

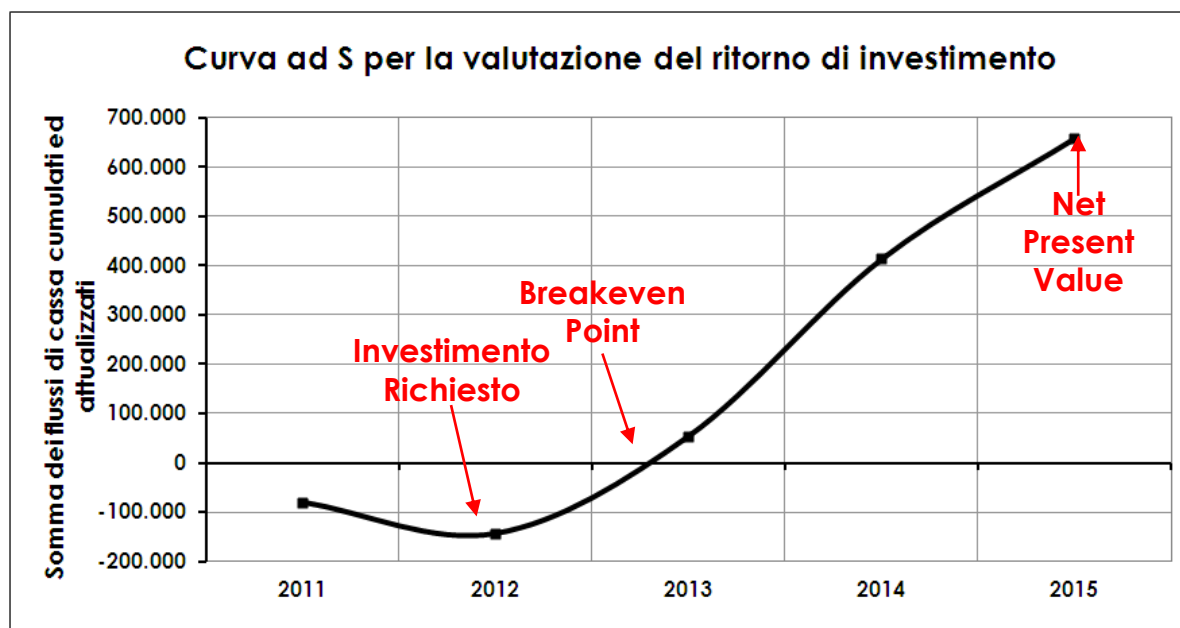
Business case for introduction of modular architecture

Consider the introduction of modular architecture when...

1. The actual product portfolio does not fulfill customer's requests
2. The number of customized products is too high
3. Need to reduce internal variety

Going modular

- To introduce the modular architecture in an existing product family normally is a strategic project
- Benefits and costs should be carefully evaluated.



Necessary conditions to introduce modular architecture

- The same functions are present in different products
- Required product performances may be obtained with modular components

To understand economics of modular architecture we will work on an example

Modularize the engines in a family of pumps

Current state



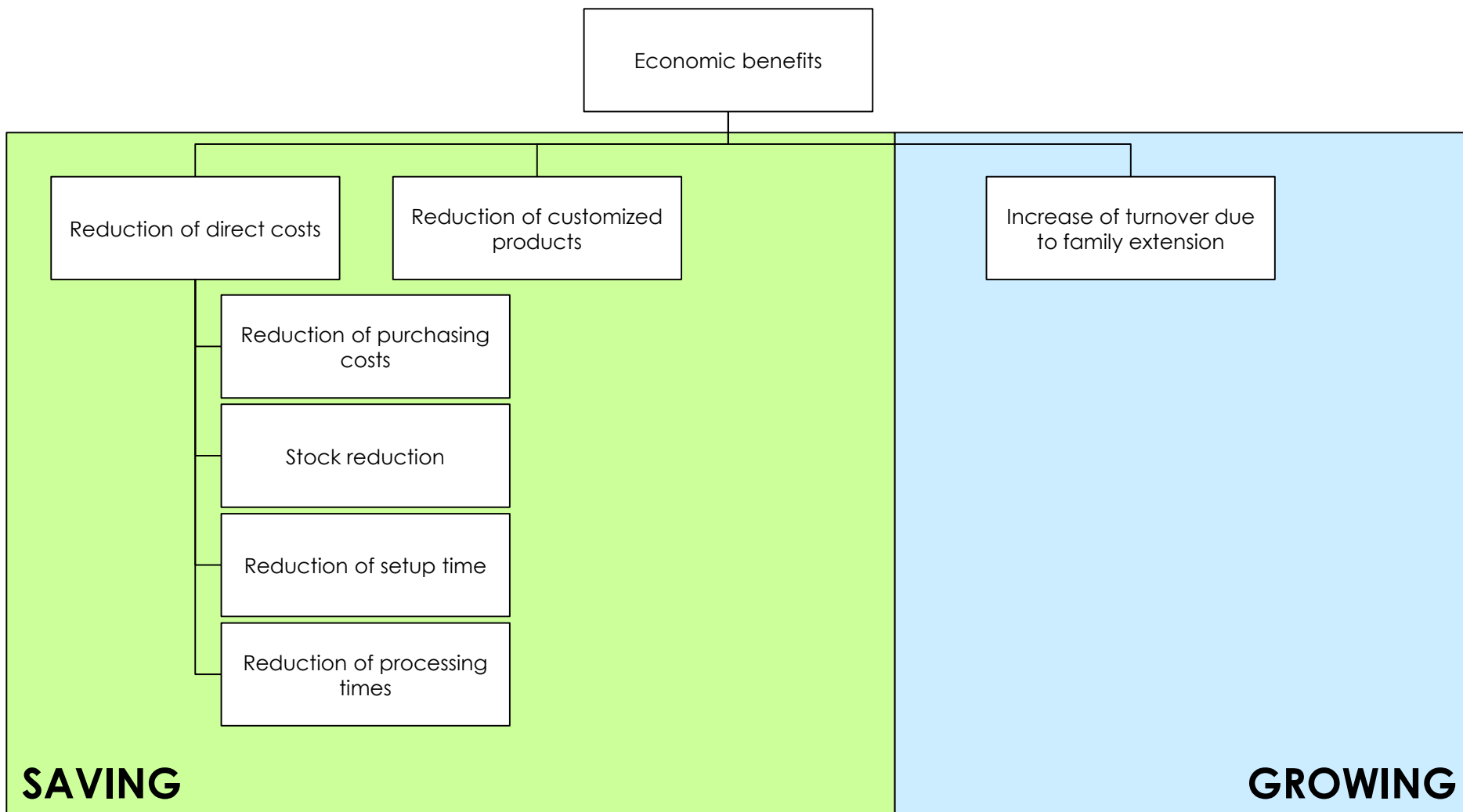
- Product family with 8 pumps, using 7 different engines, with different performances and different interfaces
- 5 M€ turnover, 10% of which realized through customized products
- Average gross margin 30%
- Hours spent each year for special products:
 - 1.000 hours for design
 - 4.000 hours for production

Modularize engines in a family of pumps

Future state

- Use 2 different types of engines
- Potential family extension: +8 products (x2)
- Effective family extension: +2 products

Overview of economic benefits



Volumes

Current state

	Prod. 1	Prod. 2	Prod. 3	Prod. 4	Prod. 5	Prod. 6	Prod. 7	Prod. 8	Engines purchasing
Engine A	X								1.000
Engine B		X							2.000
Engine C				X		X			2.500
Engine D			X						500
Engine E					X				2.000
Engine F							X		2.000
Engine G								X	500
Product sales	1.000	2.000	500	1.500	2.000	1.000	2.000	500	10.500

Volumes

Future state

New products

	Prod. 1	Prod. 2	Prod. 3	Prod. 4	Prod. 5	Prod. 6	Prod. 7	Prod. 8	Prod. 9	Prod. 10	Engines purchasing
Engine A	X	X	X	X	X	X					8.000
Engine B							X	X	X	X	3.500
Product Sales	1.000	2.000	500	1.500	2.000	1.000	2.000	500	500	500	11.500

Reduction of direct costs

Purchasing costs

INITIAL STATE	Purchasing price	Volums	Annual purchasing cost
Engine A	100,00€	1.000	100.000€
Engine B	102,00€	2.000	204.000€
Engine C	101,00€	2.500	252.500€
Engine D	98,00€	500	49.000€
Engine E	100,50€	2.000	201.000€
Engine F	99,00€	2.000	198.000€
Engine G	103,00€	500	51.500€
		10.500	1.056.000€

FINAL STATE	Current purchasing price	Discount due to increased volumes	Future purchasing price	Volume s	Annual purchasing cost
Engine A	100,00€	5%	95,00€	8.000	760.000€
Engine B	102,00€	5%	96,90€	2.500	242.250€
	<i>New products (not included here)</i>			1.000	---
				10.500	1.002.250€

**Yearly saving
53.750 € (5%)**



Reduction of direct costs

Stock reduction (components)

Current state	Volumes	Purchasing batch	Purchasing price	Estimated value of stock (0,5 value of purchasing batch)
Engine A	1.000	20	100,00€	1.000€
Engine B	2.000	40	102,00€	2.040€
Engine C	2.500	50	101,00€	2.525€
Engine D	500	10	98,00€	490€
Engine E	2.000	40	100,50€	2.010€
Engine F	2.000	40	99,00€	1.980€
Engine G	500	10	103,00€	515€
	10.500			10.560€

Future state	Volumes	Purchasing batch	Purchasing price	Estimated value of stock (0,5 value of purchasing batch)
Engine A	8.000	80	95,00€	3.800€
Engine B	5.000	50	96,90€	2.423€
	13.000			6.223€

Average reduction of stock value

4.337€

Estimated yearly cost for 1€ stock

0,15

Annual saving

651 €

Reduction of direct costs

Reduction of setup time

Current state	Volumes	Setup time (x production batch)	Average production batch	Total setup time
Engine A	1.000	15'	10	1.500'
Engine B	2.000	15'	40	750'
Engine C	2.500	15'	40	938'
Engine D	500	15'	4	1.875'
Engine E	2.000	15'	40	750'
Engine F	2.000	15'	40	750'
Engine G	500	15'	4	1.875'
	10.500			8.438'

Future state	Volumes	Setup time (x production batch)	Average production batch	Total setup time
Engine A	8.000	15'	100	1.200'
Engine B	2.500	15'	70	536'
	1.000	<i>New products (not included here)</i>		
	10.500			1.736

Setup time reduction
6.701'
Average cost of a minute
0,4
Annual savings
2.680€

Reduction of direct costs

Reduction of processing time

	Volumes	Unit processing time	Total processing time
Engine A	1.000	7,5	7.500
Engine B	2.000	6,4	12.800
Engine C	2.500	8,6	21.500
Engine D	500	7,7	3.850
Engine E	2.000	6,8	13.600
Engine F	2.000	8,1	16.200
Engine G	500	8,3	4.150
	10.500		79.600

	Volumes	Unit processing time	Total processing time
Engine A	8.000	6,8'	54.400'
Engine B	2.500	6,1'	15.250'
	1.000	<i>New products (not included here)</i>	
	10.500		69.650

Total reduction of processing time
9.950'
Average cost of a minute
0,4€
Annual savings
3.980€

Reduction of costs for customized products

Assumption: 50% of customized products will become standard products (no variation in sales volumes)

	Value
Hours to design customized products	1.000
Reduction of customized products (assumption)	-50%
Design hours saved	500
Cost of one design hour	35€
Total design saving	17.500€

	Value
Annual cost to develop special products (prototypes, tests, ...)	8.000
Reduction of customized products (assumption)	-50%
Total development savings	-4.000€

Increase of profit due to family extension

	Value
Turnover new product 1 = 500 x 500€	250.000€
Turnover new product 2 = 500 x 460€	230.000€
Turnover reduction of customized products (50%)	-250.000€
Total turnover variation	230.000€
Average gross margin	30%
Profit increase	69.000€

Increase of profit due to modular products

	Value
Current turnover	5.000.000€
Estimated turnover increase	2%
Turnover variation	100.000€
Average gross margin	30%
Profit increase	30.000€

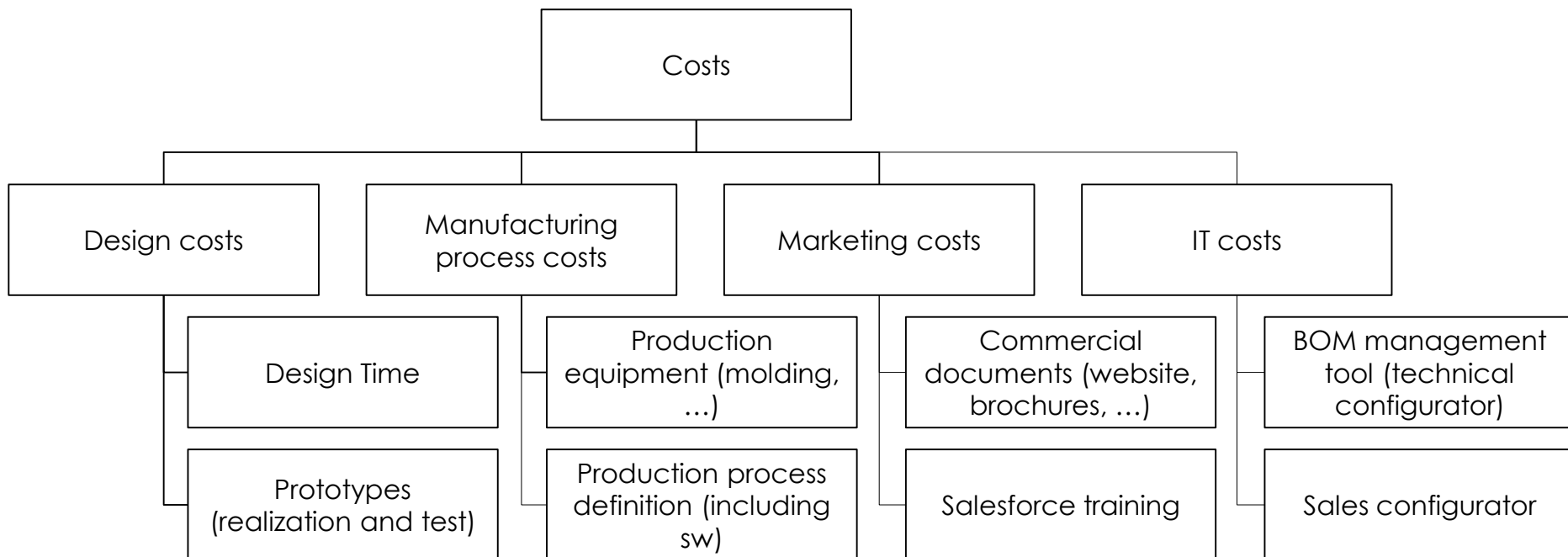
Summary of all benefits

	Value
Purchasing cost reduction	-53.750€
Reduction of stock cost	-631€
Reduction of setup time costs	-2.680€
Reduction in processing time	-3.980€
Reduction in design time for special products	-17.500
Reduction in purchasing costs for special products	-4.000
Total savings	78.941€
Increase of profit due to family extension	69.000€
Increase of profit due to modularity	30.000€
Total profit variation (per year)	177.941€

+11,8%

This figures are just examples and may be very different based on different products and production strategies. For high volume products, the savings may be significantly higher, as well as for some products modularity may be an important value for the customer and the turnover may increase significantly.

Costs to introduce the modular architecture



Costs estimation

	Value
Design time (1000 h x 35€)	35.000€
Prototypes	20.000€
Production process	30.000€
Production equipment	80.000€
Commercial documents	20.000€
Salesforce training	10.000€
Technical configurator	50.000€
Commercial configurator	---
	245.000€