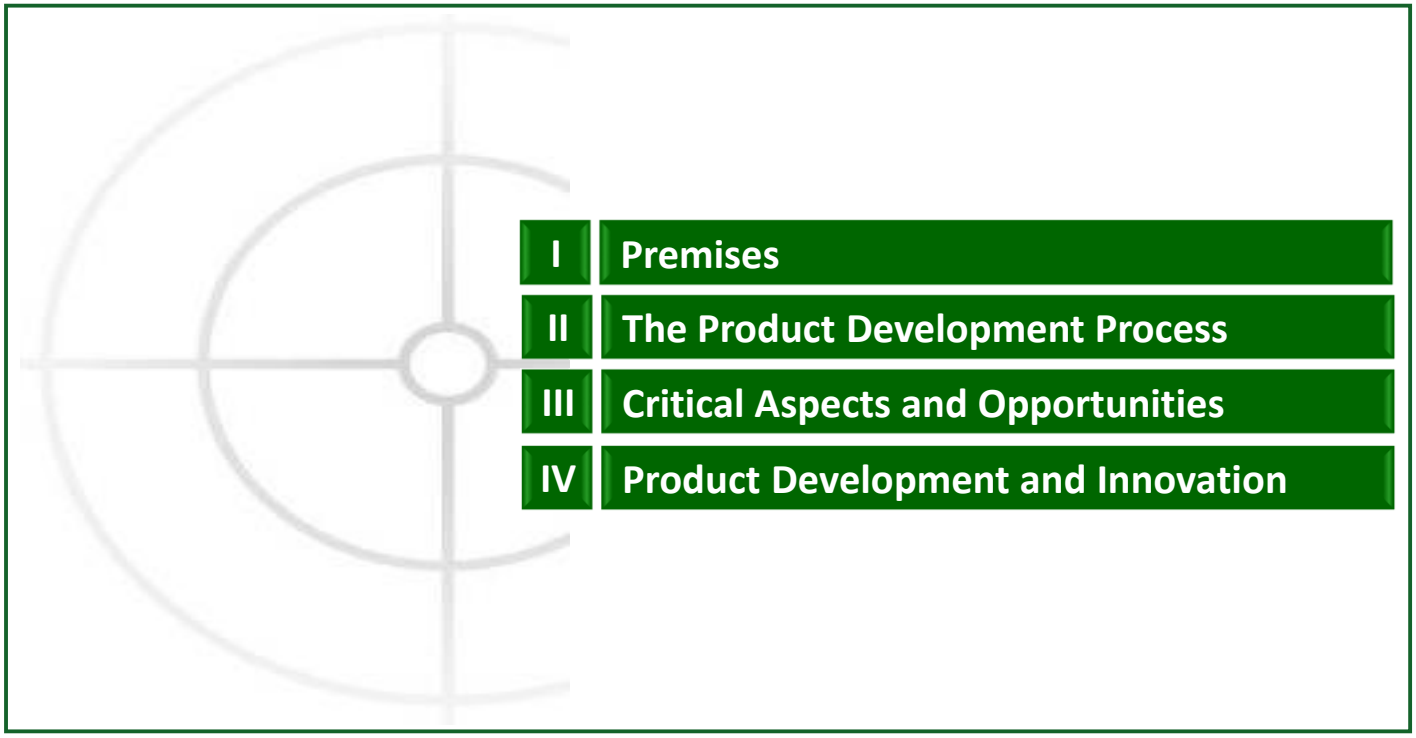
The New Product Development Process in the Modern Mass Production Industries

Summary


I Premises
II The Product Development Process
III Critical Aspects and Opportunities
IV Product Development and Innovation

Summary

I Premises

II The Product Development Process

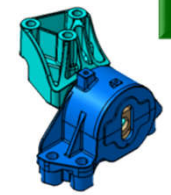
III Critical Aspects and Opportunities

IV Product Development and Innovation

Premises

Reference Products

Mechanical or electro-mechanical “finite products” and components with <u>large volumes</u> of production.












Premises

And the other Products?

For some the process is very similar

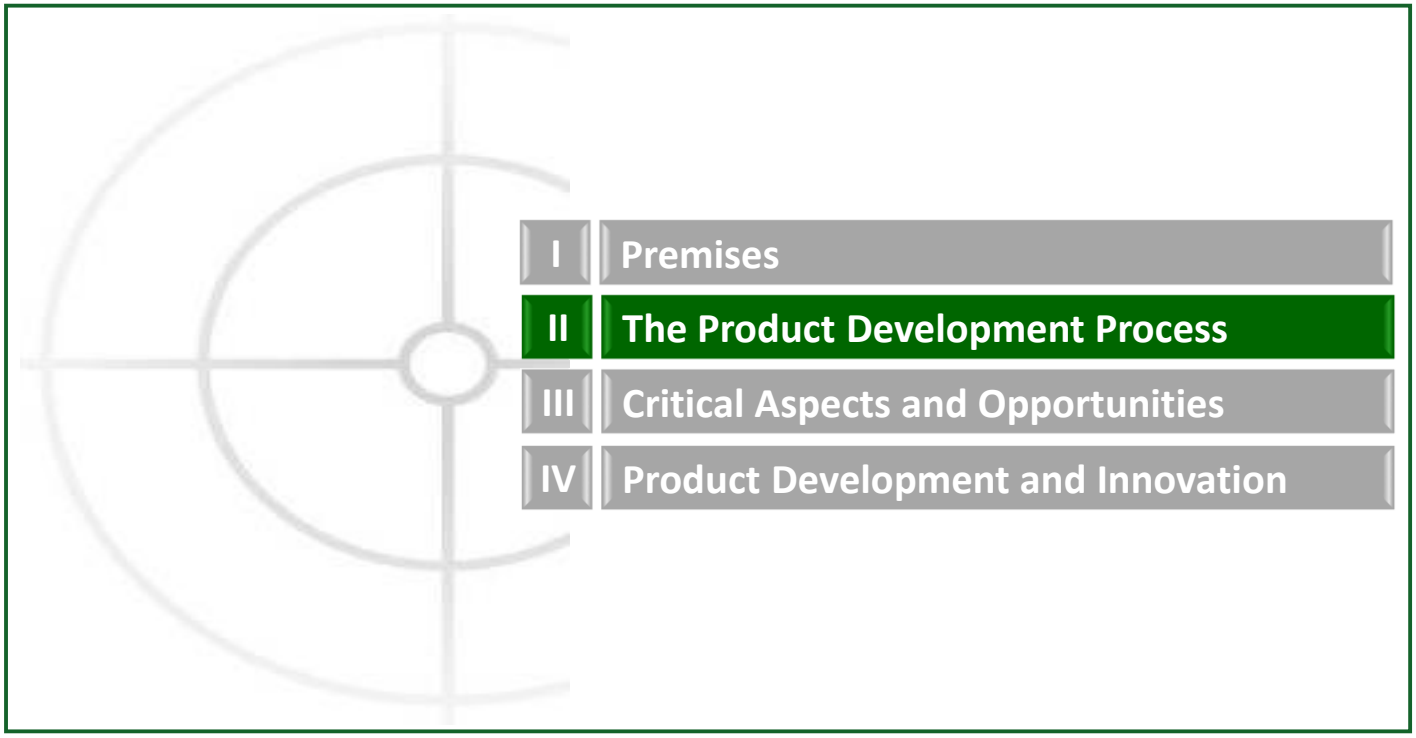
For some others the process can be very different

Premises

For “hard” products it is mainly the size of the production that makes the difference (“mass” production or 1/2 pcs.)

Software follows rules slightly different, considering the close-to-zero industrialization time.

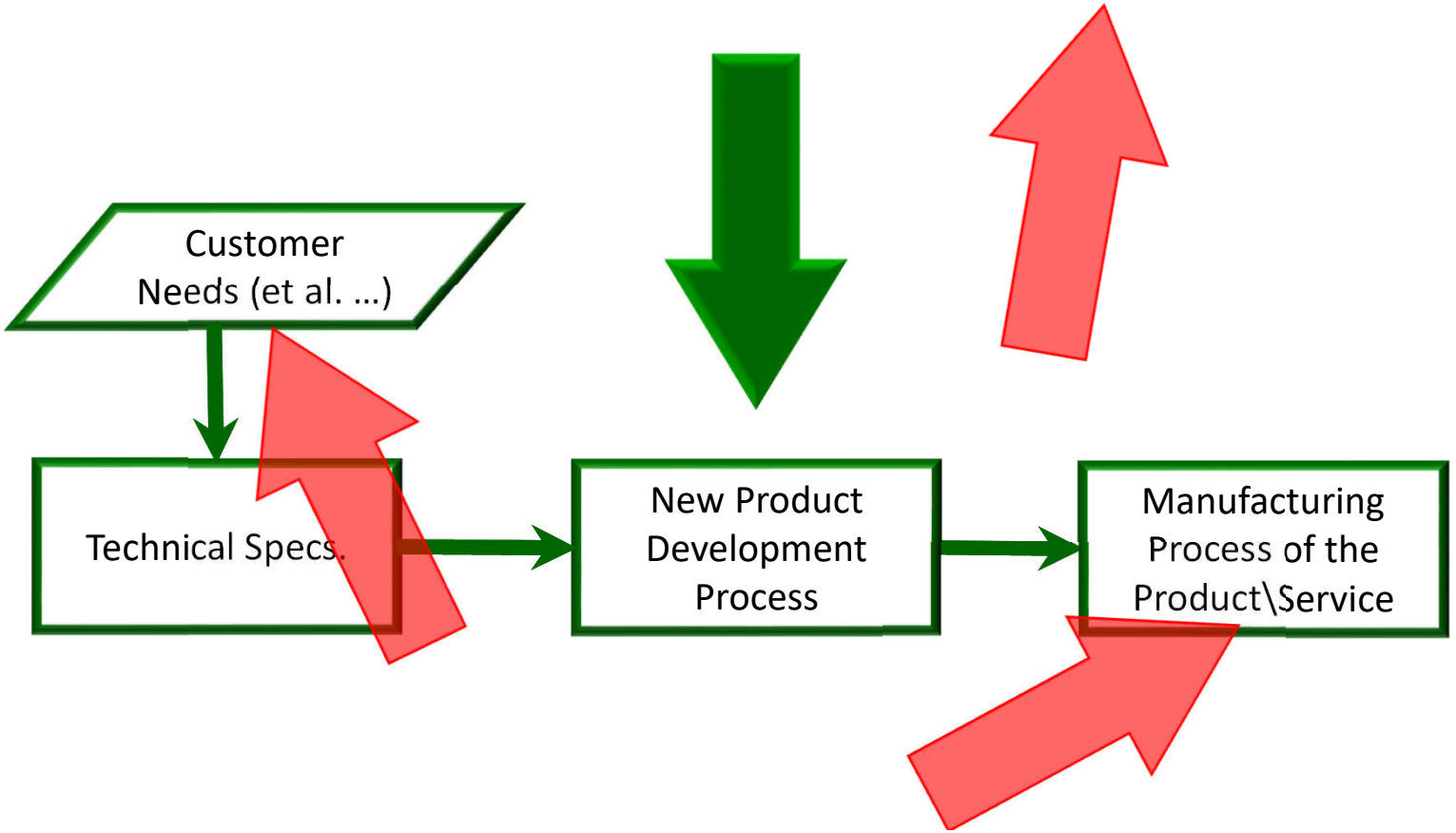
Summary


I
Premises
II
The Product Development Process
III
Critical Aspects and Opportunities
IV
Product Development and Innovation

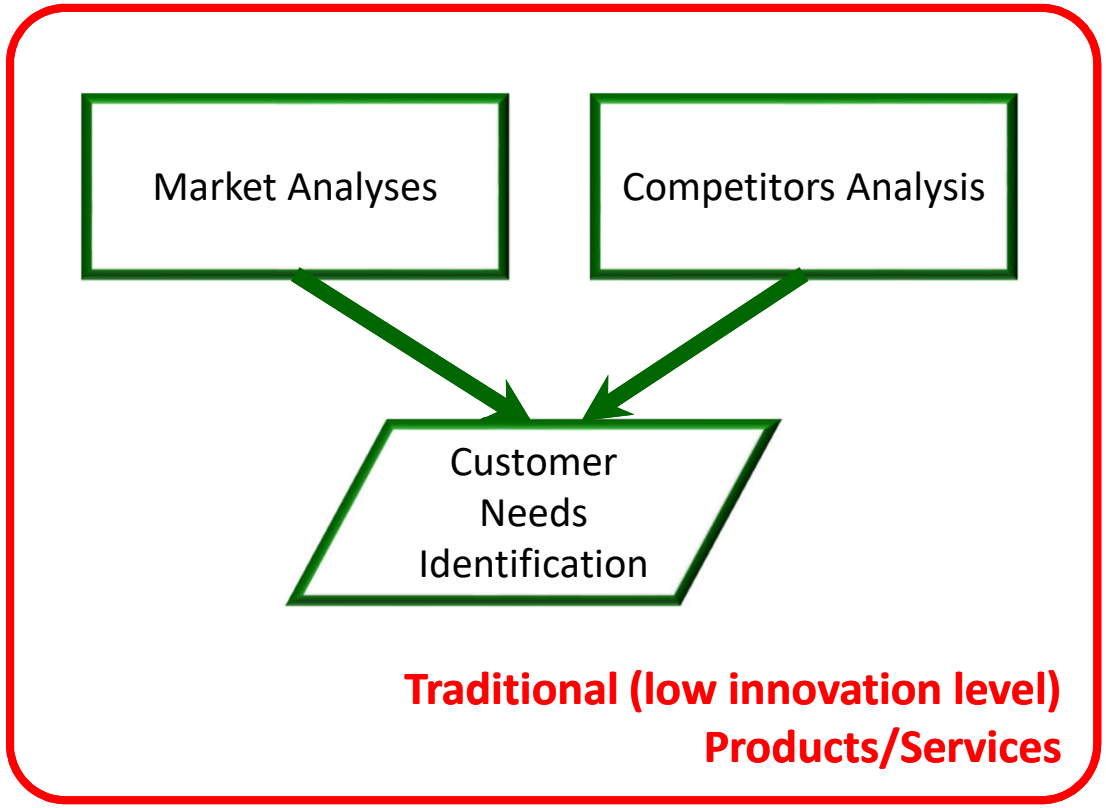
Product Development Process - Definition

Product Development Process

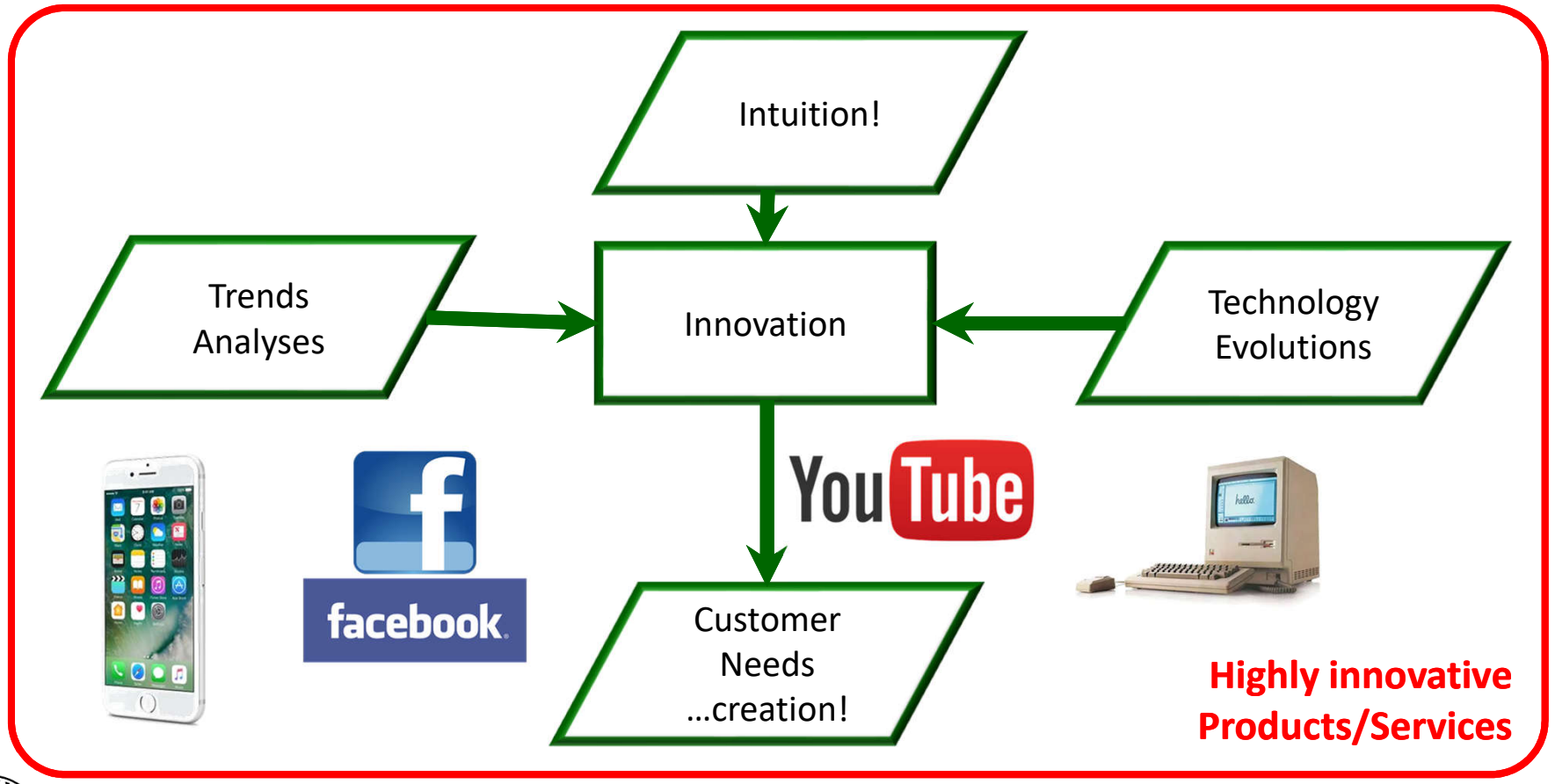
the set of activities needed to create the **Production Process** of a **Finite Product** (or a **Service**)



Product Development Process – Inputs

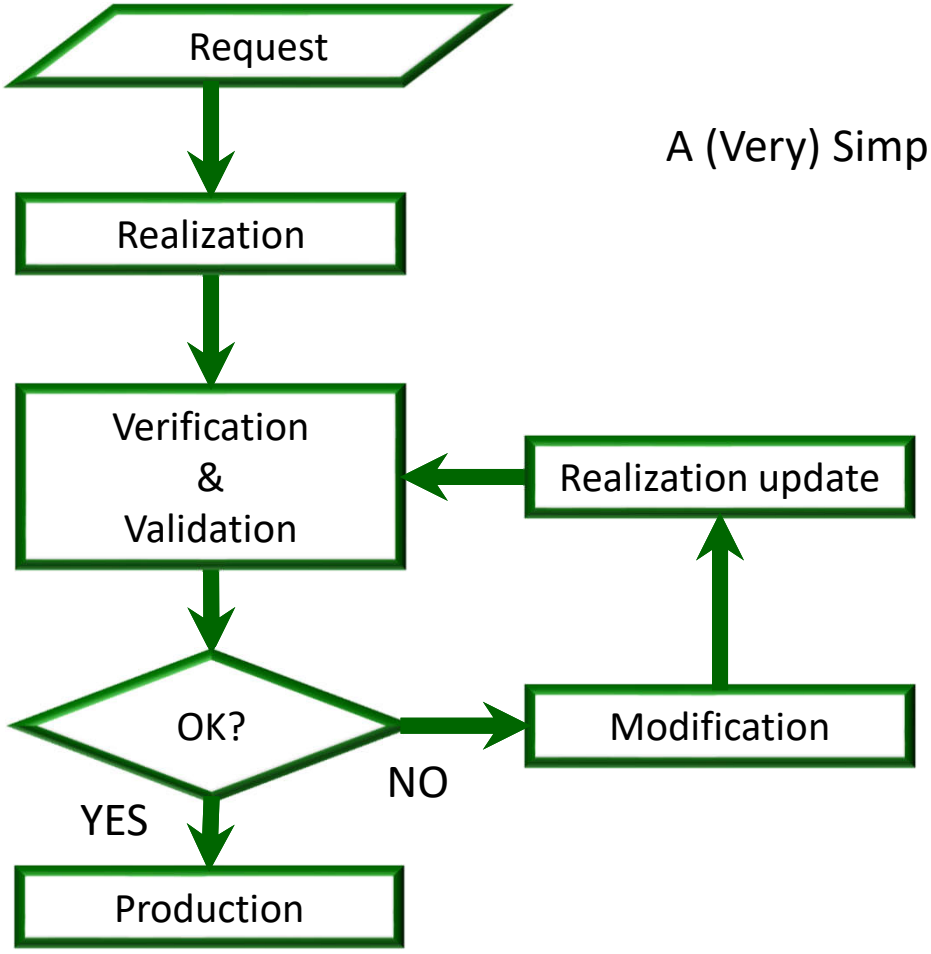


Product Development Process – Inputs



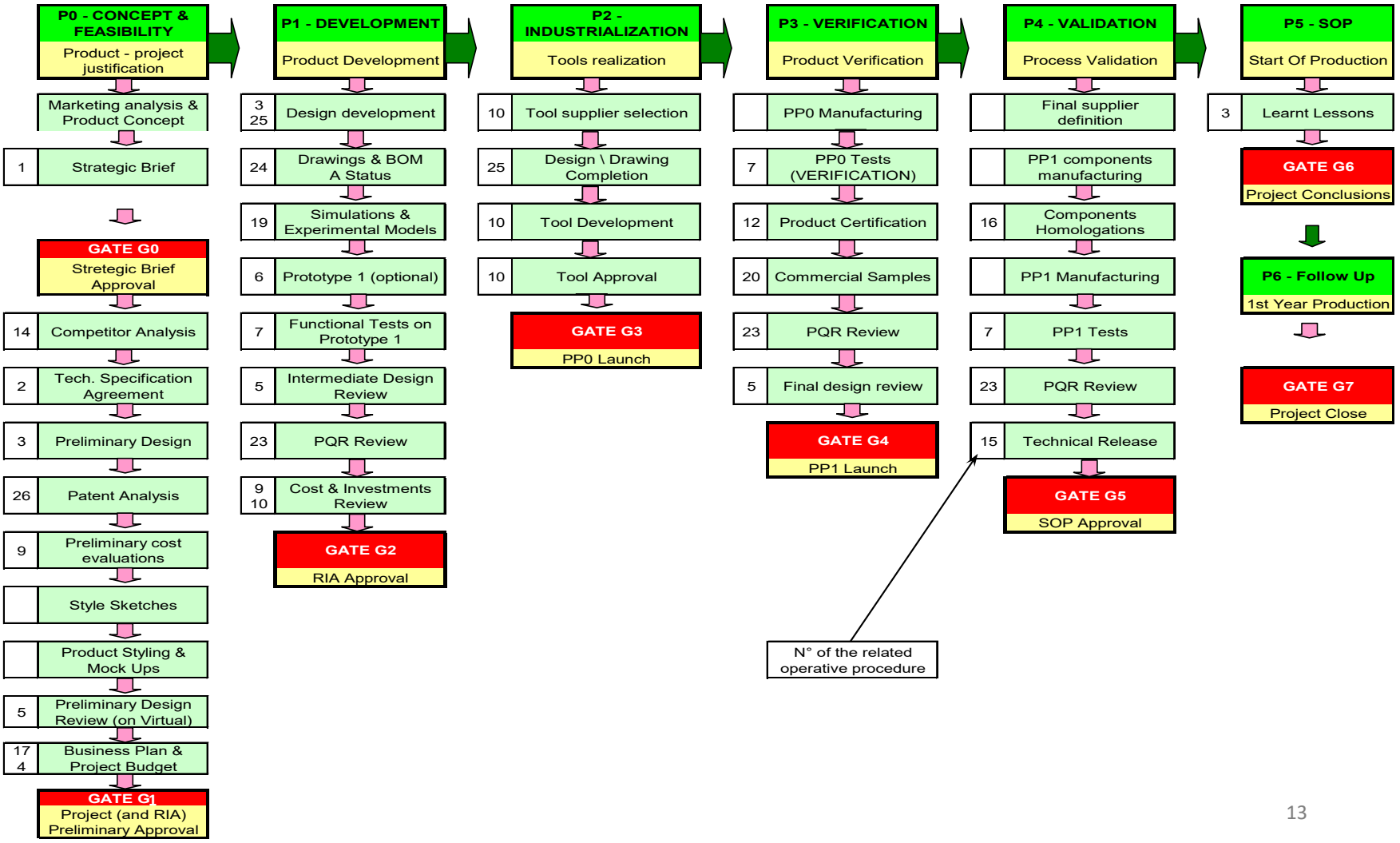
Product Development Process - Characteristics

Product Development Process – Schemes



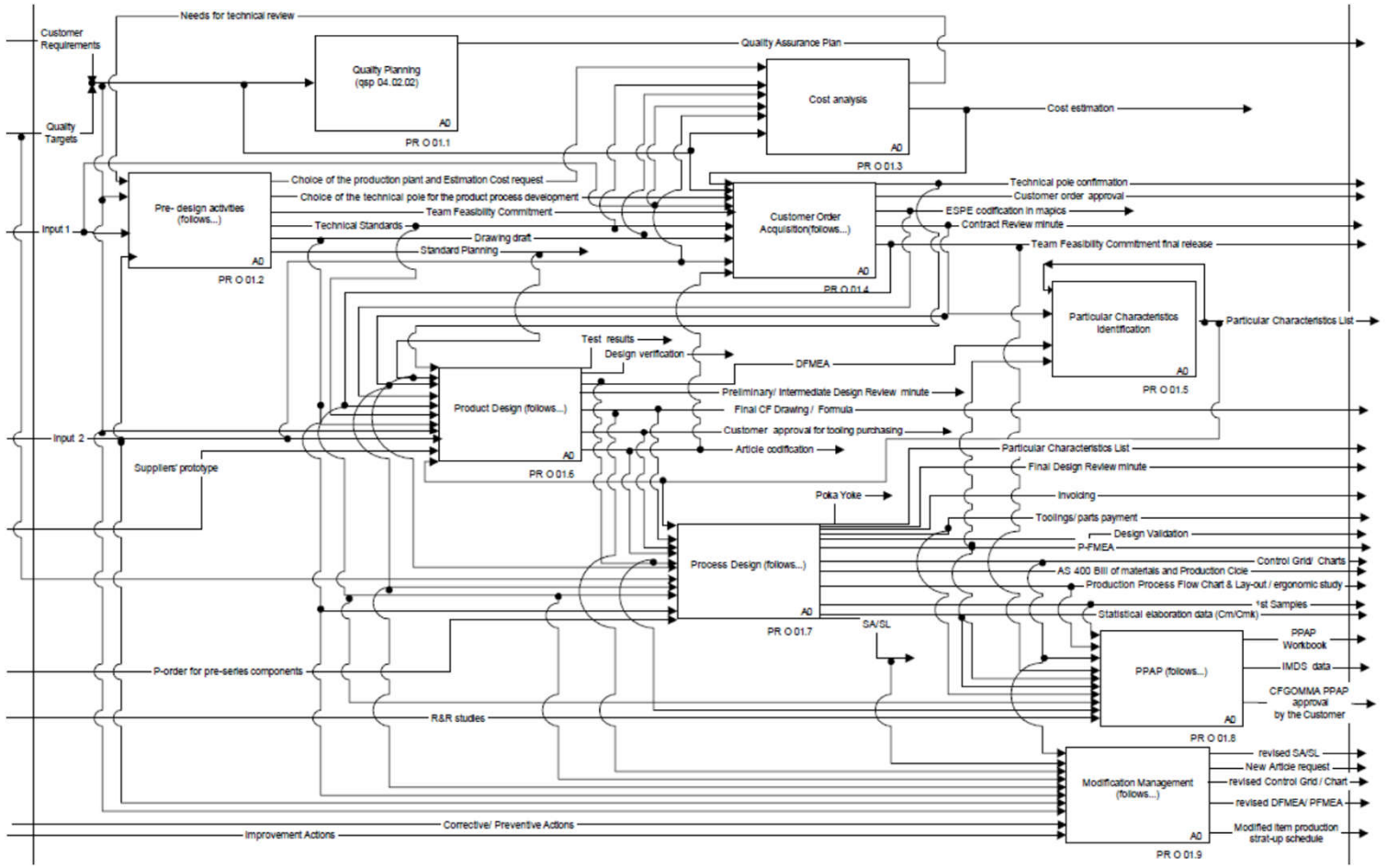
A (Very) Simplified Scheme

Product Development Process – Schemes



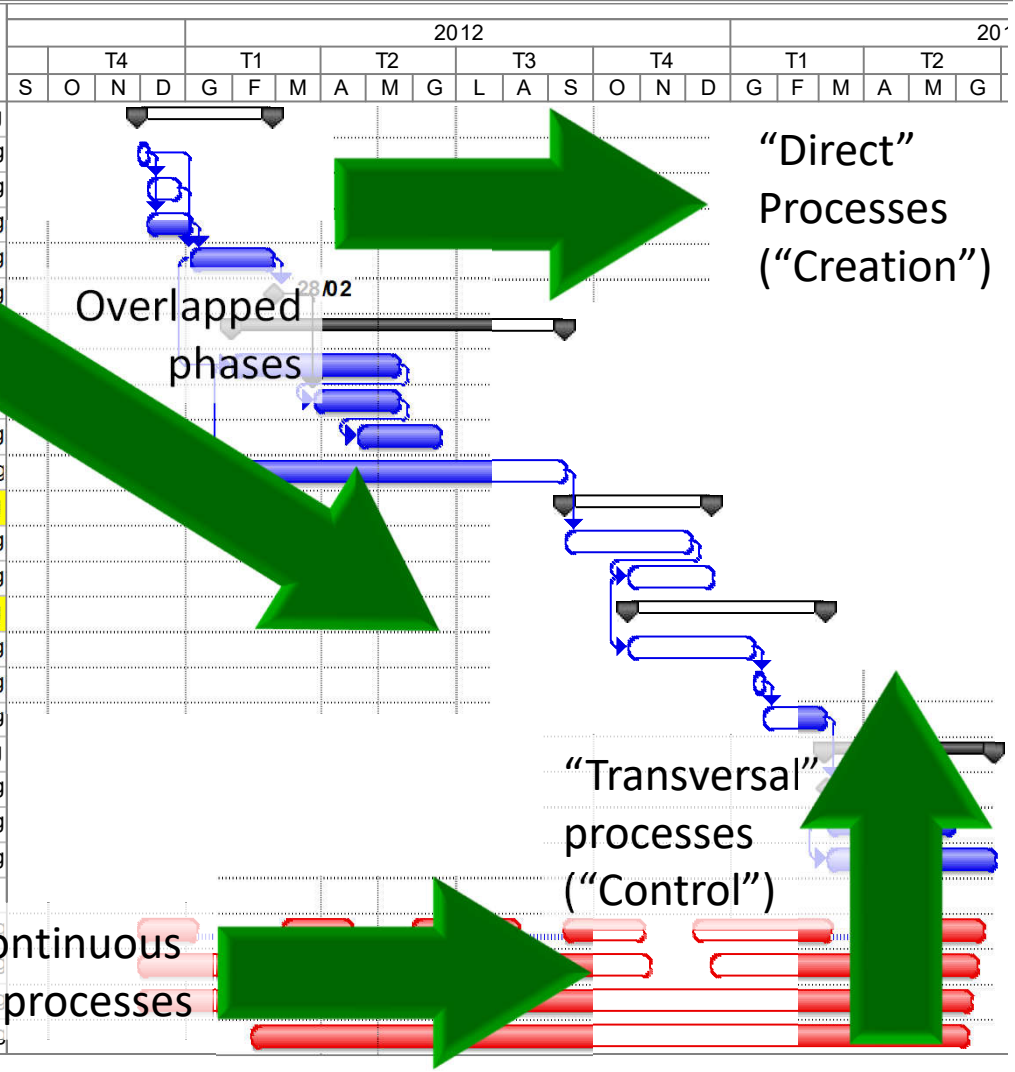
Product Development Process – Schemes

Complex Scheme



Product Development Process – Standard Scheme

ID	Nome attività	Durata
1	**CONCEPT / PRELIMINARY DESIGN**	**65 g**
2	Commercial Specifications	5 g
3	Technical Specifications	15 g
4	General Planning	20 g
5	Feasibility Studies / Style	40 g
6	Project Official Launch	1 g
7	**FULL DEVELOPMENT**	
8	Design	
9	Prototypes manufacturing	40
10	Tests on Prototypes	40 g
11	Industrialization (tool manufacturing)	160 g
12	**DESIGN VERIFICATION**	**70 g**
13	Tests on final parts (Design Verificatio	60 g
14	Modification & fine tuning	40 g
15	**PROJECT VALIDATION**	**95 g**
16	Component & Suppliers Qualification	60 g
17	Preseries / Pilot Productions	5 g
18	Tests on final parts (Project Validation	30 g
19	**MANUFACTURING**	**81 g**
20	Start of Production	1 g
21	Ramp up	60 g
22	Quality Monitoring	80 g
23		
24	Planning Reviews	278 g
25	Cost Monitoring	328 g
26	Investments Monitoring	400 g
27	Quality Monitoring	345 g



5 macro Processes or "Phases"

4 Parallel Processes

Product Development Process – The "Direct" Processes

- "Creative" part of the entire Product Development Process.
- Huge involvement of specialists.
- Activities are strictly interconnected and overlapped each other.
- Involved all sectors of the Company and of the Suppliers as well.

- The "Direct" processes are usually organized in 5 main steps/phases:
    1. Preliminary Design
    2. Full Development (full scale design, prototype and testing, industrialization)
    3. Project Verification,
    4. Product Validation,
    5. Manufacturing (start of production, production growth, quality monitoring).

Product Development Process – The "Direct" Processes

1. Preliminary Design

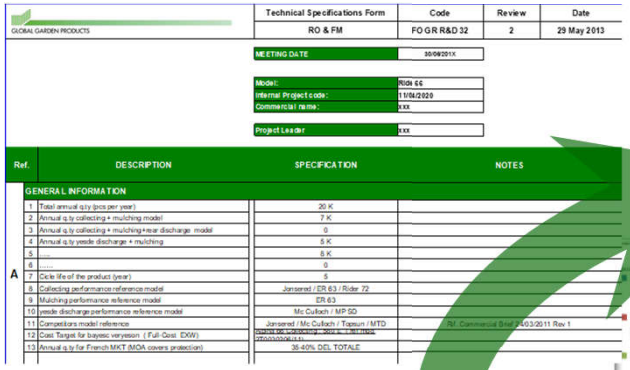
- The Commercial (Marketing) Specifications are translated into the Technical ones.
- (When needed) the Style concept of the machine is developed.
- The technical feasibility of the project is analyzed.
- All the economics evaluations (costs, investments, risks, ….) are performed.
- A preliminary industrial analysis (manufacturing processes to be adopted, tools' suppliers, plant selection,….) is developed.
- In several cases also prototypes are built and tests are performed.

≈ 5-10%

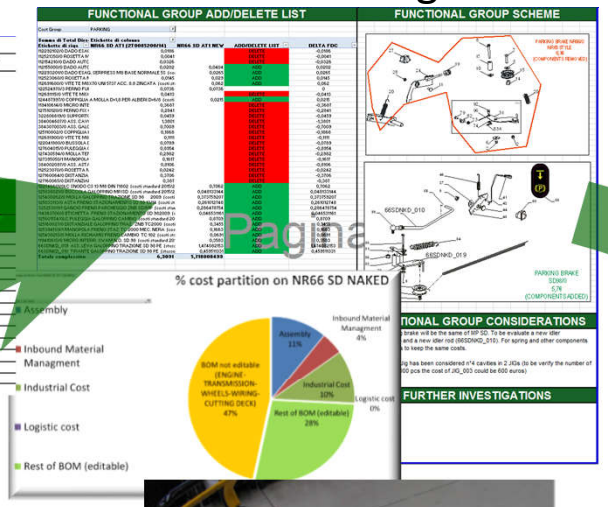
➔ It is the most critical phase
➔ It can finish also with a negative result
➔ it is not wise to save money and time in this phase.

Product Development Process – Preliminary Design

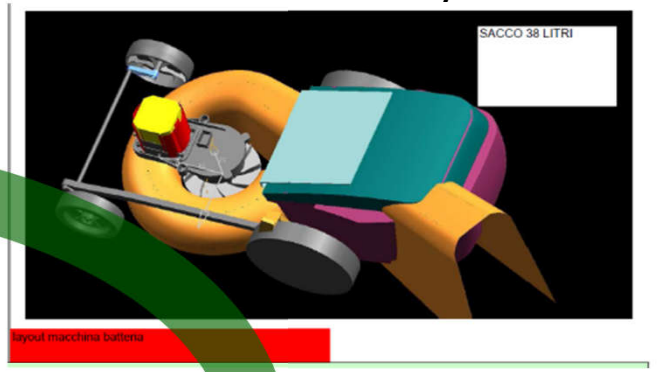
Specifications

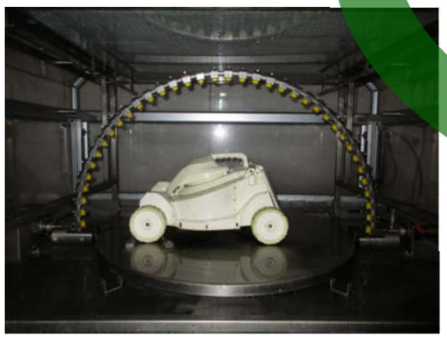


Cost modelling



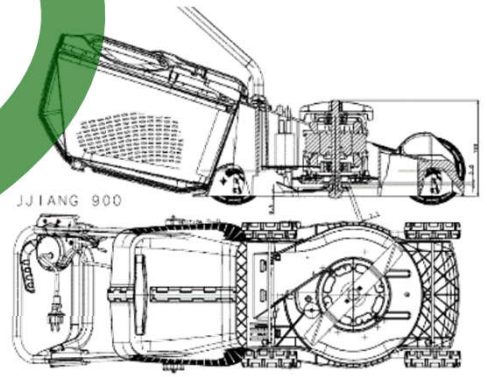
Parametric Analyses





Tests

Feasibility Protoypes



Preliminary design

Product Development Process – The "Direct" Processes

2. Full development

- The Design & Calculations activities are massively deployed.
- Test on prototypes are performed in order to get confirmation about the adopted technical solutions and to tune them.
- The Industrialization (tools and assembly lines manufacturing) is developed and fully realized, using the most "concurrent" approach possible.
- The first batch of "final" machines are realized.

≈ 60-70%

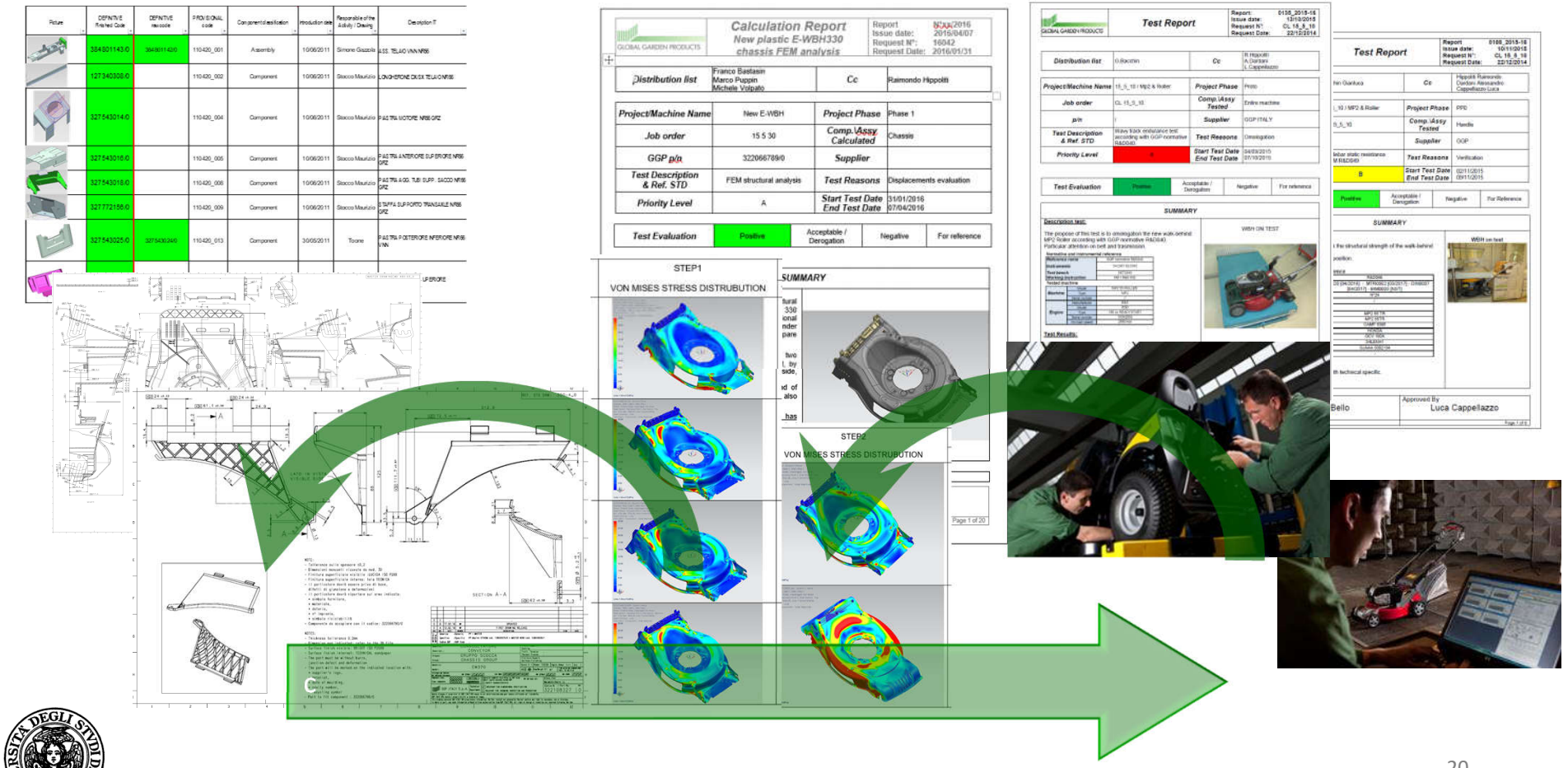
➔ It is the most expensive part of the process.
➔ It is the most critical phase for finale timing and quality results.
➔ managerial skills becomes relevant.

Product Development Process – Full Development

Drawings & Tools

Calculations

Tests & 1° production batch



Product Development Process – The "Direct" Processes

3. Project verification

- The machines manufactured with the components got from the final tools are massively put in test.
- According to the results of the tests, drawings and tools are updated in order to fix the project, enabling him to successfully pass all the required test specifications.
- At the end of the Project Verification phase a formal design review should be performed, in order to fix once for all the final configuration of the machine that shall move to the Project Validation.

≈ 10-20%

➔Step of capital importance to get a <u>good, robust and reliable</u> product
➔The fundamental know how of the Company (the <u>Test Specifications</u>) is used in order to approve the project.

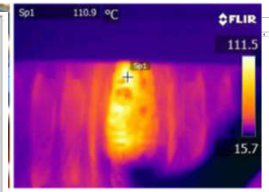
Product Development Process – Project Verification

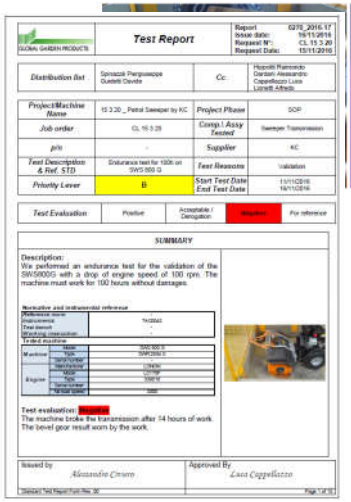
Tests

Design update

Tools update

Annex 3 – Transmission temperature





Test Report

Distribution list	Spinazzè Piergiuseppe Guidetti Davide	Cc:	Ospiti Raimondo Carraro Alessandro Cappellazzo Luca Lunetti Alfredo
Project/Machine Name	IS 3.20 _ Petrol Sweeper by KC	Project Phase	SOP
Job order	CL 15 3.20	Comp.t Assy Tested	Sweeper Transmission
p/n	-	Supplier	KC
Test Description & Ref. STD	Endurance test for 100h on SWS 800 G	Test Reasons	Validation
Priority Lever	B	Start Test Date End Test Date	11/11/2016 16/11/2016

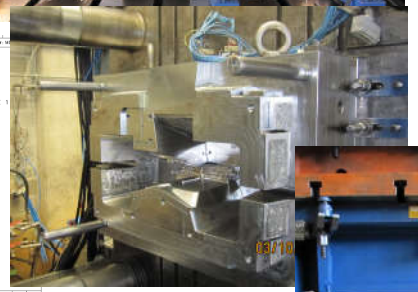
Test Evaluation	Positive	Acceptable / Derogation	Negative	For reference

SUMMARY

Description:
We performed an endurance test for the validation of the SWS800G with a drop of engine speed of 100 rpm. The machine must work for 100 hours without damages.

Test evaluation: Negative
The machine broke the transmission after 14 hours of work. The bevel gear result worn by the work.

Issued by: Alessandro Cimaro
Approved By: Luca Cappellazzo



Product Development Process – The “Direct” Processes

4. Product validation

- The final machines (final design, final tools, final manufacturing processes) are produced in a relevant number.
- All the components/subsystems/systems of the machine are homologated (released for mass production).
- A relevant number of machines is put in test, trying to estimate the reliability characteristics (MTBF and teething problems) of the machines.
- The Product (project + process)is released for start of production

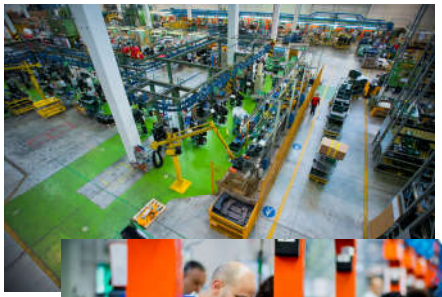
≈ 5-10%

➔The entire project and its manufacturing process, in the final working conditions, is verified.

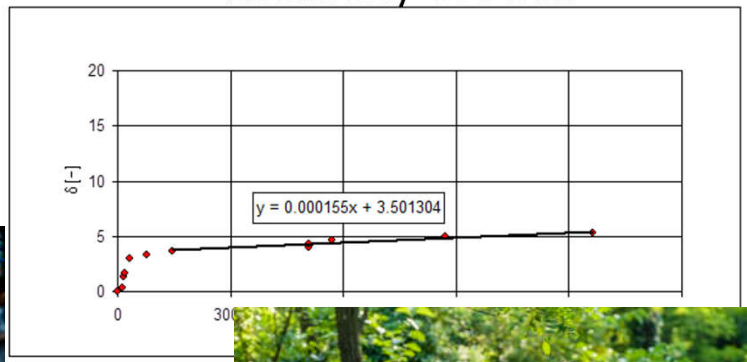
➔Only minor problems are usually found.

Product Development Process – Project Validation

Pilot Production



Final tests &
Reliability Growth



Project Released
for Mass production

Product Development Process – The "Direct" Processes

5. Manufacturing

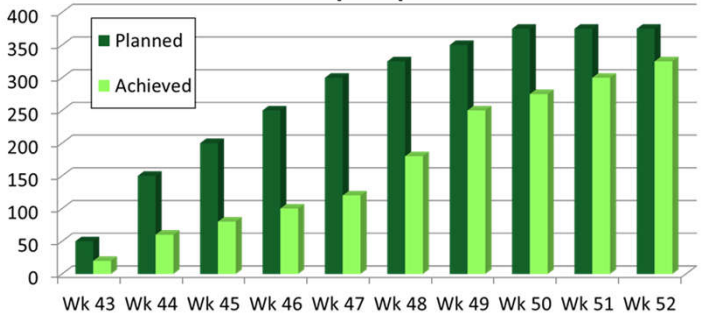
- The production starts up, progressively growing from small rates to progressively higher ones.
- The Manufacturing Processes are carefully audited in order to assure their full compliance to the Specifications.
- Quality audits and (short) tests on machines coming from production are performed to verify the stability and quality of the manufacturing processes
- Customers' returns are strictly monitored

≈ 0-5%

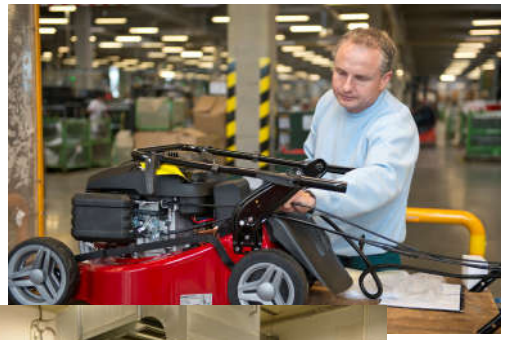
➔Extremely critical phase, being usually not monitored enough.

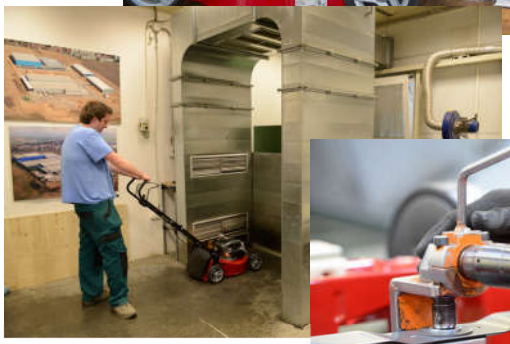
Product Development Process – Manufacturing

Ramp up



Product Audits &
Process final tuning





Final release

Product Development Process – The "Transversal" Processes

- "Control" part of the process : focused to monitor all the aspects of the project development: timing, costs, investments, achieved quality level,…
- Processes not related to activities happening in a precise moment of the project, but constantly present.
- Absolutely not minor processes!
- Usually owned by managerial resources.
- The main are:
    1. Costs review
    2. Investments review
    3. Planning review
    4. Quality review

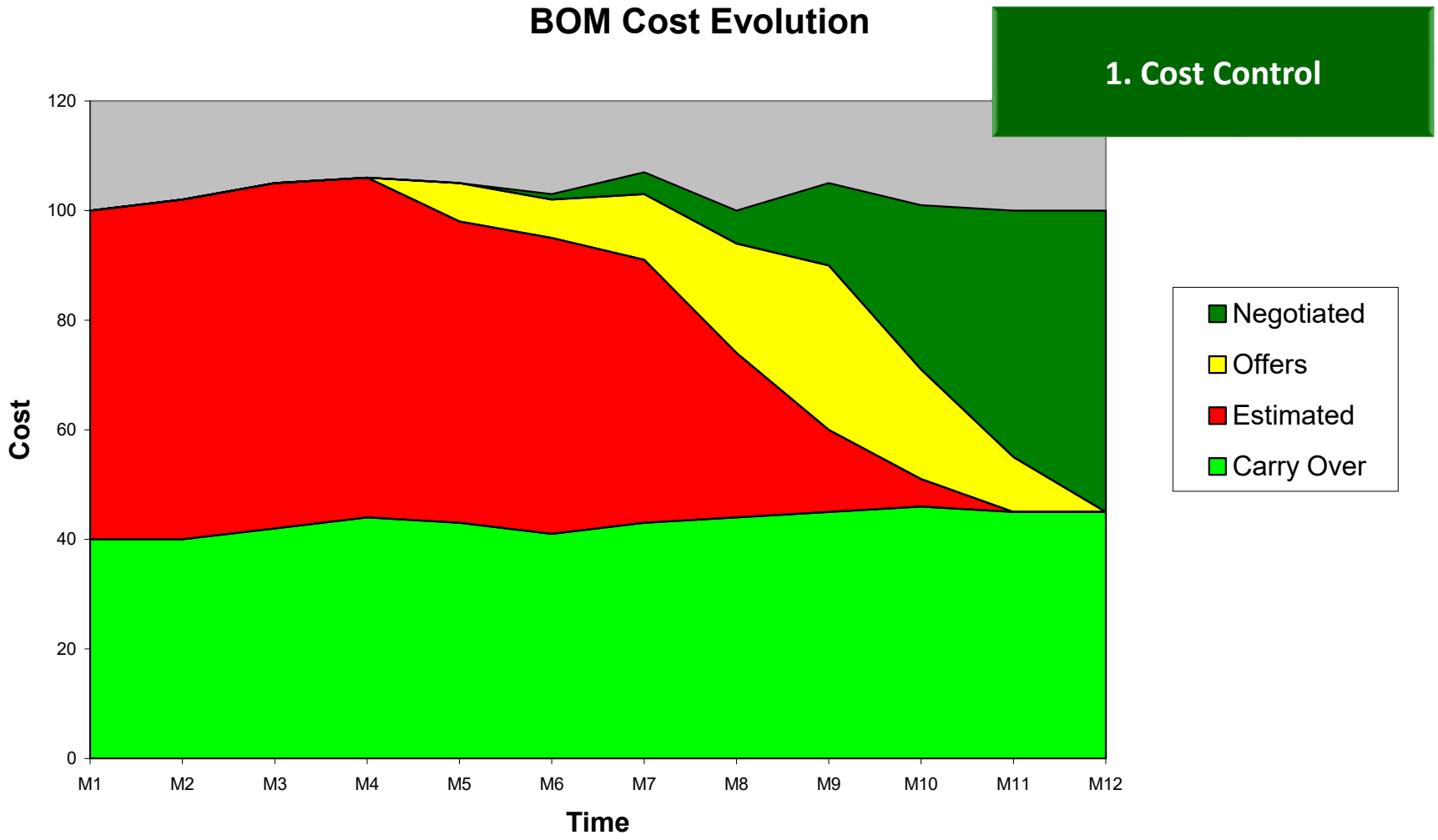
Product Development Process – The "Transversal" Processes

1. Cost Control

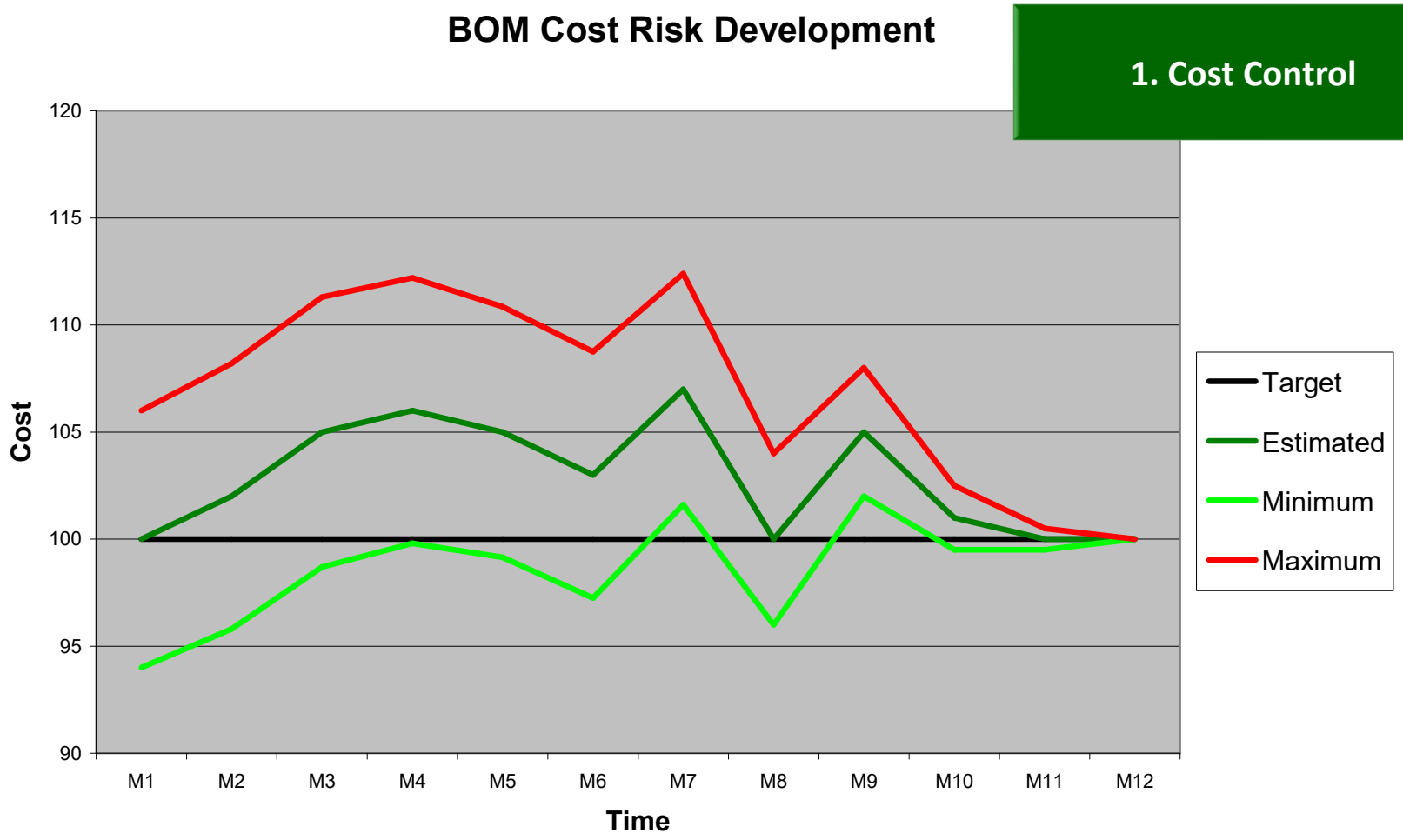
- The BOM of the machine is created, starting from a very preliminary status.
- The cost of each component is estimated and then tracked.
- All the other costs related to the machine (internal/external assembly processes, fixed and semi-fixed costs related to the plant) are taken into account.
- Progressively the accuracy level increase and the indetermination about the cost estimation decreases.

➔"Reverse" process: cost limits are fixed and design is a consequence.
➔Quite sophisticated cost simulator tools are usually used.
➔Continuous process, that progressively gets more accurate results. .

Product Development Process – The “Transversal” Processes



Product Development Process – The “Transversal” Processes



Product Development Process – The "Transversal" Processes

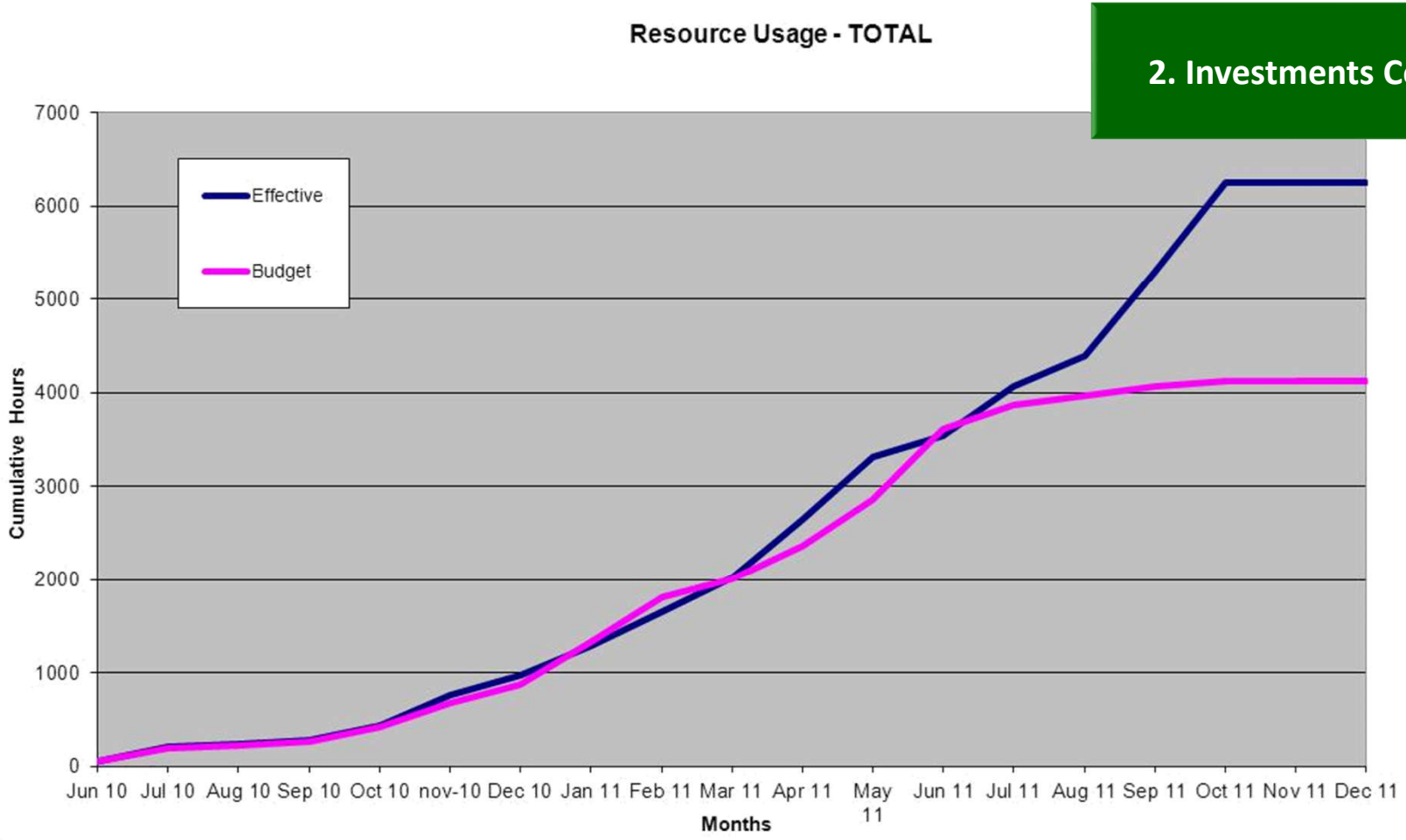
2. Investments Control

- The progression of the expenses related to the project (the "investments") are monitored – usually on a monthly base.
- The comparison with the limits planned in the project approval milestone are constantly checked.
- Any deviation (unpredicted expenses, increase in the tool costs, …) are reported to the Top Management

➔ The more complex is the project the more complex will be the investments' monitoring.

Product Development Process – The “Transversal” Processes

2. Investments Control



Product Development Process – The "Transversal" Processes

3. Planning Review

- The comparison between what was planned to do and what has been really achieved is reviewed, generally on an – at least - monthly base.
- The review can be performed analyzing in detail the status of each activity or in a simpler way, controlling the percentage of the activities closed.

➔ it is probably the most difficult process to be properly performed

Product Development Process – The "Transversal" Processes

GLOBAL GARDEN PRODUCTS

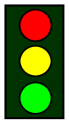
New Product Development - Project Management Form

Code	
FO GR R&D	

3. Planning Review

PROJECT:	12-5-10 NER 34 (Slovakia)
MEETING DATE	29 May 2012

CURRENT PHASE:	
0	Concept&Feasibility
1	Development
2	Industrialization
3	Verification
4	Validation
5	SOP
6	Follow up



PLANNING		
GATES	PLANNED	ACHIEVED
G0 Strategic Brief approval	25/03/2012	31/05/2012
G1 Project\RIA Preliminary appr.	14/05/2012	14/05/2012
G2 RIA Approval	18/07/2012	19/07/2012
(Tool Launch)	30/09/2012	
G3 PP0 Launch	28/03/2013	19/03/2013
G4 PP1 Launch	30/05/2013	19/05/2013
SOP	01/09/2013	

DRAWINGS RELEASES					
FO GR R&D 06 - Product Costs & Drawings Management					
Last update			12 February 2012		
Responsible			Project Leader		
TOTAL NR. OF DRAWINGS	REL. FOR PP0 & SERVICE (C status)	REL. FOR PP1	MODIFICATION / FINE TUNING FOR PP1	REL. FOR SOP (ADB Status)	NOT NEEDED
NOTES					

PARTS RELEASES						
FO GR R&D 06 - Product Costs & Drawings Management						
Last update				12 December 2010		
Responsible				Project Leader		
TOTAL NR. OF PARTS	REL. FOR PP0	REL. FOR PP1	REJECTED	UNDER CONCESSION	REL. FOR SOP	NOT NECESSARY
NOTES						

TOOLS DEVELOPMENT & APPROVAL			
FO GR R&D 03 - Project CAPEX Management Form			
Last update		12 December 2010	
Responsible:	Tooling Purchasing Manager		
TOTAL NR. OF TOOLS	AVAILABLE FOR PP0 & SERVICE	AVAILABLE FOR PP1	AVAILABLE FOR SOP
NOTES			

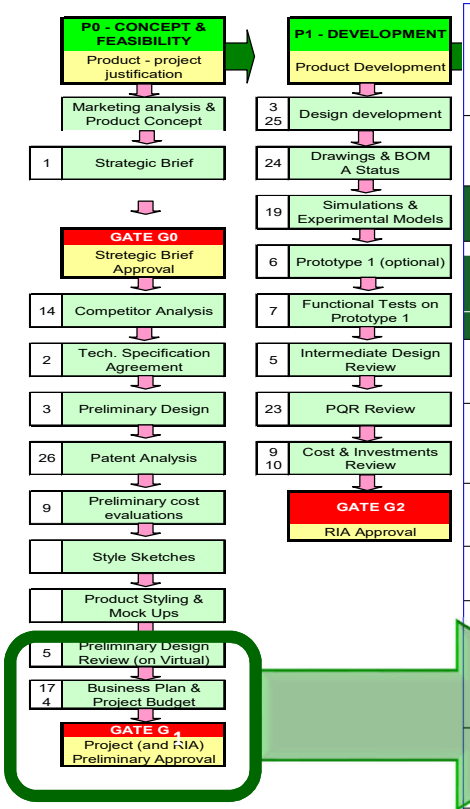
TESTING DEVELOPMENT STATUS									
FO GR R&D 27 (RO/FM) / 28 (WBH) / 33-43 (HH and Tillers)									
Responsible			Test Engineer		Last update			12 December 2010	
PPO TESTS					PP1 TESTS				
TOTAL NR. OF REQUESTED TESTS	NR. OF TEST PERFORMED	NR OF TEST WITH NEGATIVE RESULT	REQUESTED ENDURANCE TESTS	PERFORMED ENDURANCE TESTS	TOTAL NR. OF REQUESTED TESTS	NR. OF TEST PERFORMED	NR OF TEST WITH NEGATIVE RESULT	REQUESTED ENDURANCE TESTS	PERFORMED ENDURANCE TESTS
NOTES:									

PQR \ OPEN ISSUES			
FO GR R&D 17 Project Quality Review			
Last update		12 December 2010	
Responsible:	Tooling Purchasing Manager		
TOTAL NR. OF "OPEN ISSUES"	TOTAL NR. OF "CLOSED ISSUES"	TOTAL TO BE CLOSED WITH A SCORE > 6	SCORE
NOTES:			

CERTIFICATION ACTIVITIES						
Responsible		Certification Manager	Last update			12 December 2010
TUV\LNE HOMOLOGATION			Declaration of Conformity		Instruction Manuals	
			SKU	Issued Docs.	SKU	Issued
					Engines / Machines	Engines / Machines
NOTES\	NOTES		NOTES			

BOMs STATUS			
Last update		12 December 2010	
Responsible:	Tooling Purchasing Manager		
MACHINES SPECIFIED	BOMs AVAILABLE FOR PP0	BOMs AVAILABLE FOR PP1	BOMs AVAILABLE FOR SOP
NOTES			

Product Development Process – The "Transversal" Processes



	New Product Development - Project Management Form	Code	Review	Date
	GATE 1 - Project Preliminary Approval	FO GR R&D 04	10	26 October 2016

MEETING ATTENDANTS	12-5-10 NER 34 (Slovakia)

MEETING DATES	
PLANNED	14 May 2012
ACHIEVED 1st	10 May 2012
ACHIEVED FINAL	14 May 2012

STATUS OF THE ACTIVITIES

N°	MATTER	REQUIRED ACTIVITIES	RELATED FO & PR	ACTIVITIES STATUS AT 10 May 2012	RESPONSIBLE	EXPECTED CLOSURE DATE
1	Competitor Analysis	Detailed Competitors' analysis on critical models	PR GR R&D 16 FO GR R&D 29, 30 & 31.		Project Leader	
2	Technical specifications definition	Definition and agreement with the Product Management of the technical specifications	PR GR R&D 05 FO GR R&D 32		Project Leader	
3	Patent Analysis	Review of the risks and opportunities raising from the Patent field	PR GR R&D 23 FO GR R&D 1-2		Project Leader	
4	Preliminary Planning	Definition of a first temptative planning of the project	PR GR R&D 7		Project Leader	
5	Learnt Lessons Analysis	Analysis and discussion among the Project Team Members of the Learnt Lessons accumulated in the database and related to the product family (i.e. RO, FM, WBH,..) of the product under development	PR GR R&D 20		Service Mgr.	
6	Market Problems and Claims Analysis	Analysis of the most frequent problems and claims coming from the market on similar products	-		Service Mgr.	
7	Service Special Requirements	List of the special needs required by Service (e.g.: requirements related to electromics)	-		Service Mgr.	
8	Preliminary RIA	Approval by GMM of the preliminary RIA that will finance all the preliminary studies & prototypes	PR GR AFC 1		Project Leader	

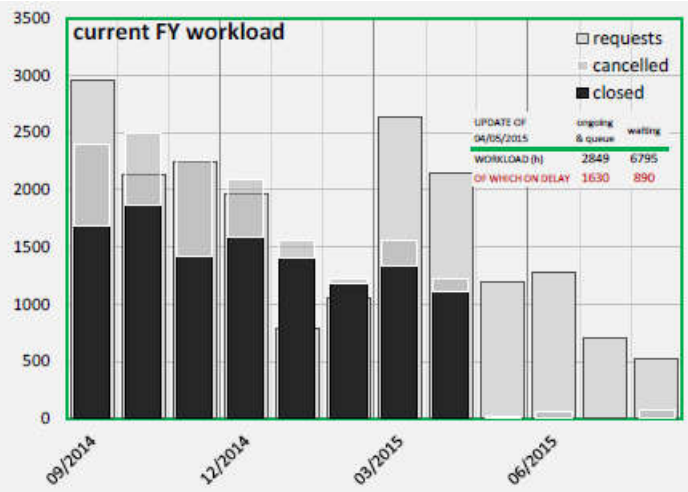
Product Development Process – The “Transversal” Processes

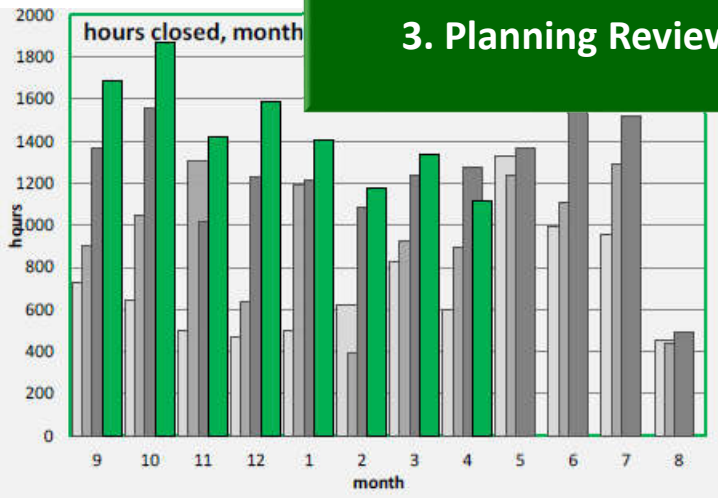
3. Planning Review

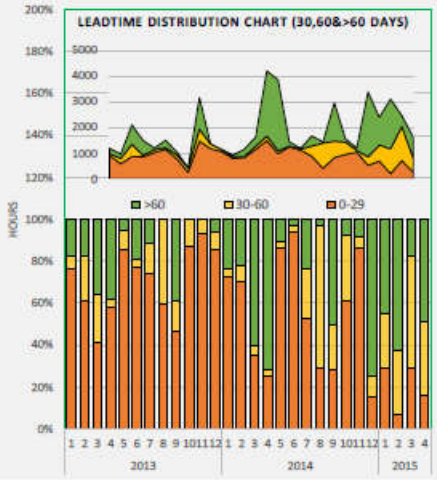
activity n°	LAST REQUEST 2817	project code	project name	business	developement phase	activity type	date of request arrival	requested activity end date	in delay / expiring in next 30 days / expiring in next 60 days — show open / show all total for FY 2013-14: 3015 activities = 38275 hours OPEN with forecast: 494 activities = 9005 hours as FILTERED in this table: 11 activities = 182 hours	requester	work hours forecast	priority	operator	status	activity START date	activity END date	currently worked hour	report n°
1528	313/2011	11 4 30	Front Accessories for TCHE and MP platforms	RO		MEC.TEST	15/09/11	30/11/11	Test durata pala Vergani su MP98	Graziotto	8	A		cancelle				
5719	1855	1X 0 10	Attività Struttura R&D\Staff Activities	STAFF	MASS P.	MEC.TEST	04/06/14	30/06/15	Inserimento in CMS dei report rumore mancanti	Cappellazzo	40	C	scapinello	ongoing	04/06/14		21	
7057	CL 15 1 10	15 1 10	Stiga Decks for Endeavour	FM	PROTO	MEC.TEST	06/02/15	30/06/15	Brakes deck 95	Soligo	16	B		waiting				
7058	CL 15 1 10	15 1 10	Stiga Decks for Endeavour	FM	PROTO	MEC.TEST	06/02/15	30/06/15	Stability test deck 85	Soligo	12	B		waiting				
7059	CL 15 1 10	15 1 10	Stiga Decks for Endeavour	FM	PROTO	MEC.TEST	06/02/15	30/06/15	Noise deck 95	Soligo	4	B		waiting				
7060	CL 15 1 10	15 1 10	Stiga Decks for Endeavour	FM	PROTO	MEC.TEST	06/02/15	30/06/15	Stopping time deck 95	Soligo	16	B		waiting				
7061	CL 15 1 10	15 1 10	Stiga Decks for Endeavour	FM	PROTO	MEC.TEST	06/02/15	30/06/15	Performances test (in comparison with competitors)	Soligo	40	B		waiting				

Product Development Process – The “Transversal” Processes

3. Planning Review







First 10 Projects

	2014												2015												Total
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
MP2 & Roller															92	336	186	62			530			480	1686
Support to Purchasing & Global Sourcing							8			16		20		8	80	292	198	171	142	136		202		40	1313
Mid/Top Range RO Platform									80		16					70	218	116	112						612
Robot Range for 2016																		24	458			120			602
Stiga Decks for Endeavour																	16	6	118		310		128		578
WBH 80 V																	12	4	206		182		100		504
MP 98 Collecting																		46			262			160	468
Chainsaw 2015 range by Zhongjian																				312		148			460
New Professional FM - 2014				4	16						20			12		99	16	12		146					325
Robot Restyling & others for 2015									96		32					40	38	104							310
Total				4	16		8		176		68			20		593	834	669							6858

Product Development Process – The "Transversal" Processes

4. Quality Review

- Quality = Total Quality, i.e. Customer Perceived Quality + Performances + Reliability
- Each problem found during the development must be accurately reported, listed, analyzed and the related corrective action(s) identified and put in place.
- Each problem must (not should, must!) have one responsible for the solution, that coordinates the efforts of all the other, and a deadline for the timing.
- The problem will be considered solved only when the experimental evidence of it will be available, not earlier.

➔ Complex process, dramatically important, not always taken in the correct consideration.

➔ Mandatory rule: who is in charge to identify the problems (and certify that they have been solved) must always be different from who (creates and) solves them.

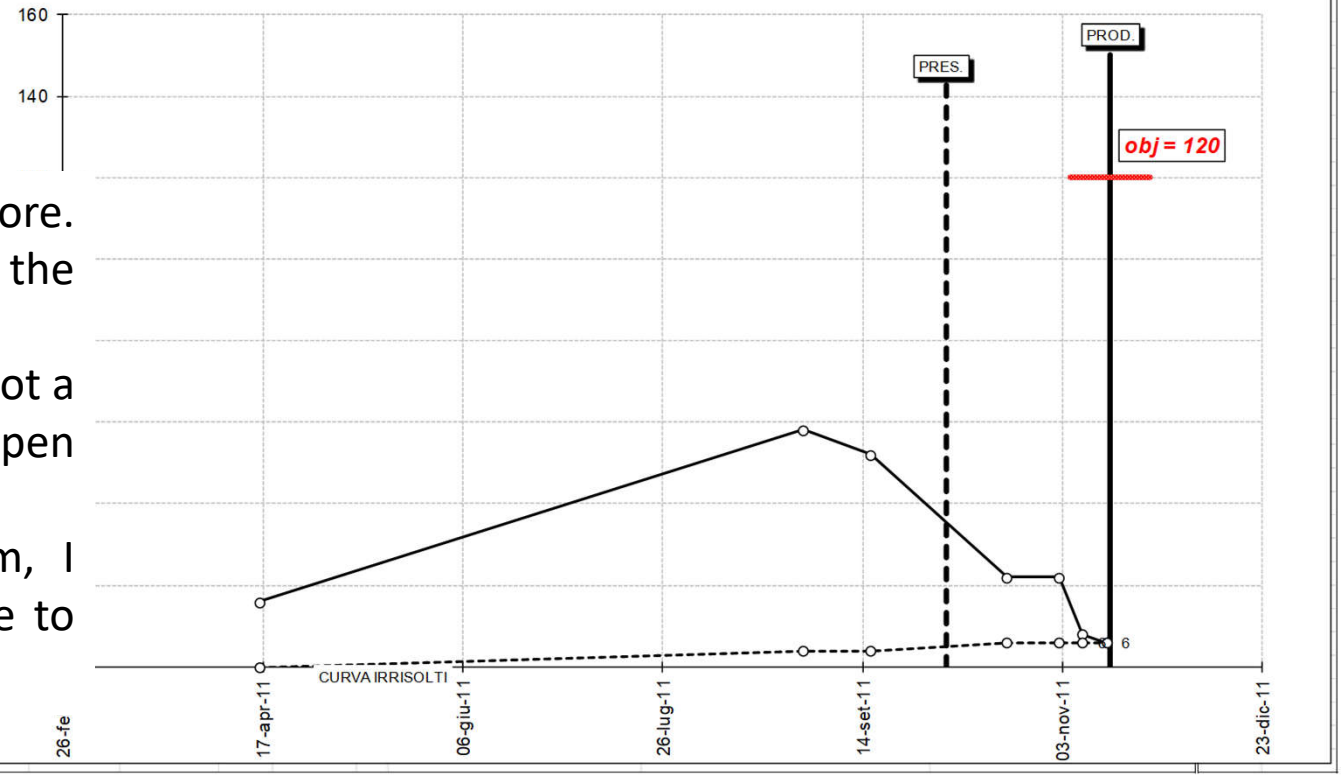
Product Development Process – The "Transversal" Processes

4. Quality Review

GRAFICO DIFETTOSITA'
OVERALL PROBLEMS GRAPH

MODELLO: **Cr 48&53**
C.P. : **E.Susin**
MECCANICO: **A.Zanon**
data aggiornamento: **14-nov-11**

ANDAMENTO		
DATA	TOT.	IRR.
16-apr-11	16	0
30-ago-11	58	4
16-set-11	52	4
20-ott-11	22	6
02-nov-11	22	6



Each problem ➔ one score. the highest is the score, the worse is the problem.
I add all the scores and I got a total score of the open issues.
When I solve a problem, I subtract the related score to the sum.

Product Development Process - Conclusions

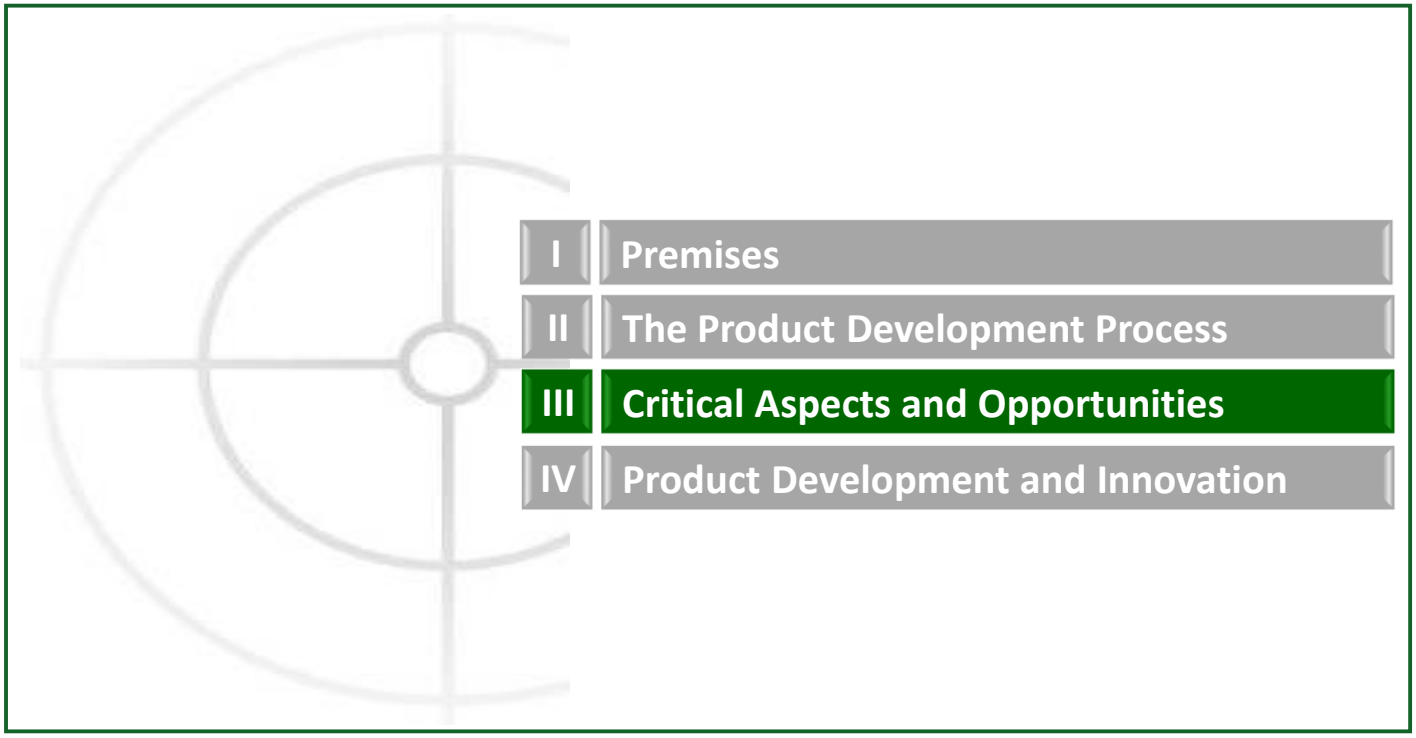
1. The Product Development Process is a very complex, cross functional and heavy process. All the departments of the Company are involved in it and must contribute.

2. It is a process with a lot of contributors. It is a very well “equilibrated” one. The difference is usually not done by the designer(s), but by the team.

3. It is a process were not only specialist/technical people are relevant, but also – mostly – managerial people are important. This is more and more true, when the complexity of the product under development grows.

4. Despite what could be imagined from outside, in most cases I personally got in touch in the past, the set of tools used in managing the project is quite simple: Excel files and not much more!

Summary

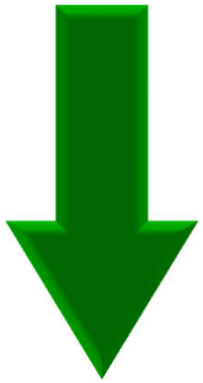

I Premises
II The Product Development Process
III Critical Aspects and Opportunities
IV Product Development and Innovation

Critical Aspects and Opportunities

Critical Aspects and Opportunities

1. The Human Resources

- A Company is made by procedures, databases, tools, machines, plants,…. but mainly by the people (and by their behaviors….).
- Technical skills and team working capability are important at the same level.
- To focus the human resources in a common approach to the work and in the compliance of the Company's rules is fundamental.



- A correct process for selection and development of the human resources is at the base of the health of the Company.

Critical Aspects and Opportunities

2. Cross Functionality & Suppliers

- Product Development is not a job only for R&D: all the Company's functions are involved (even if sometime the other Company's Functions do not have awareness of that).

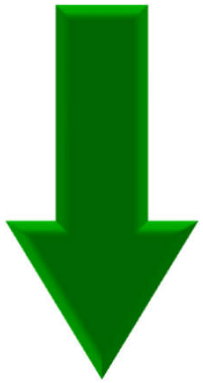
- The involvement of the Suppliers is mandatory. Today, in almost all the fields, the Manufacturer has lost most of the Know-How about the single Components. This K.H. is spread among the entire Supply chain. In several cases relevant innovation contents are coming directly by the Suppliers.

- The possibility to use external Engineering Companies must be considered as an opportunity and not as a problem (even if the complete outsourcing of skills that can be strategic, could be an error).

Critical Aspects and Opportunities

3. The IT Role

- Processes' speed and efficiency are of capital importance in the Competition. The IT support can facilitate the processes in that sense. (NOTE: facilitate, not replace or substitute….)
- IT support must be tailored to the PD Process needs and not self-referential. When the IT support is not tailored to the needs, it becomes the digital noose for the Company.



- It is extremely dangerous to underestimate the importance - in one way or another – of how much IT can affect the global efficiency of the Product Development Process.

Critical Aspects and Opportunities

4. Quality Prcedures

- Similar to IT: it can be a breakthrough for the Company or like an anvil for who is trying to swim….

- "Traditional" ISO 9001 approach: we need the certification!
  We start writing some procedures, we adapt to them in some way our processes and we got the certification. This approach does not add any value to the Company.

- The approach to ISO 9001 should be reversed:
  1. the processes must be identified and described;
  2. they must be reviewed, improved and optimized according to the ISO 9001 basic principles;
  3. each process must be evaluated from the economical point of view;
  4. each process – after its optimization - must be described by a procedure (and the procedures must be written by the process owners).

Only at the end of that the certification process can start!

Critical Aspects and Opportunities

5. The Indicators (KPI)

- In the Company the processes are complex and if you wish to control them, you always need to try describe their status with indicators that can be measured with numbers (or, even better, with traffic light indicators).

- The indicators are often called KPIs (Key Point Indicators).

- If it quite easy to identify KPIs for:
  - Manufacturing (e.g. efficiency, daily volumes);
  - Quality (e.g. internal/external scraps,….);
  - Finance (e.g. cash flow, EBITDA,…..);
  - Purchasing (e.g. average discount levels,…..);

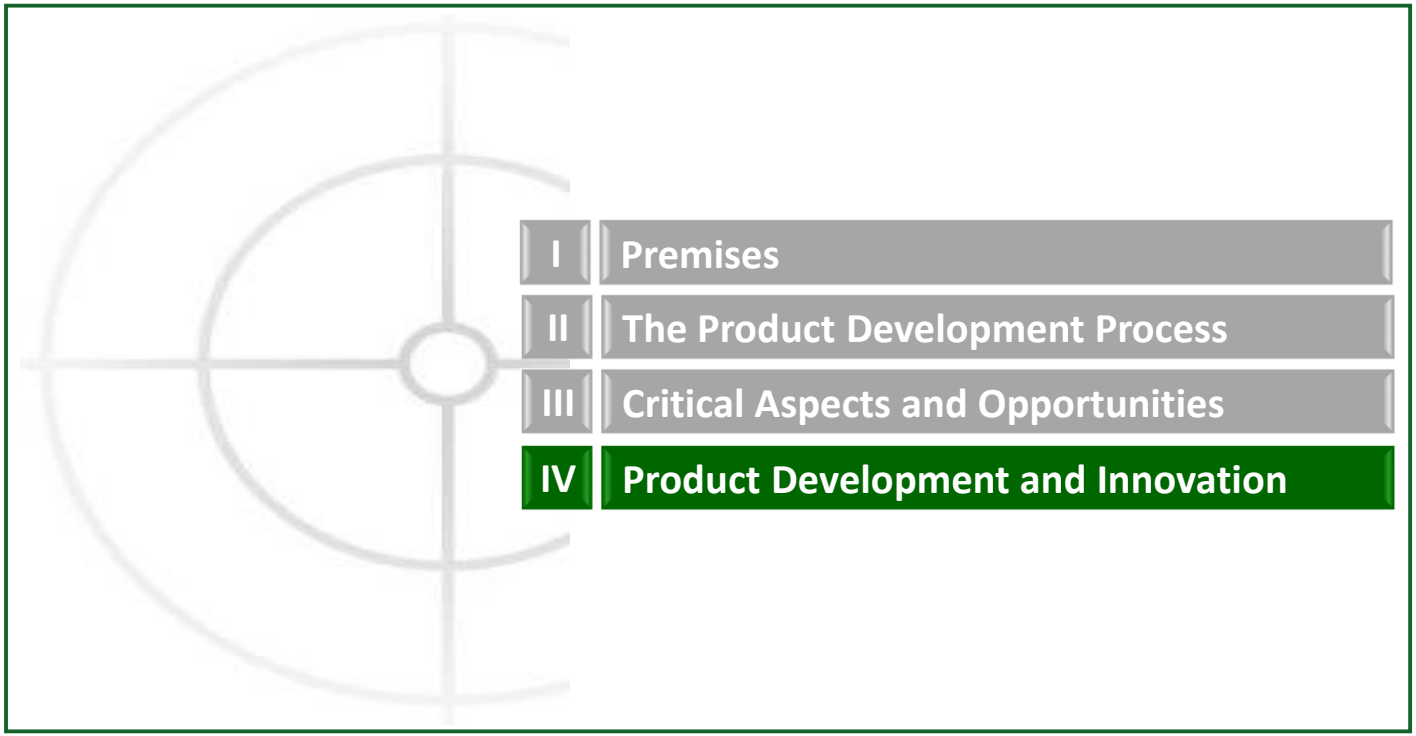
  but for the R&D processes it is a little bit more complex. But not impossible.

- GGP R&D KPIs are the deviation vs. the targets of:
  - Timings;
  - Product costs;
  - Product development costs (investments)

Critical Aspects and Opportunities - Conclusions

1. An accurate management of these aspects is crucial for the survival of the Company.
2. No one of them should be left unmanaged. They all are relevant, more or less at the same level.
3. They all involve not only one department, but all the departments of the Company. This will make even tougher an accurate management of them.
4. If you manage all these aspects in a proper way, you will be able to make things completely impossible when the aspects are not managed.

Summary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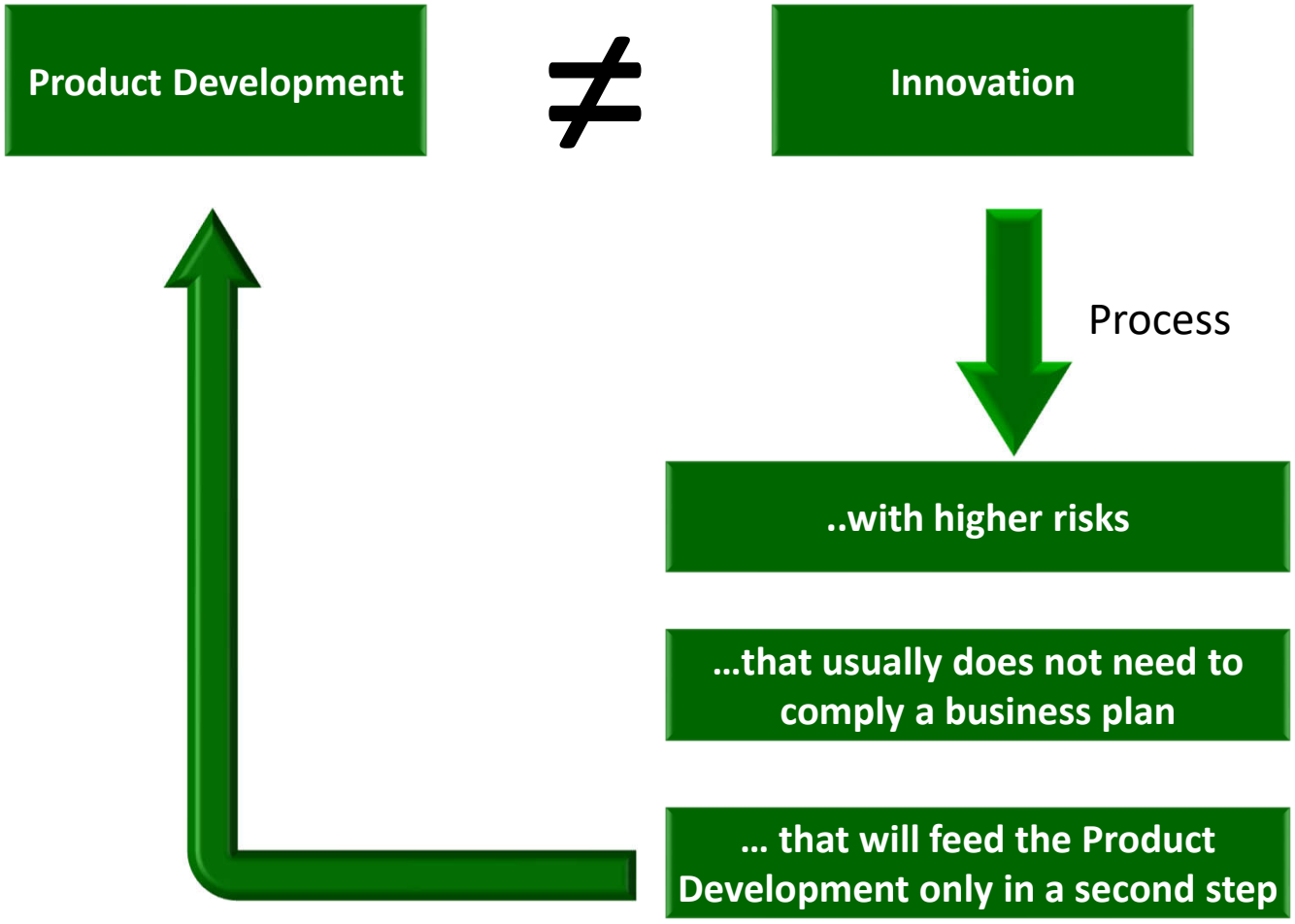
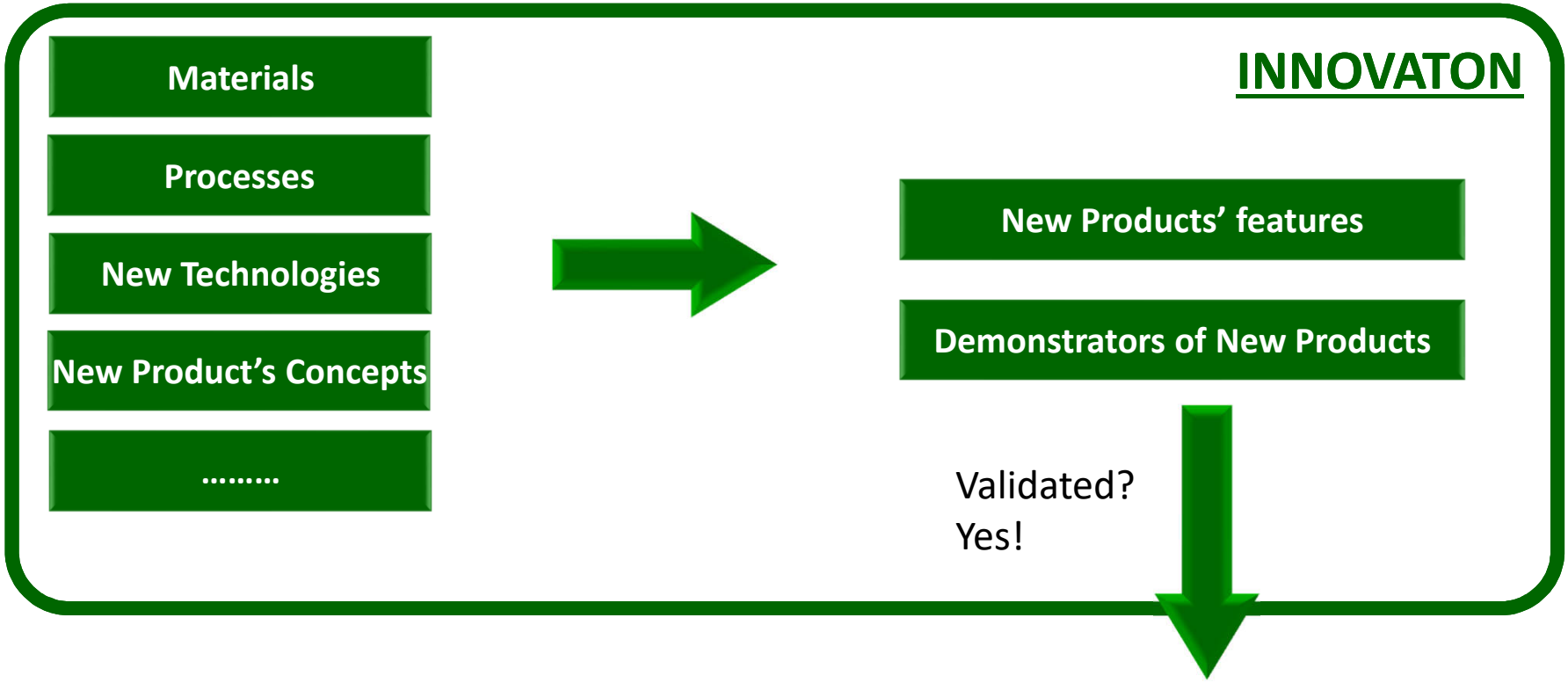
Product Development & Innovation



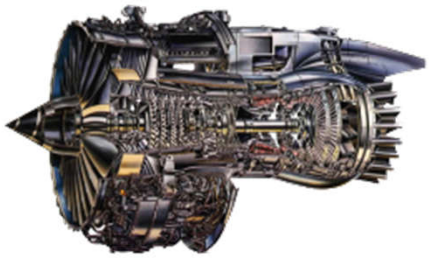
Product Development & Innovation



Innovation must be released to Product Development only after its full validation !!

Product Development & Innovation

Negative experiences



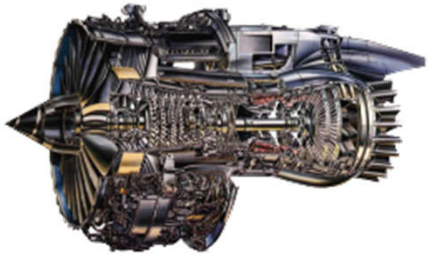
Rolls-Royce

BOEING

Positive experiences

PIAGGIO

Product Development & Innovation



- High by-pass turbofan for civil airliners
- 166-270 kN of thrust.
- 1st three spool jet engine in the history
- Potential of 50 years of development

Mid 1966	Start of the activities. Target: certification by December 1970; 147,9 kN of thrust; engine price: 511 k$
June 1967	Product configuration: high by-pass ratio, triple spoon design, Hyfil (carbon fibre) fan stage. SOP target: 1971.
March 1968	Lockheed order 150 sets of RB.211-22 engines for its L-1011 Tristar with a target of 181 kN of thrust.
May 1970	The Hyfil blade fails the tests. With the titanium blade, the engine is underperforming.
September 1970	Development cost arrived at the double of what initially estimated. Product cost above the target.
January 1971	Rolls Royce become insolvent.
February 1971	“Emergency team” appointed
April 1972	Engine certification.

Product Development & Innovation

- Long haul, mid size wide body airliner
- 335 MAX passengers.
- MTOW: 254 t
- Range 14,200 km.
- Full composite fuselage and wings.

January 2003	7E7 Project Launch
April 2004	ANA orders 50 airplanes with enter into service in 2010, price estimated in 120 M$.
August 2007	Planned date for the 1st flight
December 2009	Achieved date for the 1st flight (!!!)
August 2011	FAA/EASA certification (lasted twice what initially predicted).
October 2011	1st commercial flight
January 2013	Airplanes grounded for battery problems!!

Development costs: 32 bn$
Airplane cost: ?? (Boeing declared to loose about 30 M$ per airplane in 2015!!)

Product Development & Innovation - Conclusions

1. Keep Innovation separate from New Product Development.

2. Be sure to have fully validated the Innovation Concept before move to Product Development.

3. Remember that Innovation can fail. If Innovation never fails, maybe it is not real innovation.

Many thanks

Many thanks!