand

Experience with QRA in projects and @Risk for MSP



■ Pros

- Basic features of the tool easy to use
- For basic features similar user interface compared to @RISK
- Existing project plans could be used
- Applying Risk Management in projects improved planning accuracy
- More objective decisions („kill-rate“)
- Less fire fighting
- Improved communication in project team
- More efficient management of defined mitigation activities
- Culture, sharpened awareness

■ Cons

- Tool performance
- Tool stability in early versions
- Some resistance due to obligation to use @RISK
- No structured process, just tool usage
 - Too many risks
 - No follow up
- Sometimes no serious usages (“change the inputs until it fits“)

Experience with QRA for finance applications and @Risk for Excel



■ Pros

- Perfect integration into MS Excel
- Easy to understand user interface
- "Viewer" concept
- Tool performance
- Applying Risk Management improved planning accuracy
- More objective decisions („kill-rate“)
- Culture, sharpened awareness

■ Cons

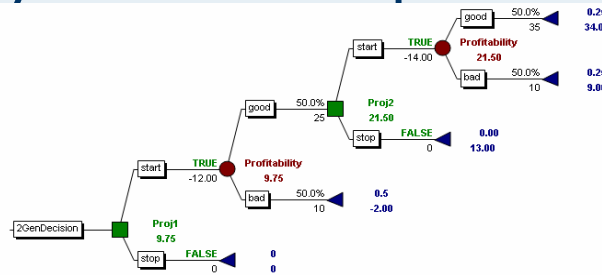
- More guidance which pdf to choose
- Some resistance due to obligation to use @RISK
- No structured process, just tool usage
- Low quality inputs destroy good projects - or vice versa

Biggest Difficulties

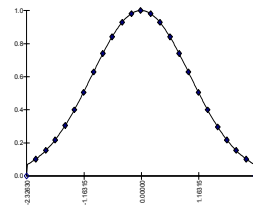
- Culture
- Training as prerequisite
- Quality of inputs

Advanced Risk Analysis: Real Option Analysis

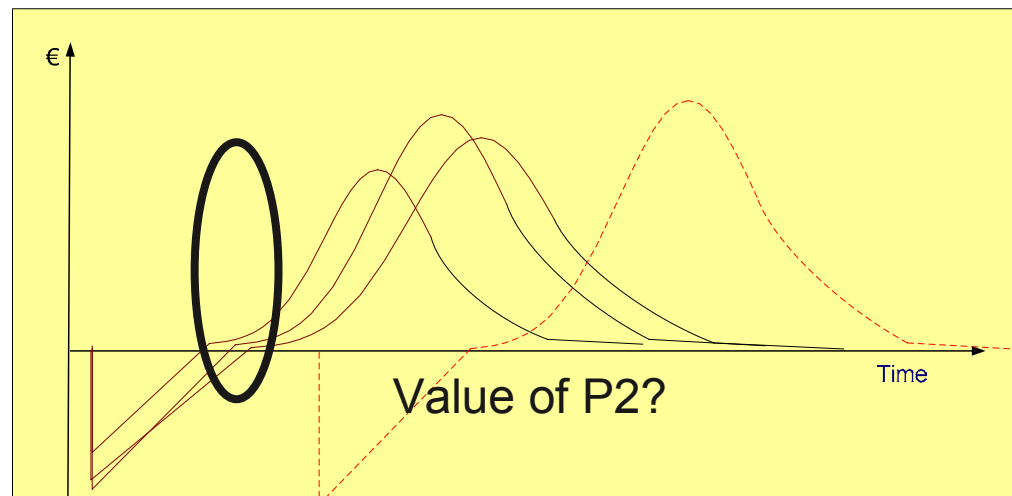
Decision Analysis



Risk Analysis



Real Option Analysis: Value of flexibility



Managing Uncertainty at Infineon ...



... is being done successfully with **@RISK !**

THANK YOU !



Questions?

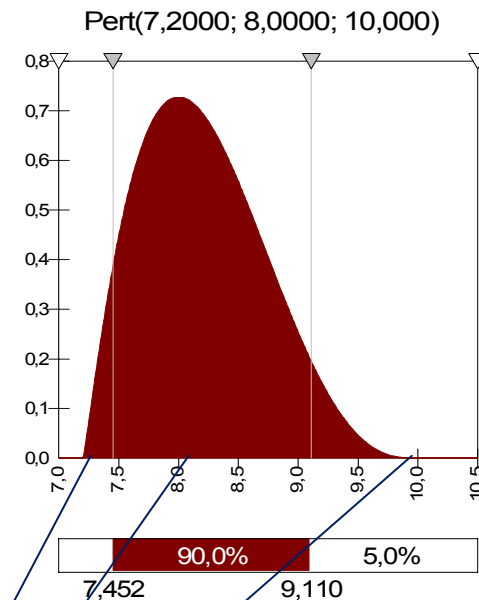
-> martin.erdmann@infineon.com



Backups

“Financial @RISK” (1)

- Sales price and volume uncertainties are defined by their minimum, most likely and maximum values using PERT distributions *

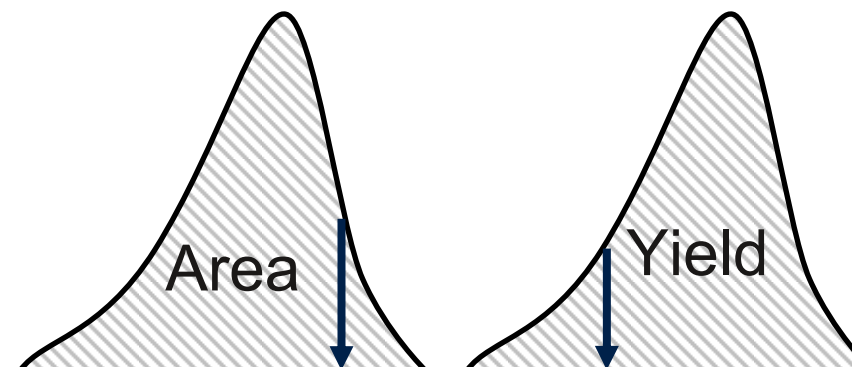


I. Revenue			03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	Total Years
		Year end date	30.09.04	30.09.05	30.09.06	30.09.07	30.09.08	30.09.09	30.09.10	30.09.11	
Sales price	€/pc			8,20	7,06	6,50	5,95	4,96	4,96	4,46	
Min (P95 on Timeline)	€/pc			7,20	6,30	5,85	5,40	4,50	4,50	4,05	
Most likely (P80 on Timeline)	€/pc			8,00	7,00	6,50	6,00	5,00	5,00	4,50	
Max (P30 on Timeline)	€/pc			10,00	8,05	7,15	6,30	5,25	5,25	4,73	
Sales Volume	kpc			21	98	1.967	9833,33	9833,33	7866,67	7866,67	37.486
Min (P95 on Timeline)	kpc			18	60	1.200	6.000	6.000	4.800	4.800	22.878
Most likely (P80 on Timeline)	kpc			20	100	2.000	10.000	10.000	8.000	8.000	38.120
Max (P30 on Timeline)	kpc			25	130	2.600	13.000	13.000	10.400	10.400	49.555
Revenue	k€			168	694	12.783	58.508	48.757	39.006	35.105	195.021

* Prices and volumes could be correlated

"Financial @RISK" (2)

- Wafer costs are defined by a trend and a deviation over time using PERT distributions
- Chip area is uncertain in the first year and kept for the next years
- Chip area distribution is negative correlated to yield



II. CoS / Production Costs		03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11
Wafer Production (FAB)									
Costs per Wafer	€/wafer		1460,04	1343,24	1235,78	1136,92	1045,96	962,29	885,30
Most likely	€/wafer	1587	1460,04	1343,24	1235,78	1136,92	1045,96	962,29	885,30
Change of most likely ("trend")	%		-8%	-8%	-8%	-8%	-8%	-8%	-8%
Min in % w.r.t. most likely value	%		10%	12%	14%	16%	20%	25%	30%
Max in % w.r.t. most likely value	%		10%	12%	14%	16%	20%	25%	30%
Wafer diameter	mm		200	200	200	200	201	202	203
Chip area	mm ²		32	32	32	32	32	32	32
Min	mm ²		29						
Most likely	mm ²		32						
Max	mm ²		33						

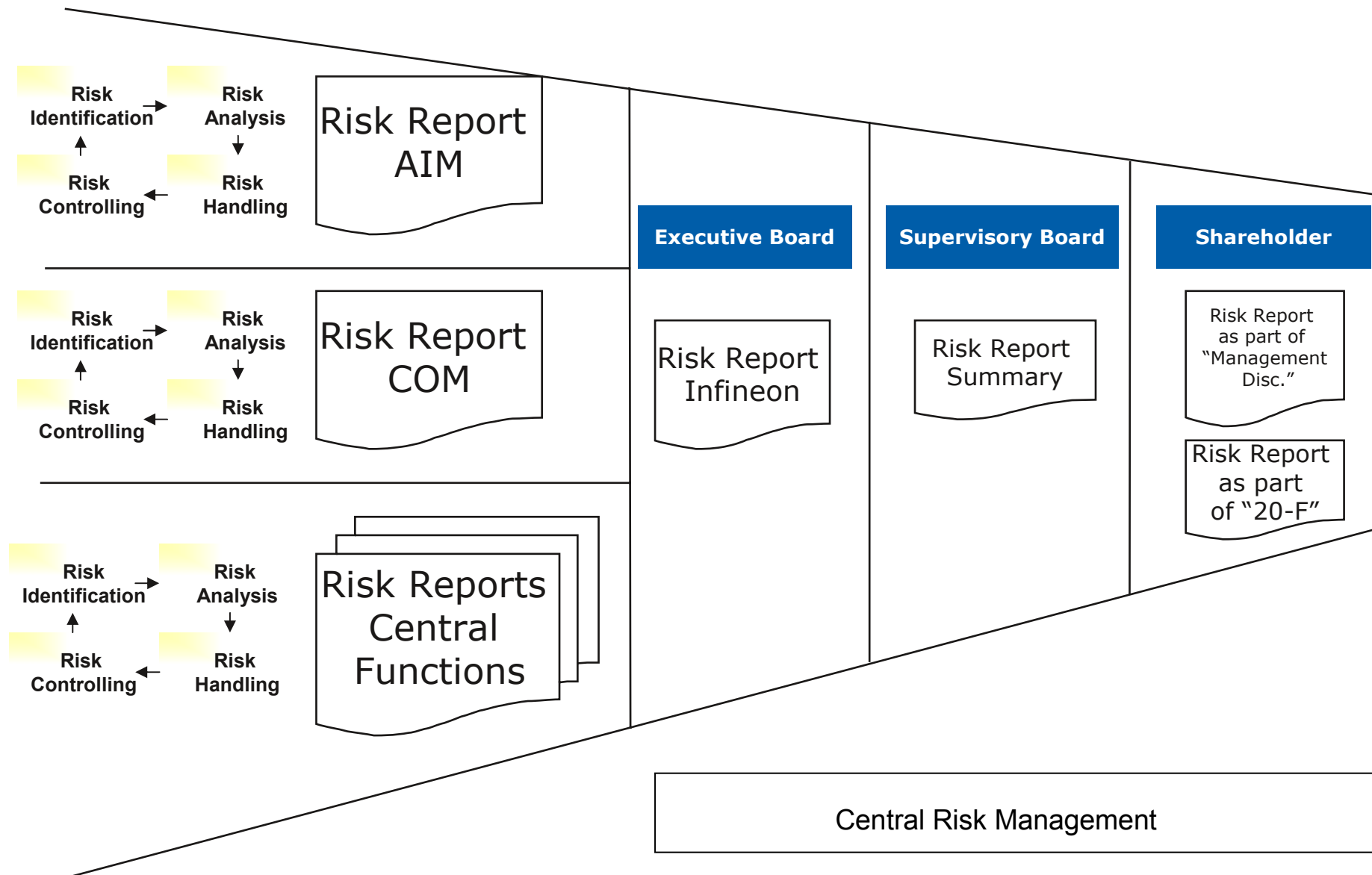
“Financial @RISK” (3)

back

- Package costs and R&D costs are defined by their minimum, most likely and maximum values using PERT distributions
- Gross Margin calculation based on sampled data during simulation
- NPV and POP distributions are created

V. EBIT, NPV & Payoff Period		03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11
Counter Years		1	2	3	4	5	6	7	8
EBIT	M€	-10,10	-5,98	-1,93	1,75	11,38	6,61	10,66	8,75
Cumulative EBIT	M€	-10,10	-16,08	-18,01	-16,26	-4,88	1,73	12,38	21,13
Pay-off Year		0	0	0	0	0	6	0	0
Discount Rate	%	15%							
Pay-off period	yr	6							
NPV	M€	1,81							
NPV target	M€	2,00							

Risk Reporting principle



"ROIMT2"

Quick Data Entry

Risks/Opportunities

R/O Typ
(2) Category
RID:

Status

Data
more Data
History
Parent of

(4) Risk/Opportunity:

(6) FY:

(7) Month of first rep.:

(8) Measure:

	(10) Impact on EBIT	(11) Probability	(12) Risks in FC, ytd.	(13) Imp. Status
previous Report	2007/03 <input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
current Report	2007/06	(14) Impact on EBIT <input type="text"/>	(15) Probability <input type="text"/>	(16) Risks in FC, ytd. <input type="text"/>
quantification	<input type="text" value="0"/>	<input type="text"/>	<input type="text" value="0"/>	<input type="text"/>
partial quantification	<input type="text"/>	<input type="text"/>	<input type="text" value="0"/>	<input type="text"/>

actual Rep.:

Description

Exported Risk Reports



confidential

Business Group:

IFX (AIM)

Period:

2005/07 - 2006/09

RID	R-No. Cat	Cross Ref.	Risks	PL	FY	Month of first rep.	Measures	previous Report 2005/04				actual Report 2005/07			
								Impact on EBIT	Probability	R in FC, ytd.	Impl. Status	Impact on EBIT	Probability	R in FC ytd.	Impl. Status
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
17862	1.4		xx' Mio € Sales Risk	AIM	05/06	2005/04	Improve xx	-10,0	medium			-5,0	medium	-5,0	
18498	3		Additional cost for xx	MC	04/05	2004/07	Reduce efforts of xx	-5,0	low		low				
18460	4.2		project xy	AP	04/05	2003/10	reduce feature set	-3,0	very low			-6,0			
Total					04/05			-8,0				-6,0			
Total					05/06			-10,0				-5,0			-5,0
RID	O-No. Cat	Cross Ref.	Opportunities	PL	FY	Month of first rep.	Measures	Impact on EBIT	Probability	O in FC, ytd.	Impl. Status	Impact on EBIT	Probability	O in FC ytd.	Impl. Status
17868	7.1		Net exchange rate effect	AIM	05/06	2005/04	hedging	10,0	medium			5,0	medium	5,0	
18558	2.2		Project win	PMD	04/05	2004/04	Customer engagement xx	2,0	medium	5,3	high	2,0	medium	5,3	high
18579	4		Various improvements (product mix)	32	04/05	2004/04	Optimize product mix. Shrinks.	2,0	medium		high				
Total					04/05			4,0		5,3		2,0		5,3	
Total					05/06			10,0				5,0		5,0	

back