



PETROBRAS



Integration of Corporate Systems and Risk Analysis with @RISK

Rafael Hartke

hartke@petrobras.com.br

**Financial Planning and
Risk Management**

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- o Motivation and objective;
- o Economic analysis of investment projects at Petrobras;
- o Projects in the E&P area;
- o Progride-@RISK integration;
- o Analyses with Progride-@RISK integration;
- o Refining and logistics projects;
- o PLANINV-@RISK integration;

An offshore oil rig is shown in the background on the left side of the slide. It features a tall derrick, a helipad with a green and yellow landing zone, and various industrial structures on a platform in the ocean.

- o Motivation:

The new Petrobras System Corporate Systematic for Investment Projects requires that all investment projects be evaluated with regard to their economic risk;


- o Objective:

Present the corporate systems used in the conventional economic analysis and the adaptations which allow their integration with @RISK in order to carry out the risk analysis;

An offshore oil rig is shown in the background on the left side of the slide. It is a large, complex structure with a tall derrick, a helipad, and various platforms, situated in the middle of the ocean.

o Principal risks modeled:

- Production of oil and natural gas;
- Demand for derivatives;
- Prices of commodities;
- Changes in CAPEX;
- Changes in OPEX;
- Date of beginning of operation;

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- o Principal risk indicators observed:
 - Expected NPV;
 - NPV standard deviation;
 - Negative NPV probability;
 - VAR @95% of NPV;

o Progride System:

- Corporate system developed by E&P, with an Excel interface and sub-routines in C++;
- Modeling of oil currents (prices and spreads);
- Modeling of taxes (IR, royalties, PE, etc);
- Internal calculation of depreciation, residual values and economic life of the project;
- Conventional sensibility and risk analysis;
- Internal calculation of economic indicators;



o Progride System :

- Handles multiple dependent projects within the same concession (base project plus complementary projects);
- Handles anticipated production projects (with “negative” future production);
- Handles OPEX reduction projects (with “negative” OPEX in the future);



Microsoft Excel - Progride 6.2 Cópia1

Arquivo Editar Exibir Inserir Formatar Ferramentas Dados Progride Janela Ajuda

Digite uma pergunta

Analise Risco Projeto Base Executar Iterations 44 Simulations 1

INDICADORES DE RISCO					CONFIGURAÇÕES ATUAIS DA SIMULAÇÃO					Rubrica	PREÇ
Concessão:					Fluxo de Caixa do Projeto Base					Item	Bre
Projeto Base:					Fluxo de Caixa Sem Corte Econômico					Tipo dado	Informado
Projeto Comp.:					Cenários de Preço dos Produtos: Referencial					Total	-
Projeto					Base	Comp	B+C	Unidade	Máximo		
VPL Esperado: μ								MM US\$	2009		
Probabilidade(VPL < 0)								(%)	2010		
Probabilidade(VPL < VPL Referencial)								(%)	2011		
Desvio Padrão: σ											
Coeficiente de Assimetria											
Coeficiente de Curtose											
Coeficiente de Variação											
VPL Esperado - Desvio Padrão: $\mu - \sigma$											
VPL Esperado + Desvio Padrão: $\mu + \sigma$											
Probabilidade($\mu - \sigma < VPL < \mu + \sigma$)											
Downside(5%)											
Upside(90%)											
Progride 6.2	Relatório: Projeto Base	Brent:Referencial	Nível de Preço:6/2009	Data Sim							
Projeto					Base	Comp	B+C				
Valor Presente Líquido - VPL											
Taxa Interna de Retorno - TIR											
Exposição Financeira											
GT % (sem impostos indiretos)											
GT % (com impostos indiretos)											
Lucro Unitário											
Custo Unitário de Investimento - CUI											
Custo Unitário Operacional - CUO											
Custo Unitário de Tributação CUT											
Custo Unitário de Produção - CUP											
VPL/Investimento Atualizado											
VPL/Dispêndios Atualizados											
Tempo de Retorno a Partir do Início do Projeto											
Tempo de Retorno a Partir do Início da Operação											
Ponto de Nivelamento								MM boe		2038	
Ponto de Nivelamento/Prod. Esperada								boe/boe		2039	
Abandono Econômico Sugerido								(ano)		2040	
Fluxo de Caixa Nominal								MM US\$		2041	
Investimentos - CAPEX								MM US\$		2042	
Custos Operacionais - OPEX								MM US\$		2043	
Valores Residuais								MM US\$		2044	
Government Take								MM US\$		2045	
Dispêndios								MM US\$		2046	
Receitas								MM US\$		2047	
Progride 6.2	Relatório: Projeto Base	Brent:Referencial	Nível de Preço:6/2009	Data Simulação:22/4/2009						2048	
										2049	

Edição dos Parâmetros da Análise de Risco

- Parâmetros Básicos
 - Modelo do Preço do Petróleo
 - Número de Simulações
- Parâmetros do Projeto Base
 - Produção, Cronograma e Outras Receitas
 - Investimentos Não Depreciáveis
 - Investimentos Depreciáveis
 - Custo Operacional Fixo
 - Valores Unitários do Custo Operacional Variável
- Parâmetros do Projeto Complementar
 - Produção, Cronograma e Outras Receitas
 - Investimentos Não Depreciáveis
 - Investimentos Depreciáveis
 - Custo Operacional Fixo
 - Valores Unitários do Custo Operacional Variável
- Parâmetros Avançados (Acesso Restrito)

Restaurar Padrões Expandir Árvore Recolher Árvore Editar Propriedades... OK Cancel



o Principal entry data of conventional Progrido analysis:

- Discounted (cash) flow rate, inflation rate and exchange rate;
- Commerciality and beginning of operation dates;
- Tax rates and depreciation time;
- Oil current;
- Production curves of oil, natural gas, and of water production and injection ;
- CAPEX (drilling, completion, surface installations collection, oil flow, and others);
- OPEX (fixed cost, variable cost unit values, cost of abandonment);



- o Principal entry data of Progride risk analysis:
 - Probabilistic production curves of oil, natural gas and water production and injection;
 - Unit production operational capacity;
 - Distributions for deviations in each CAPEX and OPEX component ;
 - Distribution for beginning of operation date;




- o Principal results of the Progride conventional analysis:
 - NPV, IRR and project return time;
 - Best date for project abandonment;
 - CUP(?) composition;
 - Financial exposure;
- o Principal results of the Progride risk analysis:
 - Expected NPV of project;
 - NPV histogram of project;
 - NPV dispersion measures of project;
 - Probability of negative NPV;

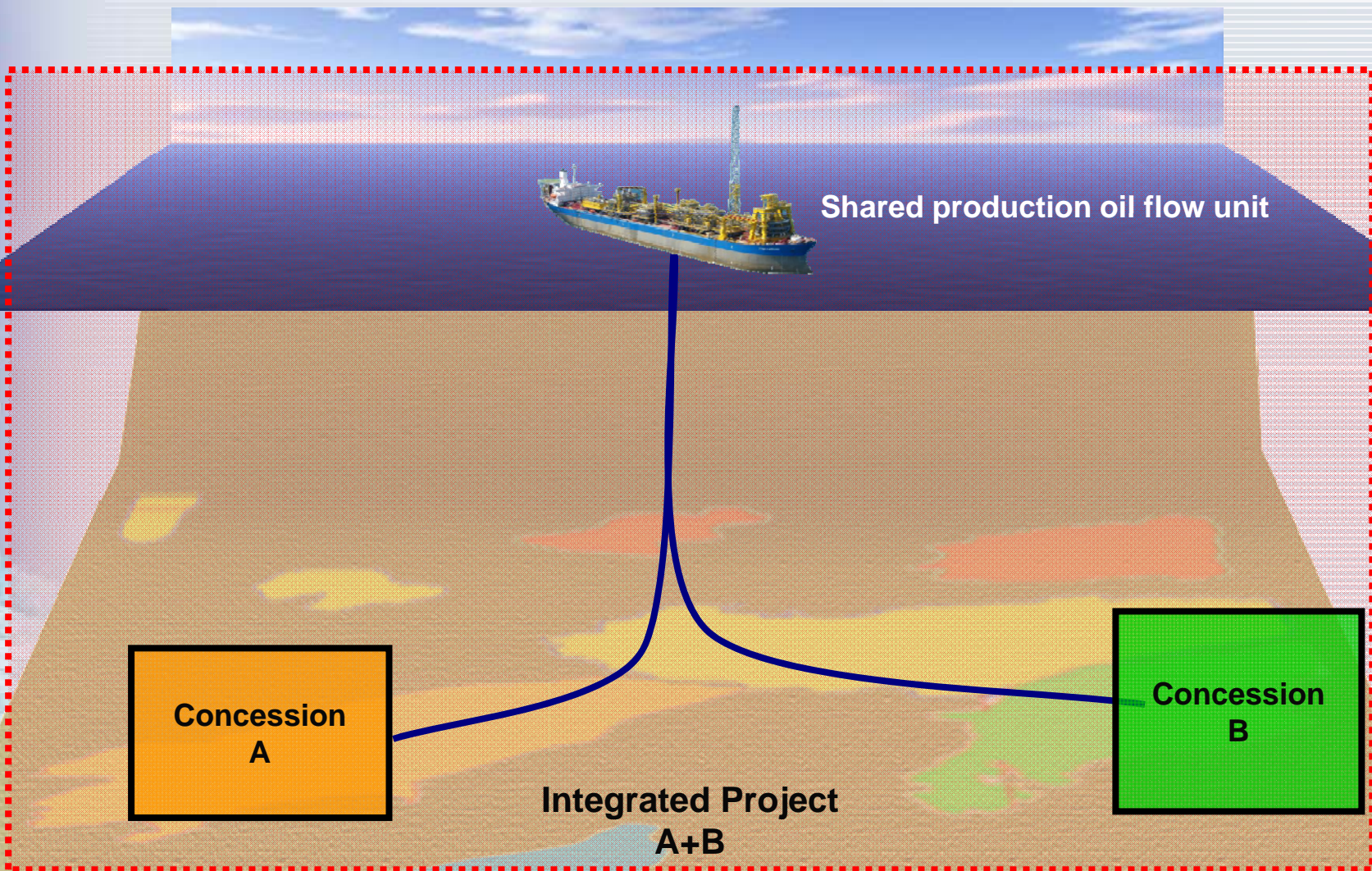
o Limitations of Progride:

- Internal risk analysis in C++, without access to probabilistic scenarios generated;
- Does not accept projects in partnership;
- Does not accept integrated projects with multiple concessions;
- Does not accept shared infrastructure projects;



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- o An example of an integrated development project of multiple concession production:
 - Development of the production of two different concessions (independent productions);
 - Investment in 1 shared production oil flow unit (shared CAPEX);
 - Individual treatment of each concession with the ANP (National Petroleum Agency) (area rent royalties, independent PE[?] and R&D);

Multiple concessions



o Multiple concessions – difficulties:

- Risk analysis should be part of the integrated project;
- Progride does not accept risk analysis with multiple concessions;
- There are risk factors shared by the concessions (prices, CAPEX deviations) and independent risk factors (production and dates of beginning of project);
- Some costs should be treated individually for each concession (area rent, royalties, PE[?] and R&D);
- Some types of depreciation should be treated individually for each concession (wells);



o Multiple concessions – solution:

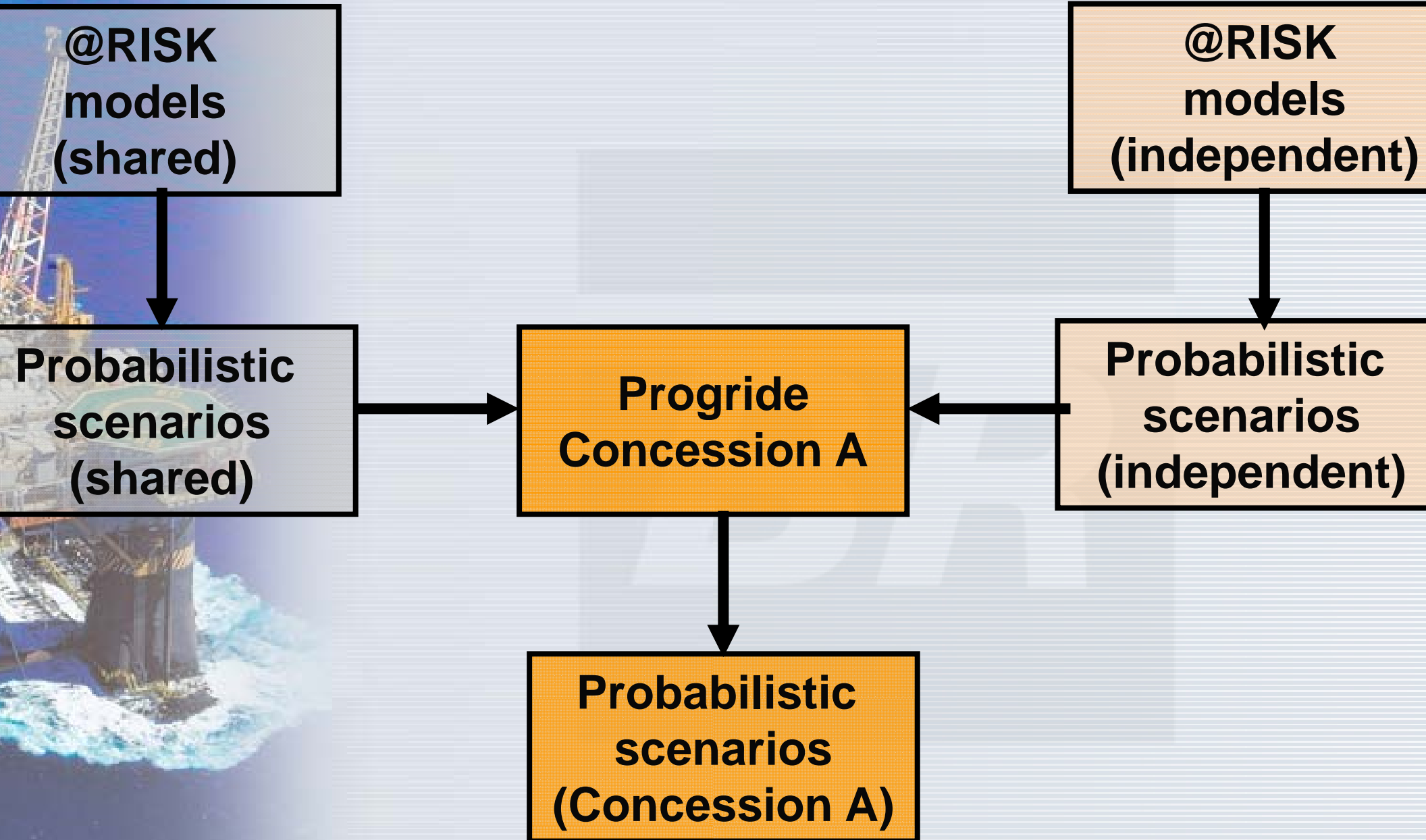
- Use 3 separate Progrides (concession A, concession B and integrated project A+B);
- Model probabilistic scenarios in @RISK for the shared risk factors (prices, CAPEX deviations) and for the independent ones (production and date of beginning of operation);
- Execute Progride conventional analysis individually for each concession, using the probabilistic scenarios as entry data;
- Exit data of Progride conventional analysis of each concession form the probabilistic scenarios (production, revenue, CAPEX, OPEX, fiscal cost and depreciation);

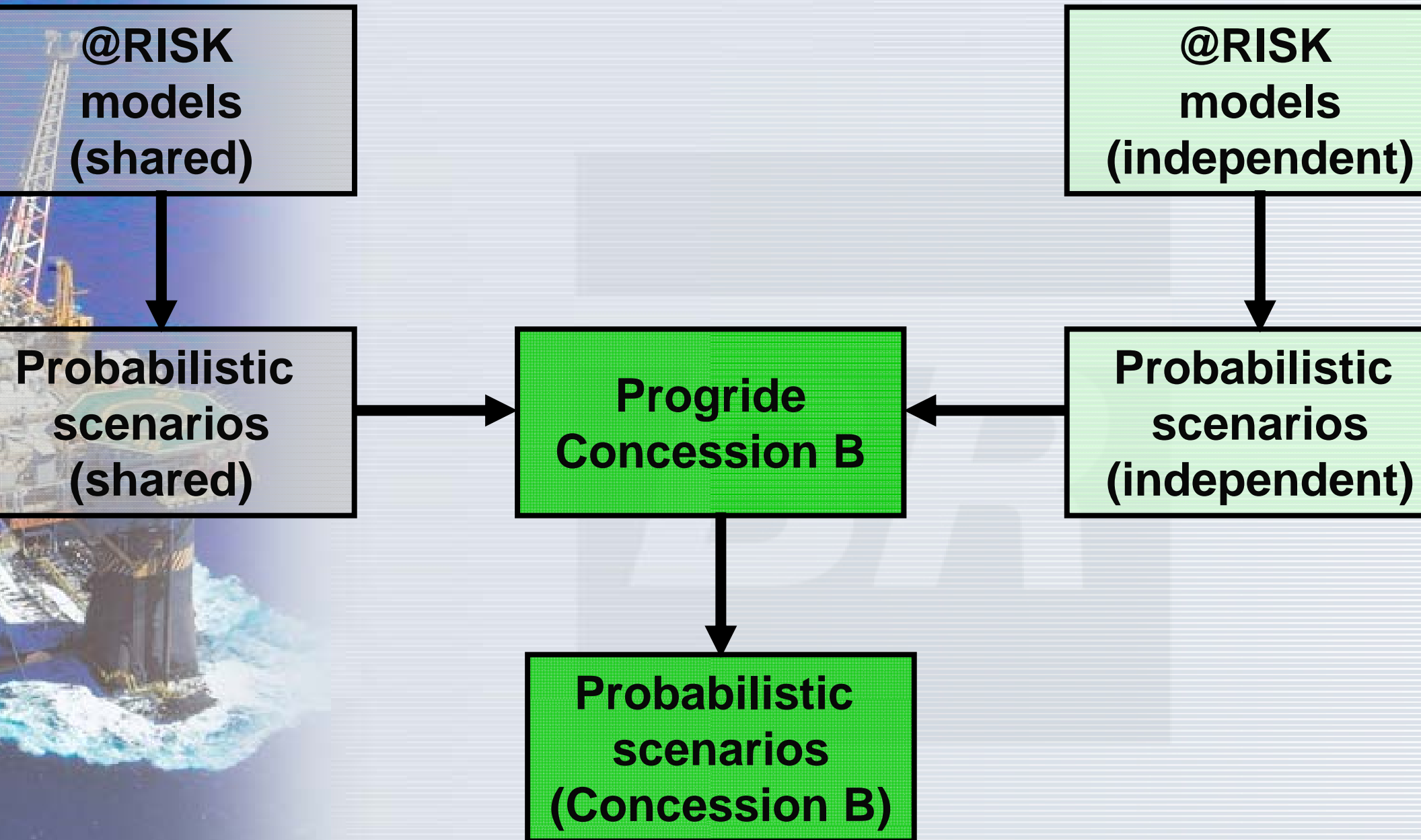


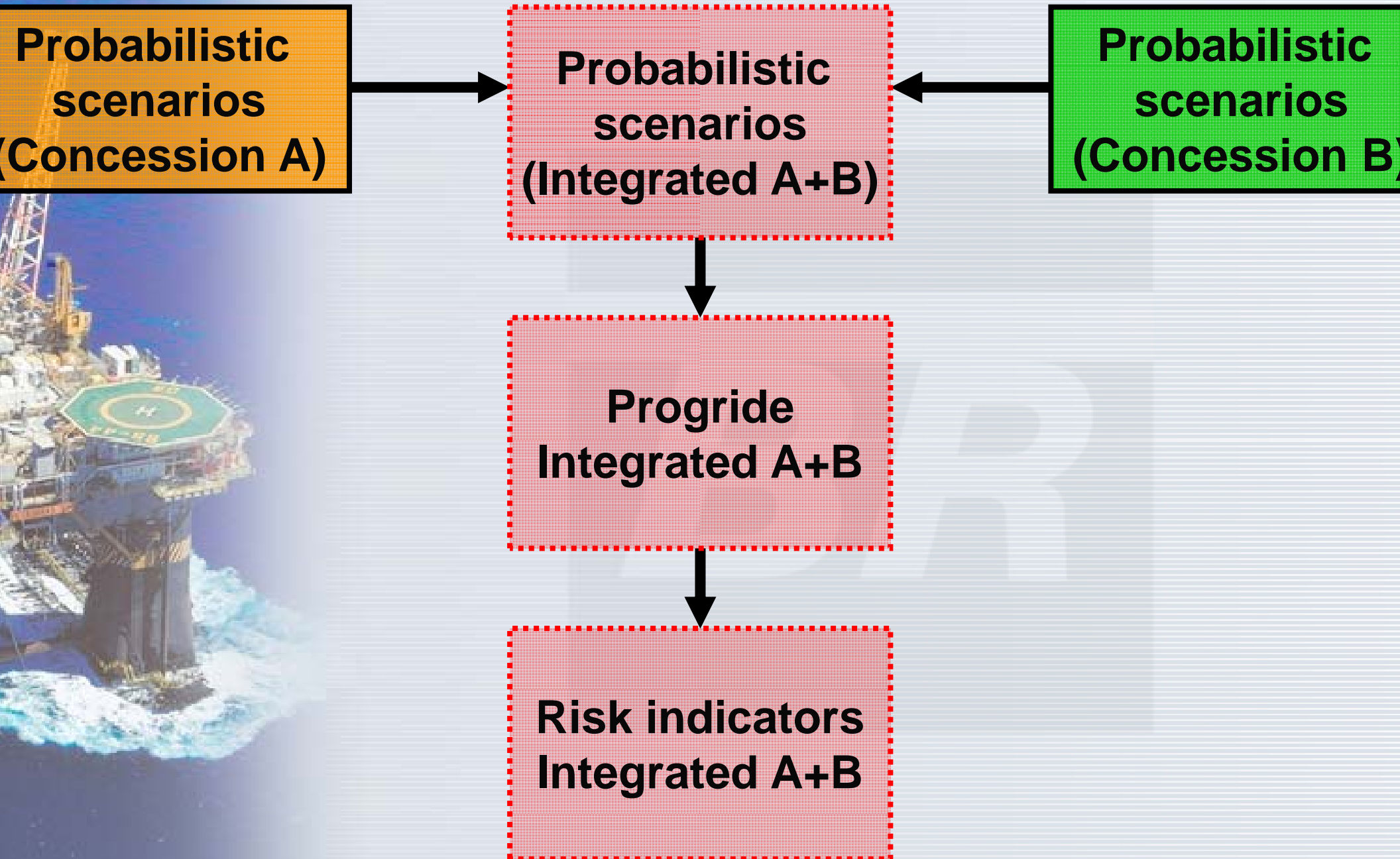
o Multiple concessions – solution :

- Determine the probabilistic scenarios for the integrated project A+B, through the sum of the values of both concession scenarios (production, revenue, CAPEX, OPEX, fiscal costs and depreciation);
- Execute a conventional Progride analysis for the integrated project A+B, using the integrated probabilistic scenarios as entry data;
- At the exit of the conventional Progride analysis monitor the desired risk indicators of the integrated project A+B;











- o 3 Stages:
 - Model and generate probabilistic scenarios for the risk factors;
 - Link Progride conventional analysis to the probabilistic scenarios generated;
 - Execute analyses of each Progride in @RISK;
- o 2 Functions:
 - RiskCurrentIter;
 - Offset;
- o 1 Macro:
 - VBA Command SendKeys to execute Progride;

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o 3 Stages:

- Model in @RISK and generate probabilistic scenarios for the shared and independent risk factors;
- Link the entry data of the conventional analysis of each Progride to the probabilistic scenario generated in @RISK, using the Offset and RiskCurrentIter functions;
- Execute the conventional analysis of each Progride individually in @RISK, calling the macro which executes the Progride conventional analysis after each @RISK iteration;

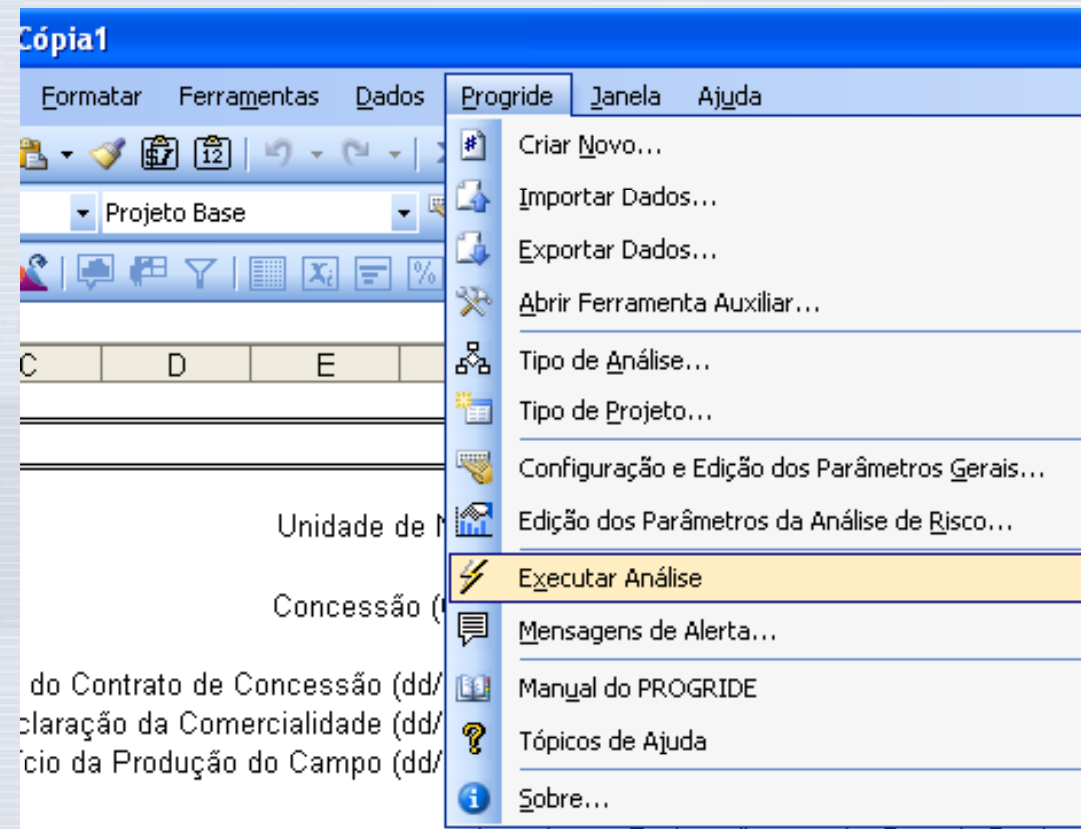
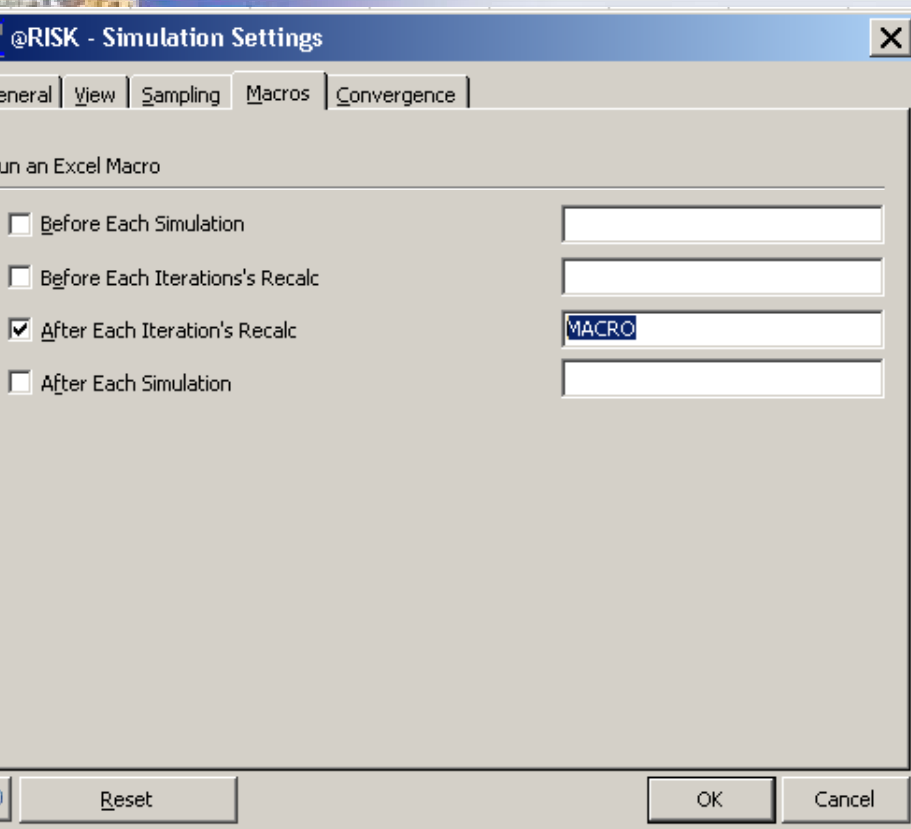
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o 2 Functions:

- RiskCurrentIter(): function of @RISK Statistics which returns to the current iteration of the simulation current;
- Offset(ref,Y,X,,): Excel function, which returns the value of a cell displaced Y rows and X columns from an initial reference;

o 1 Macro:

- @RISK: Run an Excel macro after each iteration's Recalc;
- VBA Macro: SendKeys "%PX", True



o Progride-@RISK Integration – Benefits:

- Permits the compartmentalizing of probabilistic scenarios for risk factors common to the project being analyzed;
- Permits the analysis of projects in partnership with a separate Progride for each partner, and treating the fiscal aspects individually, but sharing the project risk factors;
- Permits the analysis of integrated projects with multiple concessions, with a separate Progride for each concession and treating the fiscal aspects and depreciation individually, but sharing project risk factors;



o Progride-@RISK Integration – Benefits:

- Permits the analysis of projects with an infrastructure shared with other projects or concessions, with a separate Progride for each project and treating the fiscal aspects and depreciation individually, but sharing project risk factors;
- Risk analysis with the new regulator landmark???





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