

Core task: to conduct a comprehensive financial feasibility and economic value analysis of Motor8's new project "IMOD," an integrated Hardware-Software system for electric powertrains, considering various project trade-offs, alternative scenarios, Monte Carlo simulations, and strategic alignment with other company projects, followed by drafting recommendations for project continuation or alteration.



Trade-offs in product development

To: X

From: Andrea

Subject: ***Trade-offs analysis of a product development project***

Hi x,

Good news: your work has been considered valuable, and the CEO wants you to work on evaluating an inspiring project. The project is out of our core business, and you have to assess its feasibility and economic value.

You have to work for an automotive company, Motor8, one of our companies. The company has an extensive portfolio of projects. For each project, a careful analysis of its technical and economic feasibility is carried out, and its synergy with the rest of the company's projects is also assessed. This year a key project is being launched to develop an integrated Hardware-Software system for Electric powertrains which will be sold to the automotive industry to improve powertrain systems performance. The project is named "IMOD".

We are given a very delicate task! We have to assess whether the IMOD project will be profitable, evaluating the main project trade-offs. Given your expertise, I would propose you as Project Manager of the project. As a project manager, you will receive several emails from key departments within the company with the material we need to complete the analysis.

Thanks for your support.

BR,

Andrea

Below you will find the emails from different departments of Motor8, sending you the needed material:

To: X

From: Mr. Esposito

Subject: ***Information from the market***

Dear X,

Here is some data from the marketing division:

- IMOD is based on an established technology already considered suitable for industrial manufacturing plants. Our analysts think



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that alternative technologies currently being developed will not be competitive until 2028-2029. We suggest that the profitability of the project ought to be evaluated on a 5-year horizon (mid-2028);

- We hired a respected consultancy company to obtain reliable sales forecasts. The attached table is an extract of the report (monthly sales data are interpolated).

Month Year	1	2	3	4	5	6	7	8	9	10	11	12
2023						5100	5800	6800	7800	8950	10000	11100
2024	12500	13700	15350	17150	19450	21500	23700	25850	28500	30850	32450	34600
2025	36200	37250	38900	39050	41500	39550	39850	37800	37450	35750	33700	32450
2026	29250	28550	27100	26150	25300	23950	22300	20800	19600	17950	17100	16050
2027	15100	13450	12000	10750	9650	8500	6450	5550	4800	4100	3500	3000
2028	2550	2200	1850	1650	1300							

Best regards,

Mr. Esposito

Marketing Manager

Another email comes from the Project Management Division

To: X

From: Neri Luca

Subject: **Project information**

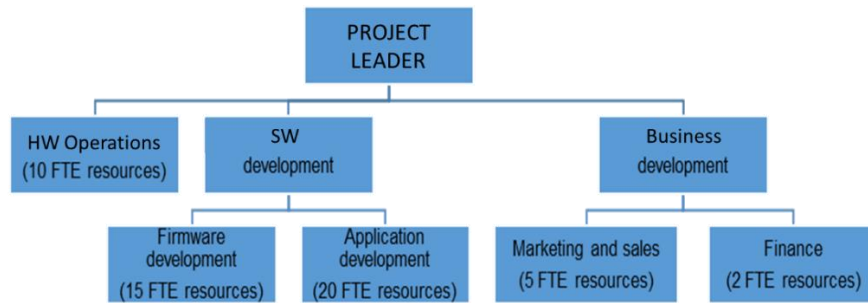
Hi X,

Here is the information from our side.

First of all, I'll report to you the organizational chart dedicated to the project. From here, you can obtain data on the available resources on the project.



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More specifically, the information on the single project activity is reported in the following table.

Activity	Description	Receives info from	Duration [months]	FTE resources required				
				HW	Firmware SW	Application SW	Marketing	Finance
1	Market research	-	2	1	1	1	10	2
2	SW vendor selection	1	1	1	1	5	2	2
3	Feasibility study	2	2	1	1	1	1	4
4	Firmware development	3,5	4	1	20	2	1	1
5	HW specification	4,6	1	5	2	2	1	1
6	Application development	4,5	4	1	4	30	1	1
7	HW vendor selection	5	1	2	5	1	3	2
8	HW Development	5,7	3	8	2	3	2	2
9	Industrial Engineering HW	8	2	8	1	2	1	1
10	Marketing planning	1,2,6,8	3	2	1	3	10	3
11	Production ramp-up	9,10	2	5	1	5	2	2
12	Product launch	11	1	3	1	5	10	2

You should also remember some other points:

- Activities 4, 5, and 6 should be managed through concurrent engineering. In preparing the schedule, these three activities should be merged in a single "macro-activity" whose duration is estimated to be around 1.5 times the duration of the longest activity in the set, involving all the resources specified for each component activity.

- Consultants can be employed when the activities require more internal resources than the available ones. The cost of internal



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resources is 8 k€ per person/month, while consultants' costs are 15 k€ per person/month.

Best regards,

Neri Luca

Project Manager

Information from the Manufacturing Department are also available:

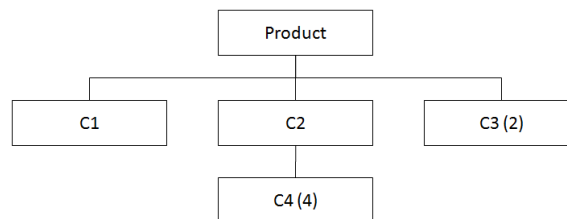
To: X

From: Mr. Bianchi

Subject: **Information from production engineering**

Dear X,

Here is our data! Consider the following BOM for the IMOD system. The information on the components is the following:



- **C1** is sourced from a US supplier under a long-term agreement that fixes the unit price at 320 USD (360 было в пр году).
- **C3** costs is 110€ (120 было);
- **C2** derives from the assembly of 4 units of C4. The cost of C4 is yet to be determined since a supplier is still developing it. In principle, they expect a unit cost equal to 60 €, but – in reality – the probability of achieving this value is only 45%. There also is a 35% (было 45%) chance that it might cost only 35 € and a 20% (35%) chance it may cost 90 €;
- The production of IMOD will have a variable transformation cost of approximately 190 €, which is not expected to decrease;
- IMOD will also require investments in new manufacturing equipment, with an expenditure of 1.7 (1.9 было) M€. This investment will be carried out during the "industrial engineering HW" project activity. No significant constraints will come from production capacity, which implies that production and sales will occur during the same month;
- The marketing department confirmed that IMOD will be sold at a unit price of 1250 € (constant in time). IMOD is expected to



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achieve a market share of about 11%. However, this market share could be as low as 8% or as high as 15%. This uncertainty currently cannot be reduced.

Best regards,

Giacomo Bianchi

Operation Manager

Finally, you received general information on the Financial situation of the company directly from the CFO:

To: X

From: Mr. Russo

Subject: **Information from finance**

Dear X,

IMOD is considered a relatively high-risk project for the company, and the opportunity cost of capital has therefore been set at 16% (было 17%), significantly higher than their Weighted Average Cost of Capital (WACC), currently 8%.

Given the relatively limited size of the project, there will not be any special funding needs that may change interest payable on the Profit&Loss (P&L) statement.

In general, you may need a few other pieces of information:

- Currently, the exchange rate is 1.06 EUR/USD (было 1.12). Most analysts expect a 3% yearly appreciation of the EUR over the next few years, with monthly volatility of 0.0074 (было 0.0054). Experts are divided on this subject, and estimates on EUR appreciation currently range from 1% to 5%;

-The company is profitable and pays 27% corporate tax on income gained from January through December each year. Tax payments are made in June of the following year. The project's size is relatively limited and will not make them go "in the red". This implies that the I-MOD project's initial losses will, at first, lead to tax savings (to be represented as a positive cash flow). At the same time, it will increase the tax payable when it turns profitable (thus representing a negative cash flow).

-Product development personnel usually work at saturation and should not be considered sunk costs.

-The company has chosen to expense and not to capitalize on product development costs for projects of this type. Investments



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made for manufacturing equipment will instead be capitalized over 3 years.

-For the sake of simplicity, it is possible to neglect inventory and working capital. Consequently, costs and revenues must be applied to the same month the goods are bought, produced, or sold. This implies that P&L and cash flows will differ only because of depreciation.

Best regards,

Mr. Russo

Chief Financial Officer

Once you have collected all the needed data, you can finally start your assignment. Try to structure your report according to the following points:

- a. At first, try to operate under a deterministic scenario, using the most probable values (modes) for the three main parameters subject to uncertainty (i.e., market share, cost of C2 and Euro appreciation over US Dollars) and develop an NPV analysis.
- b. Then, work on the three alternative scenarios (Best, Normal, and Worst) that emerge out of the levels of the three main uncertain parameters (i.e. market share, USD depreciation, cost of component), and try to provide some deeper insight on this matter.
- c. Verify what would happen if the overlapping activities 4-6 took not 1.5 times but twice the duration of the longest component activity.
- d. Then, set up a Monte Carlo analysis by using the YASAIw add-in for Excel (available on the Portale della Didattica) by modeling the three probabilistic parameters as follows:
 - The market share can be represented by a triangular distribution, with a minimum value 8%, mode 11% and maximum value 15%. The function name is `=Gentriangular(a;b;c)`
 - The cost of C2 can be represented as a discrete distribution. The function name is `=Gentable (v;p)`, where p is an area containing probabilities, and v is an area with the corresponding values.
 - The exchange rate can be modeled by representing the trend (or "drift") as a triangular distribution, with a minimum value 1%, mode 3%, and maximum value 5%. Then, each monthly value will be given by $yt+1 = yt + m \cdot yt + et \cdot yt$ with m = monthly drift and $et = N(0,s^2)$, and s = monthly volatility. The function name for the normal distribution is `=Gennormal ( $\mu,s$ )`.
 - The output is the NPV at a date of your choice. The function name to be used is `=Simoutput (cell; name;2)`



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What is the output of this model? Is it correct to go on using 17% as a discount rate? Given that the Monte Carlo model covers major risks, should the discount rate be different, such as Motor8's WACC? What would the outcome be in this case?

- e. Finally, what conclusions could you draw about the project "IMOD", and what recommendations would you give to the company?
- f. The IMOD Project is part of a portfolio of Motor8's projects. The table shows the values of 8 other competing projects: NPV, consistency with strategy, risk (technological and market), PBT, and Development costs. For the IMOD project, you already have the information needed (consider the deterministic case and remember to discount the development costs). Try to prioritize the projects and, under a development costs budget of 12 M, decide which projects to launch. You can use a variety of approaches at your discretion, such as bubble charts, pie charts, or simple multi-criteria methods.

Project	Stragic Alignment	Technology Risk	Market Risk	NPV [M€]	Payback Time [months]	Development Costs [M€]
IMOD	9	0.3	0.75	-	-	-
SPARK	1	0.7	0.85	0.24	5	1.09
IRIS	3	0.25	0.3	6.01	18	2.30
DESIN	3	0.7	0.75	1.00	17	2.88
TASA	3	0.6	0.875	2.68	14	9.00
DEEP	9	0.55	0.6	2.26	18	3.23
HYBRID	9	0.8	0.35	6.38	20	6.27
TRAQ	3	0.7	0.9	3.05	23	6.69
CELL	1	0.9	0.2	5.88	31	6.62

Strategic Alignment	Technology Risk	Market Risk	NPV	Payback Time	Development cost
9	0,3	0,75			
1	0,7	0,85	0,24	5	2,09
3	0,25	0,3	6,01	29	2,3
3	0,7	0,75	1	17	2,88
3	0,6	0,875	2,68	14	9
9	0,55	0,6	2,26	22	3,23
9	0,8	0,35	6,38	20	6,27
9	0,9	0,9	3,05	23	6,69
1	0,9	0,2	5,88	31	6,62