

# Optimizing the process for New Product Development

Master in Quality and Performance Assessment in Organizations  
*Methodological Intelligence Thesis*

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## Abstract

Stage Gate process has become a popular idea-to-launch system among innovative organizations that develop new products.

Yet, implementing and operating such a process remain a significant challenge. In fact, there is no standard for this methodological approach. Thus, each organization has to continuously improve this process and yield a leaner version that fits the needs of its projects.

This thesis aims to describe the approach adopted to optimize the Stage Gate process within one of the most important innovative companies.

The main purpose was to implement better decision making practices through a flexible and adaptable tool for gate reviews in order to better manage R&D (Research and Development) projects.

**Key words:** Stage Gate process, methodological approach, optimizes, better practices, R&D projects.

## Résumé

Le processus Stage Gate est devenu un système très utilisé de lancement de nouveaux produits au sein des organisations innovantes.

Cependant, la mise en place et l'exploitation de ce processus demeure un enjeu de taille. En effet, il n'existe pas d'approche méthodologique standard bien définie à suivre. Il est donc nécessaire pour toute organisation de l'adapter à ses propres besoins en permanence.

Le présent mémoire a pour but de décrire l'approche choisie pour optimiser le processus Stage Gate au sein d'une des plus importantes compagnies innovantes.

L'objectif principal est de mettre en place des bonnes pratiques pour la prise de décision par le biais d'un outil flexible et adapté pour le contrôle des portes « Gate » en vue de bien gérer les projets R&D (recherche et développement).

**Mots-clés:** processus Stage Gate, approche méthodologique, optimiser, bonnes pratiques, projet R&D.

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*Finally, I would like to thank my family and friends for their unconditional love and support during this year. I would not have been able to achieve this without their presence in my life.*

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## **Glossary**

**SGGI:** Saint-Gobain Glass Industry

**WCM:** World Class Manufacturing

**EHS:** Environment, Health and Security

**HRDC:** Herzogenrath Research and Development Center

**SGR:** Saint-Gobain Research

**CRDC:** Chantereine Research and Development Center

**NPV:** Net Present Value

**5W1H:** (QOQCP in French) is a quality management tool. A method by asking questions (WHO, WHAT, WHERE, WHEN, HOW, WHY) about a process or a problem.

**SWOT:** Strengths, Weaknesses, Opportunities, Threats

**PRA:** Preliminary Risk Analysis

## **Preamble**

As a graduate in Chemical Engineering, I have decided to acquire a double competency and strengthen my management skills.

Therefore, I decided to complete my engineering path with a master program in Quality and Performance Assessment in Organizations at the University of Technology of Compiègne UTC.

As part of the master's program, I had an internship opportunity in Saint-Gobain Glass Industry which was in line with my professional project. I had the chance to put into practice my knowledge and critical analysis as an engineer while combining my management skills in quality.

I have worked in a multicultural and pluridisciplinary environment which enhanced my skills at all levels. I had a challenging position mainly focused on improving the R&D process of Saint-Gobain Glass Industry.

## INTRODUCTION

Over the last decades and to adapt to the ever-changing economy and growth, Innovation has become a critical skill to achieve success.

In fact, innovation generates long term advantages and contributes to a rise in position in a competitive scale and allows the organization to cross new performance thresholds. It is vital for the organization to be innovative in order to keep the profitability and competitiveness at the best level.

Therefore, every organization urges for the need to improve its business process for the sake of effectiveness and efficiency.

The innovation has always been at the heart of Saint-Gobain values. In order to maintain its innovation's culture Saint-Gobain keeps enhancing the quality of the daily life by continuously delivering innovative and high performance materials.

The innovative materials represent 24% of Saint-Gobain 2015 consolidated sales. They are subdivided into 2 main types of products: Flat glass and High Performance materials.

The following figure 1 shows the types of innovative materials produced by Saint-Gobain in 2013 and their corresponding percentage.

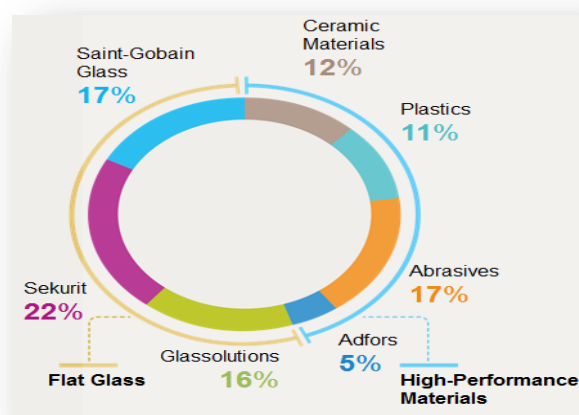


Figure 1: Innovative materials sectors sales for 2013 [1]



In order to drive their projects from ideation to industrialization faster and with limited risks and commercial failures, most innovative companies have implemented a Stage Gate process.

A recent research made by the Product Development and Management Association PDMA showed that nearly 60 percent of the firms surveyed are adopting the Stage Gate Process for their new product development [2].

The Stage Gate process is conceptual and operational model of new product/process management. This model enables firms to continuously assess their core capabilities and better manage their development projects through the gate reviews.

It is a tool that assists project team to better understand and control the status of the project and reduce the risks throughout the stages.

The overall purpose of the Stage Gate process is to bring both scientific and business management rigor to conduct projects.

However, the Stage Gate process remains a complex approach and sometimes includes non-valued work. Thus, it needs to be constantly reviewed and improved.

Making the Stage Gate process more flexible, focused and including fluid and adaptable gate reviews is very essential to make it operational and vital.

This present thesis is the outgrowth of a dedicated 5-month work at Saint-Gobain Glass Industry in the R&D control Department as part of an internship to obtain my master's degree in Quality and Performance Assessment in Organizations at the University of Technology of Compiègne.

My main mission was focused on optimizing the existing R&D Stage Gate process for Saint-Gobain Glass Industry and integrating the Early Management Pillar of the World Class Manufacturing in this process.

# 1. SAINT-GOBAIN

## 1.1 General presentation of Saint-Gobain

Saint-Gobain has 350 years of history (Figure 2). 1665 was the year of the birth of the group with the creation of the Manufacture Royale des Glaces and throughout the years the group extended its activities and expanded across Europe. During the 1900, it diversified into new markets and new products.

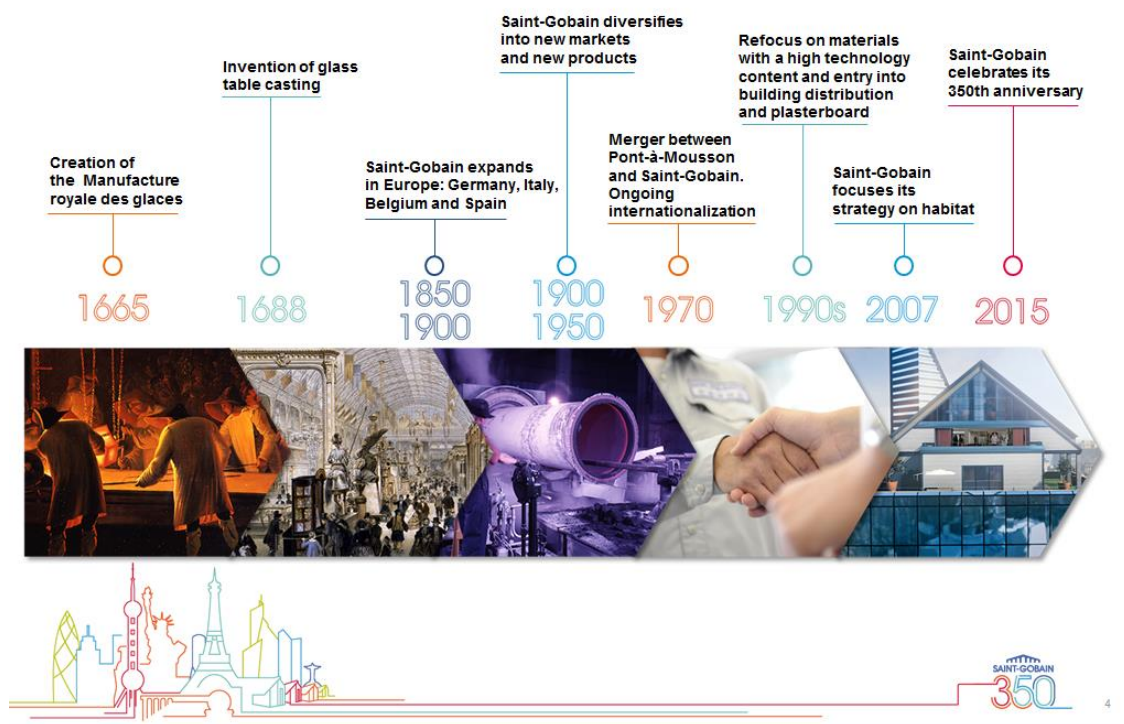
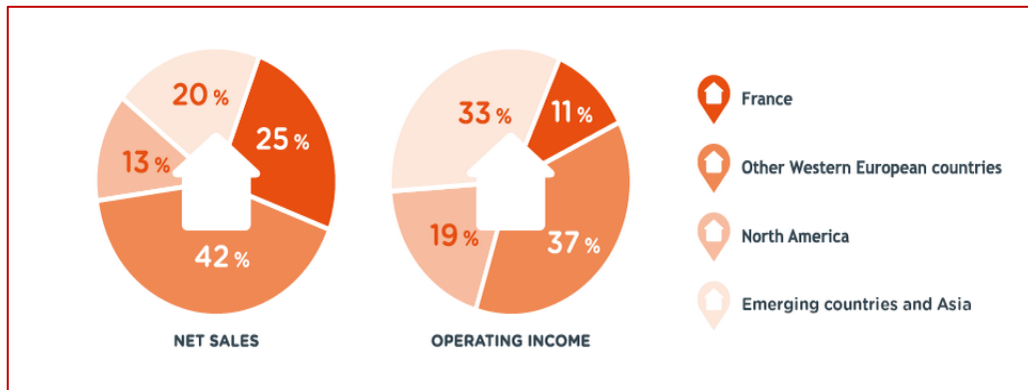


Figure 2: History of Saint-Gobain[3]

Saint-Gobain is one of the top 100 industrial groups worldwide. It is worldwide group present in 66 countries in the habitat and high performance materials [3]. It has over 500 manufacturing facilities across the world and is still growing in emerging countries (Figure 3).



**Figure 3: Keys figures by geographic area for 2015[4]**

Saint-Gobain is a unique and committed organization with an operation excellence at the heart of its culture. It is a world or European leader in all its businesses. It has also an exceptional innovation potential thanks to its expertise in distribution and its research and development [4].

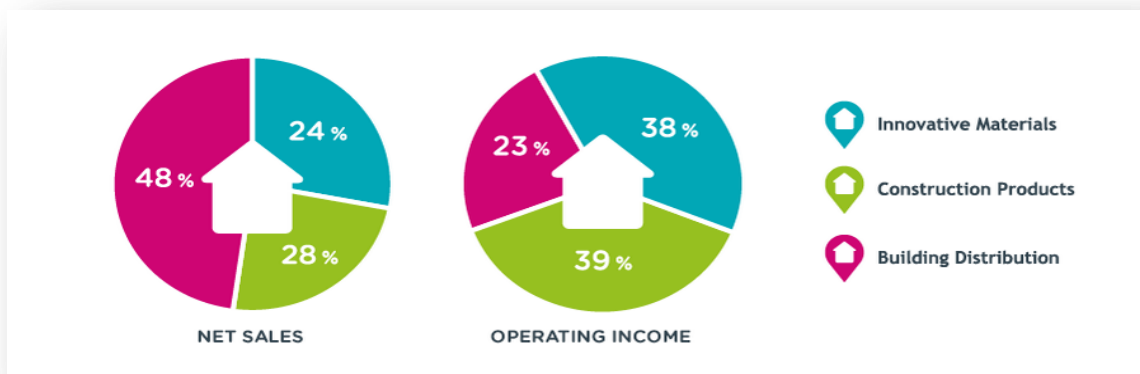
It consistently provides high value added solutions responding to the needs of market with a detailed knowledge and analysis.

Saint-Gobain is an innovation-driven group. The strategy of Saint-Gobain is focused on 3 priority axes: Differentiation, strong market positions and internationalization.

The group has 3 activities hubs, organized as followed (Figure 4): and their corresponding net sales and operating income (Figure 5).



**Figure 4: Saint-Gobain's sectors[1]**

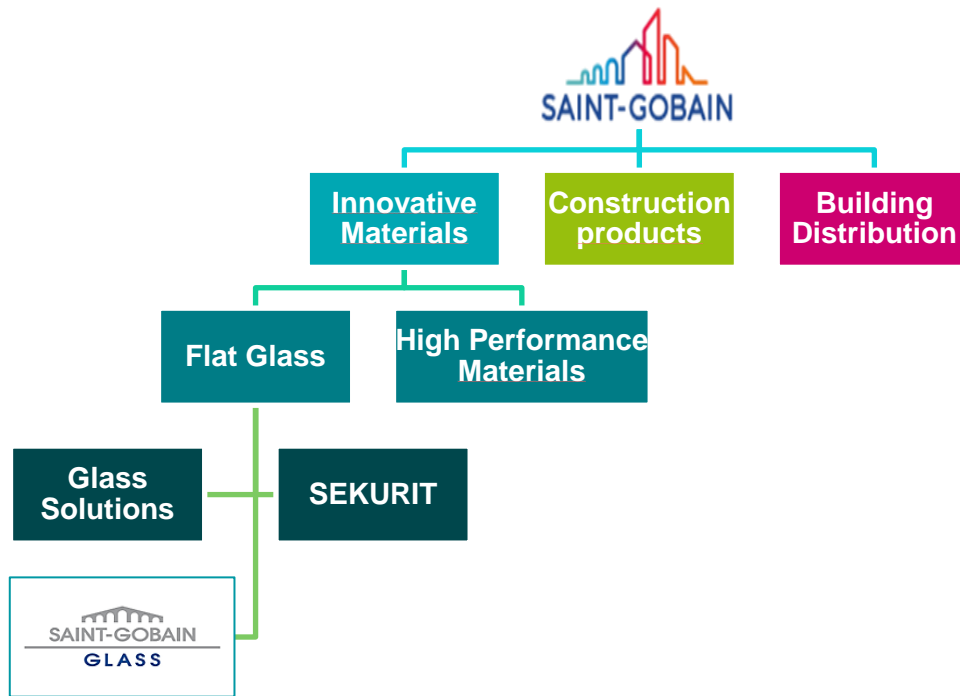


**Figure 5: Key Figures by sector for 2015: Net Sales and Operating Income[5]**

- **Innovative materials**: It deals with various fields including the habitat, transport, health and industry. It is subdivided into two types of materials:
  - *Flat Glass* (flat glass, building transformation and distribution, automotive glazing, specialty glass)
  - *High-Performance Materials*: ceramic materials, abrasives, performance plastics, technical fabrics.
- **Construction products**: It provides solutions for interior and exterior living spaces : plaster, insulation, facade coatings, roofing products and pipes.
- **Building distribution**: It delivers the new construction, renovation and habitat finishing markets. (Building materials distribution, new building and renovation, volume and specialist brand networks, services and solutions, information and training for customers ...)

Moreover, 80% of Saint-Gobain sectors' sites have adopted the WCM (World Class Manufacturing) program: a lean manufacturing program.

## 1.2 Saint-Gobain Glass



Innovative materials in Saint-Gobain include 2 main sectors: Flat Glass and High Performance Materials. These materials are distributed as illustrated in the Figure 6:

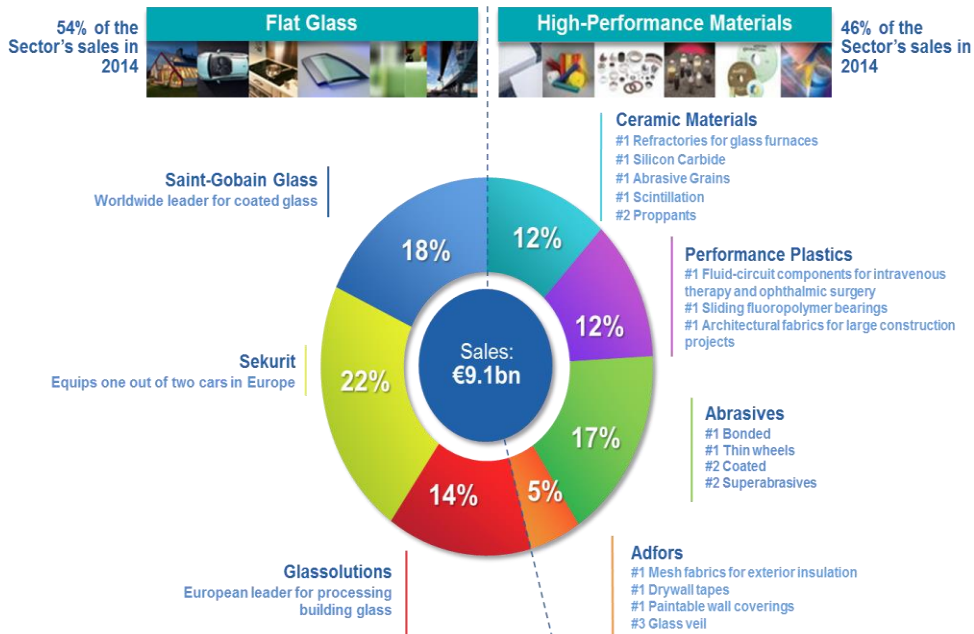


Figure 6: Market-leading activities of Saint-Gobain [1]

Saint-Gobain Glass Industry is part of the Flat Glass sector and contributes with 18% of sales. It produces flat, coated, laminated, printed, silvered and lacquered glass and is a worldwide leader for coated glass [1]. Saint-Gobain Glass Industry's manufacturing facilities include: 33 floats, 15 coaters, 3 patterned lines distributed around the world.

The Flat glass products are present in 3 different markets: habitat, healthcare and transportation:

**Habitat:** fire resistant and security glass, high energy efficiency glass, self-cleaning glass, tintable glass, active glass switching from transparent to translucent, decorative glass, lighting mirror, heating glass, glass door for ovens...

**Healthcare:** ecological mirror, glass anti-ionizing radiation X, double glazing with integrated blinds...

**Transportation:** Ultra-thin glass or polycarbonate lightweight glazing, Head-up display, Laminated windshield, Panoramic car roof, Bus windshield, Cockpit windows...

### 1.3 R&D in Saint-Gobain

Research and innovation are at the heart of Saint-Gobain's strategy. It is one of the 100 most innovative companies in the world.

The research and development is a key driver in Saint-Gobain:

- 3700 researchers are working for Saint-Gobain.
- Nearly 350 patents were filed in 2015.
- 8 main research centers in the United States, France, Germany, China and India (Figure 7).
- 1 in 4 Saint-Gobain products sold today did not exist five years ago.



**Figure 7: R&D multi-business centers around the world [6]**

Developing breakthrough projects with significant margins is a real challenge in Saint-Gobain. R&D in Saint-Gobain is an important hub. It follows a Stage Gate process from Ideation to Industrialization which means a path with detailed steps and key points in order to turn the idea into money. Each gate is a decision point based on the deliverables of the checklists [7].

Saint-Gobain developed an *Innovator handbook* which capitalizes the existing experiences in Saint-Gobain and presents the best practice for the R&D.

In the first part, it describes the mandatory rules for R&D at Saint-Gobain including EHS, Financial doctrine...

In the second part, it describes the Stage Gate process adopted in Saint-Gobain in order to better manage the R&D projects and fits the needs of the Business Units [7].

The organization of R&D at SGG is steered with 3 levels of committees:

- A **Portfolio Management Committee (PMC)**: Analyze and decide to start new projects according to technical and marketing feasibility.

- A **technical Platform committee**: Optimize R&D and resources according to competencies, analyzing the project's technical issued at each stage of the process.

- A **Steering committee**: Validate the project's key points (R&D, Marketing and Industrial) and make gate decisions (go / no-Go/ rework / put on hold)

Each R&D project is evaluated economically with the calculation of NPV (Net Present Value) which is performed by R&D project leader and validated by the marketing manager.



## 2. CONTEXT AND ISSUES

The internship took place in the R&D Central Department of Saint-Gobain Glass Industry in Aubervilliers.

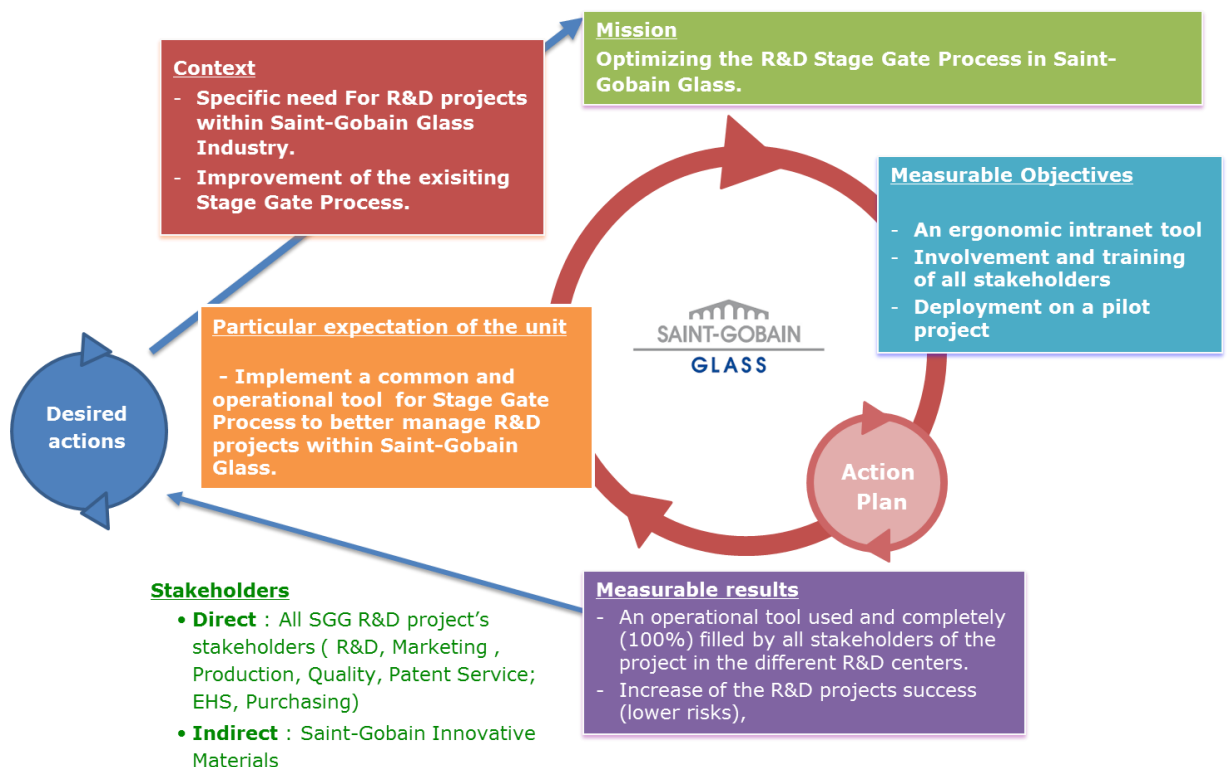
The main mission was part of a project initiated by Saint-Gobain Glass Industry with the aim to optimize the existing Stage Gate process.

### 2.1 Context

Innovative materials in Saint-Gobain follow a Stage Gate process from the idea till the launch of the product.

Within the framework of continuous improvement of this process, Saint-Gobain Glass initiated a project to optimize it and make a specific and agile tool of gate review for its Glass Products.

A Dynamic Strategic Plan was designed (Figure 8) to give an overview of the internship and explain its objectives.



**Figure 8: Dynamic Strategic Planning of the project [8]**

## 2.2 Problem and issues

In order to frame the problem of the internship and identify the key points a 5W1H quality management tool was used (Figure 9).



**Figure 9: 5W 2H of the project [8]**

The main issue of the project is to implement a common Stage Gate process tool for all R&D Saint-Gobain centers. This tool has to be flexible and adaptable to the needs of its stakeholders. However, the operationalization of the Stage Gate process for new product development is a complicated approach.

Upon completion of this analysis, a solving-problem approach was concluded which is focused mainly on the communication and involvement of the different stakeholders to have a deeper and detailed analysis of the weak points of the existing stage gate process and optimize it according to their experience, feedbacks and suggestions of areas of improvement.

### 2.3 Risk Analysis

A preliminary risk analysis was conducted to assess the risks that may be encountered during the internship to better manage the project, reduce the risks and take action plans efficiently (Figure 10).

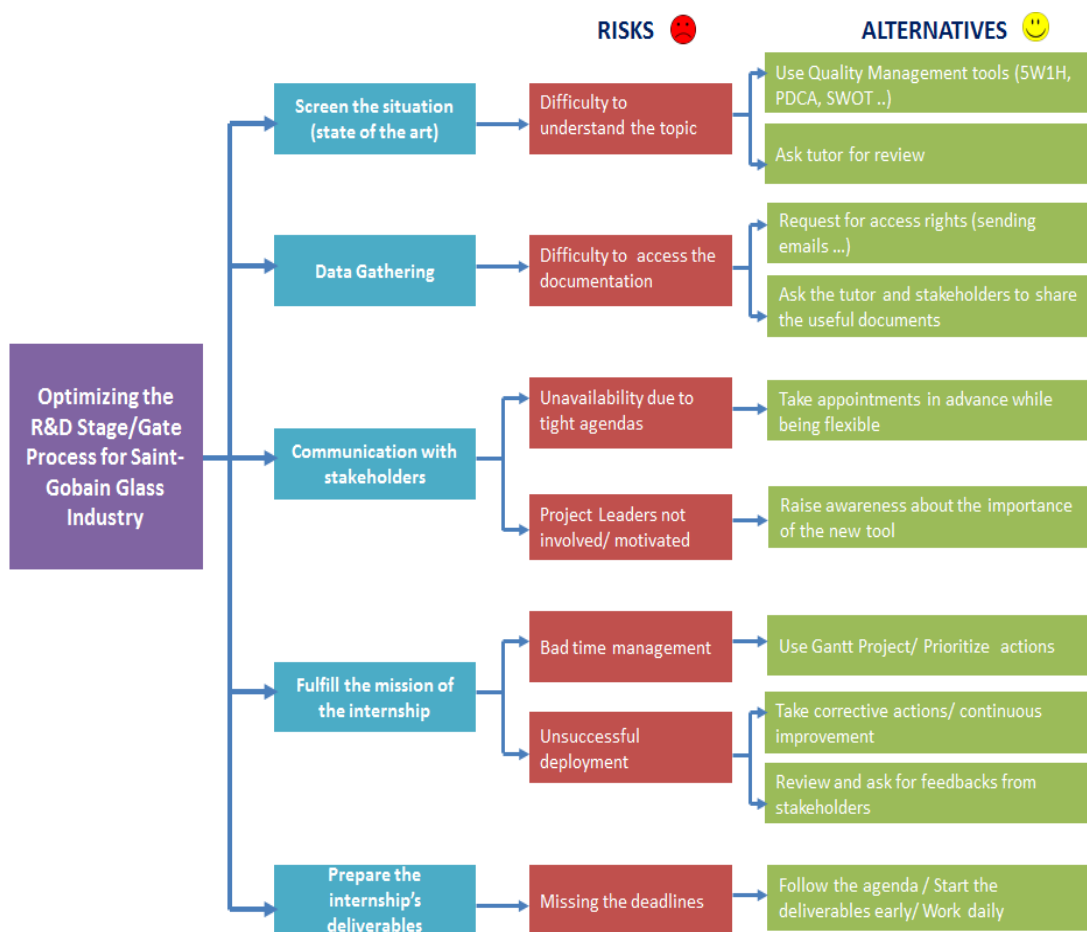


Figure 10: Project Risk Analysis [8]

This tool helped to optimize the performance of the internship and highlight the critical points. According to the main activities, various risks have been deduced. Thus, alternatives have been identified to face those risks. Thanks to the action plans put in place the fulfillment of the work was conducted successfully with minor issues and problems.

### 3. Optimization of the R&D Stage Gate Process

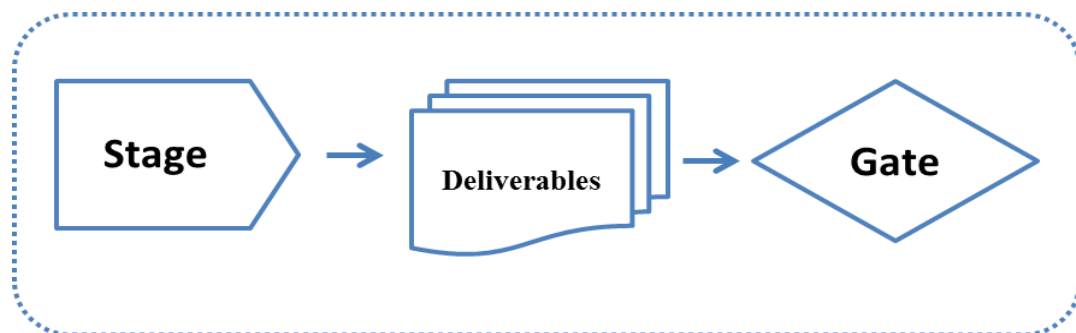
#### 3.1 Presentation of the Stage Gate

A Stage-Gate process is a roadmap for running projects:

Each stage consists of a set of activities undertaken by different functional areas (R&D, Marketing, EHS, Quality ...) and the result is a list of deliverables which are the inputs to the next Gate. The results are then assessed by a steering committee (Paragraph I.3) during the gate review which represents a decision point.

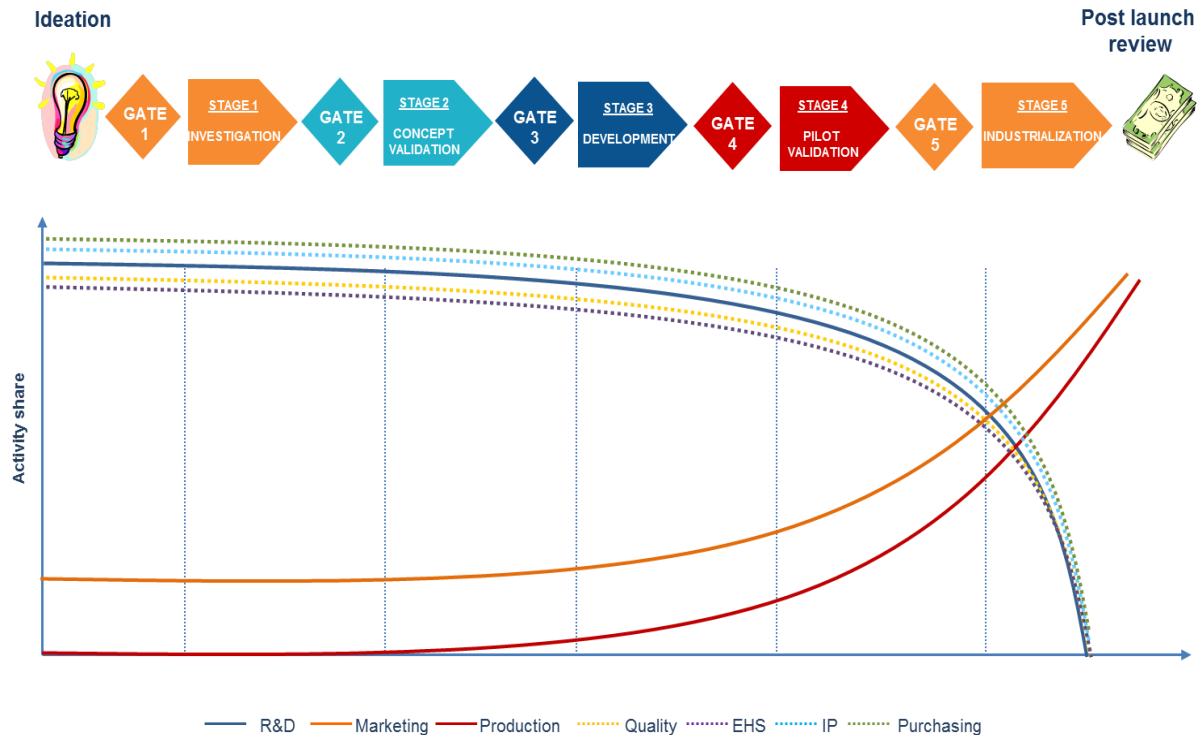
A gate consists of:

- *Checklist*: Criteria to evaluate the project, a list of questions.
- *Deliverables*: The outputs to the decision point. The results of the tasks completed during the stage.
- *Decision*: a Go /No-Go/ Rework /Put on hold decision where the path forward to the next stage.



The full Stage-Gate process is a step by step methodology designed in Figure 11. The process starts with an ideation stage and ends with the Industrialization of the product followed by a post-launch review.

A simplified process could be adopted and is called **Fast-Track** Process starting from stage 3 or merging Stage1&2 and Stage 3&4. In this case, the steering committee has to justify the need to go through this fast process ( Incremental-type project, Low risks, modification or improvement of the product, Time ...). The final objective is that the process scale and suits the different types of projects.



**Figure 11: R&D full Stage Gate Process in Saint-Gobain Glass [8]**

The Stage Gate is roadmap with 5 stages and gates followed by a post launch review:

**Gate 1:** It is the initial idea screening to decide if it offers a high potential value in Market and fits the Business Unit objectives. If the decision is favorable funding is granted for the stage 1.

**Stage 1:** It is the preliminary investigation to validate the idea and define the objectives of the project.

**Gate 2:** It is the feasibility review to evaluate the requests for the next stage.

**Stage 2:** It is the concept validation to validate the idea by carrying a deep marketing and feasibility analysis.

**Gate 3:** Authorize funding and resource commitment for the following stage.

**Stage 3:** It is the development phase to:

- Produce a working prototype E0 at lab scale.
- Identify process capability.
- Analysis of the technical and financial trial results.
- Marketing analysis and business plan confirmation.

**Gate 4:** To approve the budget required for full production trials.

**Stage 4:** It is the pilot validation to:

- Perform full scale trial
- Define the process improvement
- Calculate production costs
- Validate supply capacity and confirm business plan

**Gate 5:** To review the results of previous stages and the projected financial data.

**Stage 5:** The final stage is the industrialization which means to implement the full production run and successfully launch the project.

Following the full Stage Gate Process, a post launch review is conducted in order to evaluate the effectiveness of the process and suggest improvements for future project launches.



The Stage Gate is cross-functional. It is driven by R&D, Marketing and Production. The R&D is supported by different departments including: Quality, EHS, Patent Service and Purchasing. A steering committee evaluates the performance of the project during each gate review. This is a milestone check and decision point based on the deliverables of the checklists. The project cannot proceed and go to the next stage without a “go” ahead decision.

The checklists contain a list of deliverables to be checked based on the tasks done in the previous stage.

### 3.2 Problem

The Stage-Gate process has been initiated to the culture of Saint-Gobain R&D in order to better manage innovation. Continuous improvement of the existing process is at the heart of Saint-Gobain Glass Industry objectives. The main goal is to permanently meet the R&D project objectives and fit the needs of project leaders.

The following table shows the key strengths and weaknesses of the existing Stage-Gate process. This helped to better screen the current situation and identify the main areas of improvement.

+++ 	--- 
<ul style="list-style-type: none"> <li>- Strong documentation basis: Innovator Handbook of Saint-Gobain.</li> <li>- Continuous improvement.</li> </ul>	<ul style="list-style-type: none"> <li>- Heavy gate review checklists</li> <li>- Many tools used in the different R&amp;D centers (gate checklist, Product Launcher)</li> <li>- More than one data base for R&amp;D projects</li> <li>- Lack of training of the project leaders</li> <li>- Bureaucratic system (many deliverables, questions to answer, non-added-value items many meetings and committees...)</li> </ul>

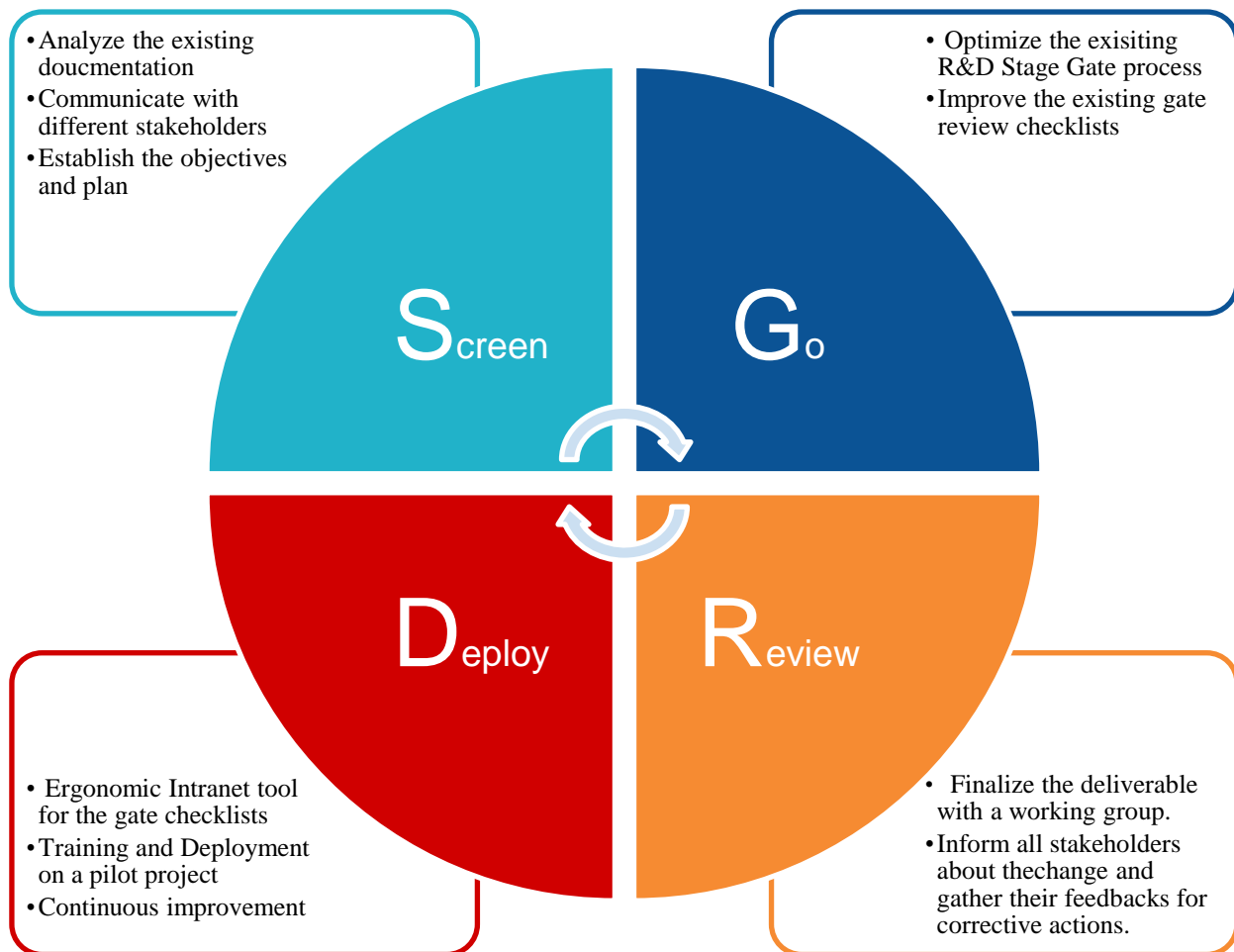
**Table 1: Strong and weak points of the existing Stage Gate Process[8]**

Gate review is a critical check point and one of the weakest area in new product development. In fact, only 33% of firms have a robust operational Gate review system [9]. Moreover, only 56 % of project are successful and meet their sales targets.

The existing gate review in Saint-Gobain Glass is not fully satisfactory and doesn't fit the needs of project leaders. The tool is considered heavy and an extra work. Nevertheless, this extra work if it is well defined and optimized it is well worth the effort as it yields to increased success rates, greater profits and often shorter time to launch in the market.

### 3.3 Problem solving methodology

In order to adopt a robust problem solving methodology a Deming Circle was designed (Figure 12). **SGRD** refers to **S**creen, **G**o, **R**evise and **D**eploy.



**Figure 12: SGRD Saint-Gobain R&D Deming wheel [8]**

**Screen:** The first step was to understand the existing system. The state of the art analysis is critical since it helps to identify the main areas of failures and improvement. Analysis of the existing documentation and communicating with the stakeholders were important to do a better screening. Afterwards, a deep analysis was conducted on problem identification and the plan of the action plans.

**Go:** The DO phase and putting into practice the tasks planned in the screening phase. The core project is to improve and implement a new gate review checklist while tackling the weak points and failures of the existing system. Interviewing the stakeholders mainly the project leaders was the method adopted.



**Review:** Upon completion of the GO phase and once the deliverables are ready, a checking phase is essential in order to have feedbacks from stakeholders, identify the potential problems and take corrective actions as necessary.

**Deploy:** The final phase is the deployment of the new tool on a pilot project. Therefore, training of project leaders is highly needed to ensure that they assimilate and know how to operate it. Continuous improvement of the new tool is also one of the main tenets of this work.


Aligning with the SGRD described previously, a plan was plotted using Gantt project shown in Appendix 1.

The main objective was to implement an integrated, evolving process that builds agile methods. The new Stage Gate process is not a lock-step rigid process. It is a tool that helps to have a better project management system rather than a heavy project-control mandatory tool. It is therefore tailored to the needs of the project.

### 3.3.1 Screen

To better screen the situation, analysis of the existing documentation was essential (Innovator Handbook, Gate Checklists, Product Launcher, Gate review presentations ...). Moreover, stakeholders helped me to better understand and assimilate the situation and provided me with needed information.

Then a short anonymous questionnaire was prepared and sent to Project Leaders (Figure 13):

Stage Gate Process for New Product Development 					
Questions	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
The Stage Gate process is in place and well defined	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The Stage Gate process is well documented and clear	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The gate process training "R&D Project Leader" is helpful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The Stage Gate process is really used	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The Stage Gate process is an extra work	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The Stage Gate is lean and scalable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The Stage Gate process facilitates success	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The existing Stage Gate process needs improvement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Comments and suggestions of improvement</b>					

**Figure 13: Questionnaire about the existing Stage Gate Process [8]**

Project Leaders were reactive and most of them responded to the questionnaire and gave their opinions and suggestions of improvement. 100% of the Project Leaders that answered agreed that the existing Stage Gate process needs improvement.

Upon completion of this screening phase a SWOT analysis was designed (Figure 14) to identify the internal and external factors that affects the fulfillment of the mission.



**Figure 14: SWOT Analysis [8]**

This framework helped to uncover the strengths/opportunities to exploit and weaknesses/threats to face and know how to avoid and eliminate.

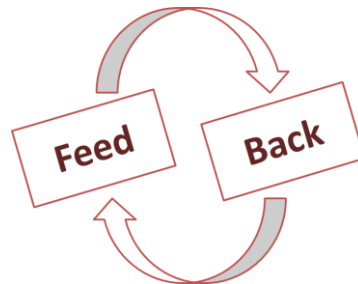
### 3.3.2 Go

Improving the existing Stage Gate Process required a significant communication with stakeholders and auditing R&D project.

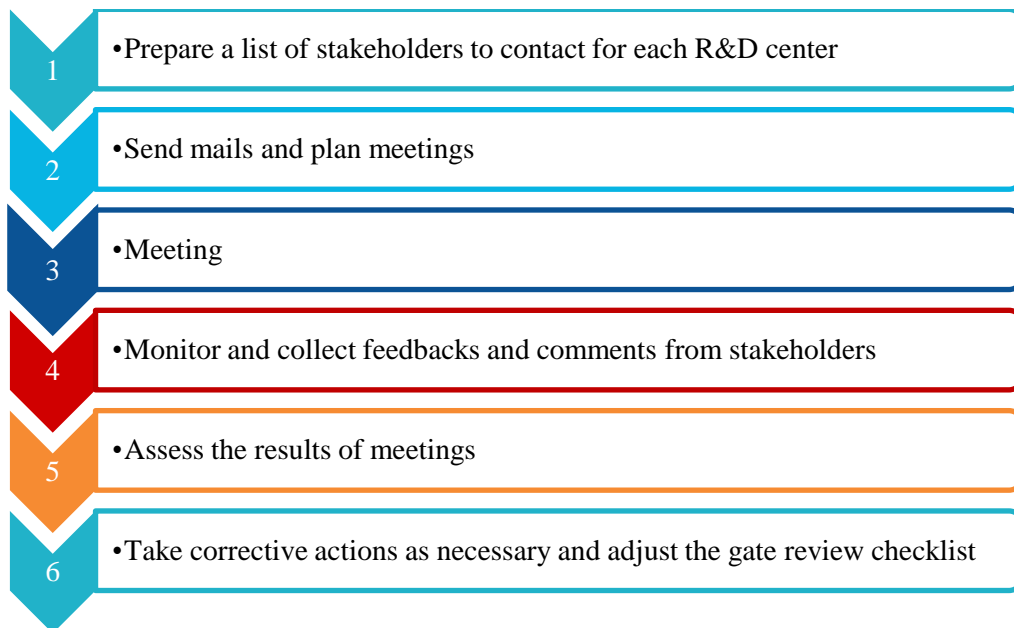
#### 3.3.2.1 Communication with stakeholders

The method adopted was agile: interviewing and meeting the stakeholders was the key success to implement the new gate review tool. In fact, effective communication keeps the stakeholders engaged and motivated. It has also played a crucial role to identify the root causes of the existing system's weaknesses.

Gathering constructive feedbacks from stakeholders helped to implement the necessary corrective actions and make a suitable and operational common tool for the Stage Gate process.



The following flowchart (Figure 15) shows the steps taken to hold the interviews with the stakeholders.



**Figure 15: How to bridge the communication gap? [8]**

The stakeholders involved mainly project leaders (experienced and new), Portfolio managers and Quality managers.

A checklist questionnaire for the meeting was prepared in advance with open-ended questions as follow:

1. First feedback about the proposal of the gate checklist's new version (Format, sections ...)?
2. Is there any incomprehensible question?
3. Do you consider this question mandatory or optional?
4. Is there any missed question at this stage that is killer to the project?
5. Do you suggest any other areas of improvement?

Upon response to these questions, corrective actions are undertaken to better fit the stakeholders' needs.

The human factor played a crucial role to make a better adapted Gate Checklists. Meetings were undertaken in 3 different R&D centers: SGR, CRDC and HRDC.

### **3.3.2.2 Project Audit**

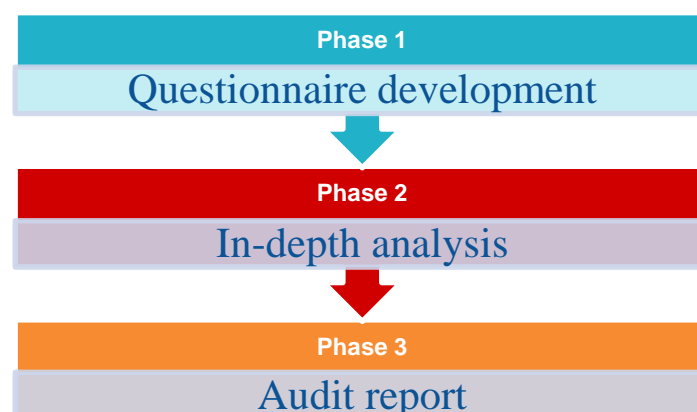
In order to support the feedbacks gathered from the different interviews, a project audit was planned and conducted on a pilot project in the Research Center of Germany HRDC.

The evaluation of R&D projects within Saint-Gobain is based on two criterias:

- Evaluation of the steering committee
- Rating of the project audit

The project audit was conducted by a qualified auditor internal to the organization: the head of quality management in the R&D center of Germany.

The audit is performed in 3 phases and usually occurs after the stage 3 of the Stage Gate process:



### **Phase 1: Questionnaire development (Appendix 5)**

This phase is focused on interviewing the project leader to evaluate the performance of his work and ensure that the major project keys points / needs are met.

The audit checklist is sent to the project manager and other stakeholders (audited entity) in advance so they get informed about the questions.

The interview helps the auditor to get deeper insights into the interviewee's answers and comments.

The checklist questionnaire reflects the project's successes, failures, challenges and missed opportunities.

### **Phase 2: In-depth analysis**

This phase is mainly based on assessing the issues to get the root causes of the problem. Thus, the auditor reviews all the deliverables/documentation of the project according to the checklist questionnaire.

Following this, the lessons learned and action plans are identified in order to improve the performance the project .

The improvement program is monitored by the audited entity and must be completed within duration of 90 days. The auditor monitors the implementation.

### **Phase 3: Audit Report**

This phase consists of collecting the information and consolidating the documentation review. Then the auditor creates and finalizes the audit report and recommendations.

Another audit has to be planned to review the corrective actions and action plans taken by the project leaders and make sure that the deviations have been corrected.

The main objective of a project audit is to identify the action plans that can help improve the performance and yield of a project as well as to improve future projects. Therefore, project audit is highly beneficial and recommended for every organization.

The project audit helped to better assess the weak points of the existing Stage Gate system.

On the basis of the communication with stakeholders and project audit action plans have been taken. A new gate review checklist have been implemented which will be transferred in an ergonomic interface (in progress). The planning of the review and deployment phase is ongoing.

### 3.4 Results and perspectives

The main modification and improvement made are shown in the following table:

Before	After
<ul style="list-style-type: none"> <li>- 2 tools of gate review: Gate checklist (excel sheets), Product Launcher (intranet).</li> </ul>	<ul style="list-style-type: none"> <li>- One common tool: Intranet for the whole process from ideation to Industrialization.</li> </ul>
<ul style="list-style-type: none"> <li>- Heavy tools, Many questions, redundant questions, some poorly phrased questions</li> </ul>	<ul style="list-style-type: none"> <li>- Ergonomic facilitator tool (Intranet) for the Stage-Gate process, streamlined checklists, focused questions and easy to understand.</li> <li>- 4 sections: <ul style="list-style-type: none"> <li><i>R&amp;D</i> to be filled by the R&amp;D project leader.</li> <li><i>MARKETING</i> to be filled by the Marketing responsible.</li> <li><i>PRODUCTION</i> to be filled by the WCM responsible.</li> <li><i>DECISION</i> to be filled by the Steering Committee.</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>- Many deliverables (too much paperwork)</li> </ul>	<ul style="list-style-type: none"> <li>- Fewer deliverables (only the project's killers)</li> </ul>
<ul style="list-style-type: none"> <li>- Problems using the tool</li> <li>- Project leaders are left on their own and gathering project data and managing documents on their way.</li> </ul>	<ul style="list-style-type: none"> <li>- Strengthened training of the project leaders to the new tool.</li> </ul>
<ul style="list-style-type: none"> <li>- Project leaders not very involved and motivated.</li> </ul>	<ul style="list-style-type: none"> <li>- Raising awareness about the importance of the new tool to better manage projects and involvement of all project leaders from the different R&amp;D centers.</li> <li>- Informing and involving all project leaders from the different centers.</li> </ul>
<ul style="list-style-type: none"> <li>- Templates for deliverables proper to HRDC and CRDC</li> <li>Templates do not exist for other R&amp;D centers</li> </ul>	<ul style="list-style-type: none"> <li>- Common templates for deliverables to be used by all the R&amp;D centers within SGG (useful guide to help structure the bare essential information)</li> </ul>
<ul style="list-style-type: none"> <li>- The gate checklists are filled by the Project leader</li> </ul>	<ul style="list-style-type: none"> <li>- The new tool is filled by all stakeholders</li> </ul>

**Table 2: Comparison table before and after optimization [8]**

A sample of the new gate checklist is presented in Appendix 4. The objective of this improvement is the creation of a well-defined common process.

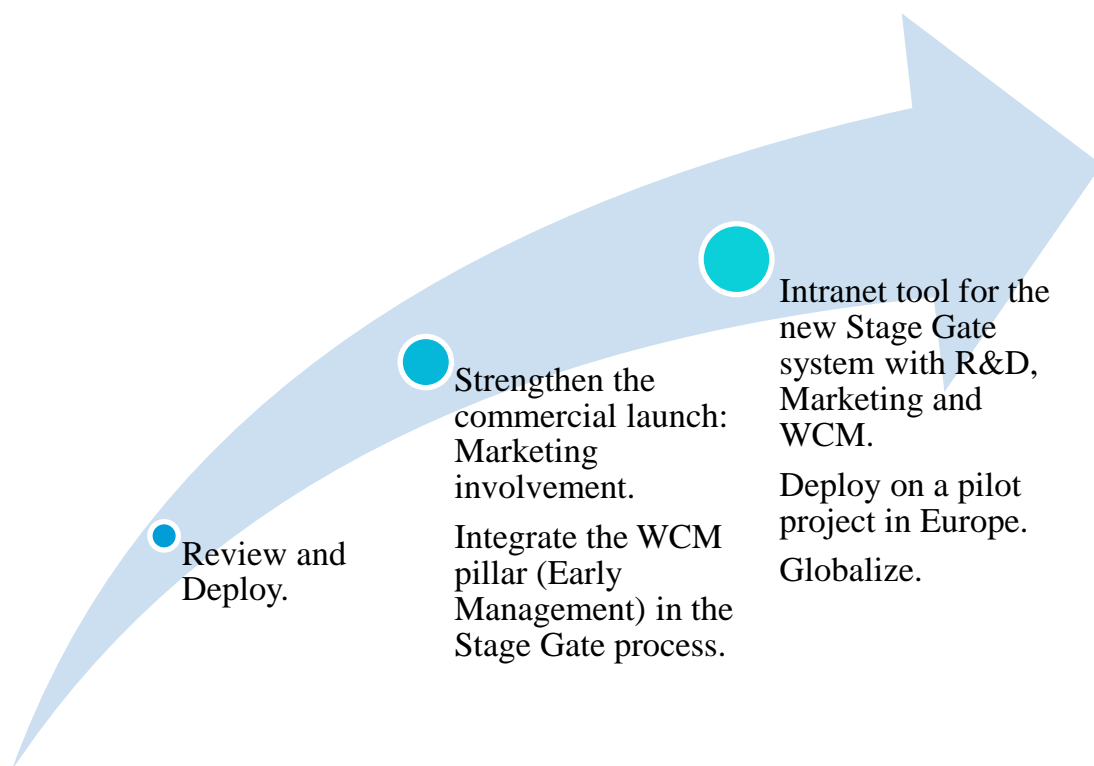
This new version of the checklist will be finalized and validated during a meeting with a working group composed of the quality managers of the different R&D centers.

The action plans of this meeting:

- Discuss the new version of the checklists
- Corrective actions
- Plan the release of the final new version to the stakeholders
- Plan the training of stakeholders
- Discuss the integration of the WCM pillar in the Stage Gate Process
- Deployment on a project
- Transfer the checklists in an ergonomic interface

At this point of the mission the two phases of the SGRD were fulfilled successfully: SCREEN and GO.

The perspectives of this project are described in Figure 16:



**Figure 16: Perspectives of the project [8]**

## CONCLUSION

This thesis outlines the details of the Stage Gate process for new product development. It has tackled a challenge within one of the most innovative companies, an initiative to improve its existing system. A new agile approach has therefore been built approach to manage projects with all R&D centers of Saint-Gobain Glass.

The method adopted was agile based mainly on engaging the key stakeholders to solicit their inputs and feedbacks for a better change management.

As mid-term vision, Saint-Gobain Glass plan to foster the marketing involvement in the Stage Gate process and integrate the Lean Manufacturing pillar :” Early Management” at the end of this process.

As long term vision, Saint-Gobain Glass will implement the tool for the new Stage Gate process in an ergonomic intranet and deploy this on a pilot project to finally achieve its objective which is putting in place an operational and common tool for all R&D centers within Saint-Gobain Glass.

Upon completion of the internship I have acquired skills at the interpersonal and professional level (Appendix 2):

- Improvement of communication skills (French and English skills)
- Increase of autonomy
- Project management
- Autonomy
- Self-control capacity
- Confidence
- Put in practice the Quality tools
- Keys points to manage R&D projects (technical vocabulary ...)

It was no doubt a valuable experience which allowed me to discover new horizons. My previous professional experiences were mainly focused in laboratories and thanks to my internship within Saint-Gobain I have learned what are beyond laboratories and what is the purpose of Research and Development and what comes next: A whole step by step process. I therefore have learned the methodology of conducting R&D projects and their key elements.



The mission assigned was challenging. I had to and implement a tool for 8 R&D centers of Saint-Gobain Glass Industry. To fulfill this, I had to coordinate with employees at every layer mainly project leaders from different centers and countries. I had to make sure that all stakeholders are engaged and well informed about the change.

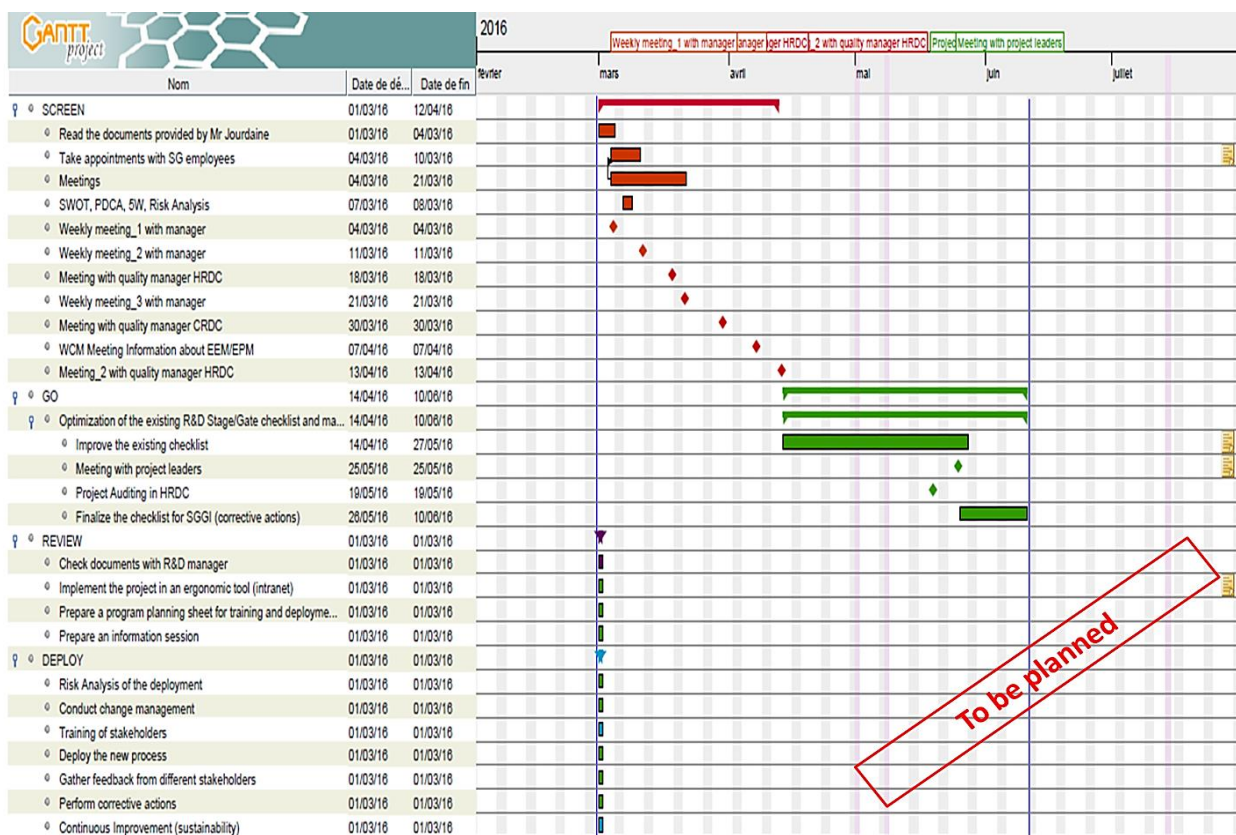
Thanks to this, I have learned how to conduct a good project management. Moreover, I strengthened my leadership skills and professional communication.

As a graduate in Industrial Chemistry with double major in Quality Management, my interest in working in innovative companies became stronger. Developing my technical and management skills for a better innovation is now at the heart of my professional objectives.

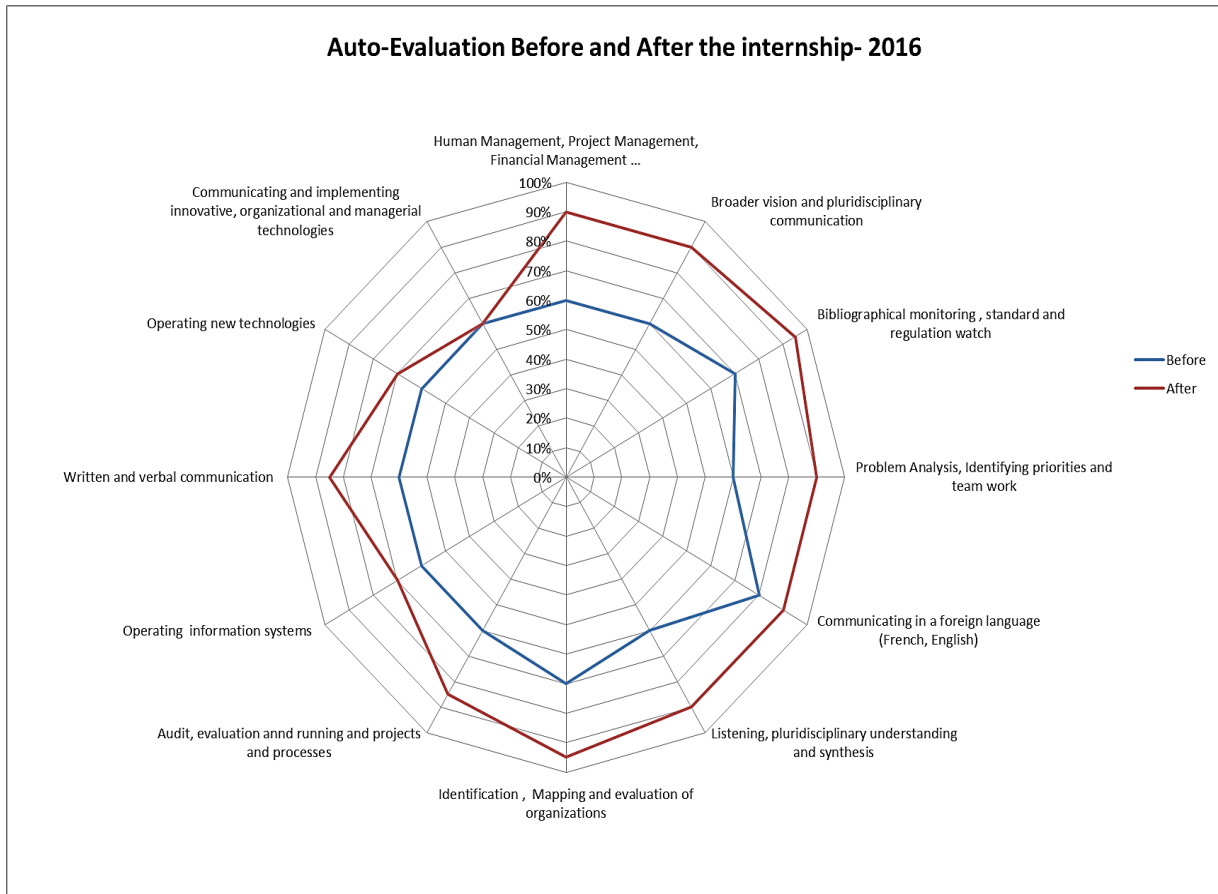
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## APPENDIX



**Appendix 1:** Gantt Project planning for the internship



**Appendix 2:** Auto Evaluation before and after the internship

Gate-Checkliste (xRDC) +SGR											For Doc.Code see Sheet Tab: "Quality Code"	
4. Stage 3 > Gate 4 Development											Remark	
4.0 Gate criteria	Responsible	Document (link to document)	Validated by	Date of validation	No	Under-way	Yes	Not relevant	Template xRDC	Template CRDC	Remark	
<b>4.1 Management/Clearness</b>												
4.1.1	In case of a change: Are the new Project leader or SC members confirmed, inclusive of responsibility and authorizations?	Hyperlink to nomination										
4.1.2	Has the project plan been updated?	Project Plan										
4.1.4	Has the monthly project report been written?	Project Report										
4.1.5	Has the cost monitoring of project been updated?	cost monitoring										
<b>4.2 Sales /Marketing</b>												
4.2.1	Have the intended selling price and sales volume been established and approved by Sales?	Rough volume plan & selling price update (Project data sheet update)										
4.2.2	Has the probable profit for the first five years of sales (business plan period) been estimated?	Market study (Update)										
4.2.3	Have the target margins been met?	Market study (Update)										
4.2.4	Have potential competitors' response (initial or secondary) to the new product been anticipated and strategy to address these concerns prepared? Has a competitive analysis been benchmarked?	Market study (Update)										
<b>4.3 Capital investment / Controlling</b>												
4.3.1	Will the potential payback justify any R&D and Capital investment? Are the standard production costs and bill of material costs included?	ROI/NPV calculation (Update)										
4.3.2	Have the estimated manufacturing costs and invest been analyzed and are they acceptable?	ROI/NPV calculation (Update)										
<b>4.4 Patent</b>												
4.4.1	Saint-Gobain IP : - Have you checked that all new developments of the R&D product / process are covered by the existing patent applications? - In case you have found a new technical solution and/or an alternative, did you file the corresponding invention disclosures (ID 's)?	SC presentation										
4.4.2	Third party IP : - Have you reviewed the search terms of the patent watch? - If you have identified highly relevant 3rd parties' patents, have you informed your Steering Committee? - In case of highly relevant documents, have you prepared an appropriate action plan with the BU IP Manager?	Patent survey (Update)										
4.4.3	Collaborations: If a collaboration is needed: - Has the collaboration contract been signed? - Are the SC slides fully completed?	E-Mail in Livelink file and Project data sheet cell C56										
<b>4.5 Technical feasibility</b>												
4.5.1	Have the results of process/product testing (internally) and/or externally performed (e.g. customers) been reviewed? Are the results of the trial production acceptable (by quality representative)?	Feasibility statement (Update)										
4.5.2	Is there a detailed process/product specification available?	Process/product specification in Livelink										
<b>4.6 Purchasing</b>												
4.6.1	If the purchasing sensitivity is confirmed, has the specific purchasing organization acted as requested by SC and what are the results?	Meeting reports with purchase targets in Livelink file										
4.6.2	Has the project leader been requested a supplier audit to the Supplier Development Manager. Has Purchasing qualified the choice of supplier(s)? Has been the SGI-suppliers-panel taken in account ?	E-Mail in Livelink file										
4.6.3	If new suppliers or new type of components/raw materials will be purchased for this new product or process project, have you engaged specific contract with potential suppliers (NDA/JDA, ...)?	Official Document signed in Livelink file										
4.6.4	Has the project leader been informed his team that they have to keep care of the purchase specifications/restrictions and the supplier charts?	Signed declaration of team members										
4.6.5	Are the planned providers of purchased parts listed in the approved list of purchasing for provider?	List of purchasing for provider. Printed SAP or Easy order list in livelink										
<b>4.7 Legal / Ethical / Environmental</b>												
4.7.1	Does the product fulfill regulation compliances (e.g. CE, ECE, WEE, UL, ...)?	Feasibility statement (Update)										
4.7.2	EHS check-list: following rule applies - no "unknown" item (meaning that item has not been investigated) - no "very unfavourable" item. - "to be assessed" is tolerated (meaning that item has been investigated but information is not sufficient to yield	Updated HSE checklist										
<b>4.8 Quality</b>												
4.8.1	Have the specific requirements of customer been included and considered?	Feasibility statement (Update)										
4.8.2	Has project leader been informed his team that they have to keep care confidentiality if development happens by order of customer?	Signed confidential declaration of team members										
4.8.3	Have the first product (design) FMEAs been done? Are actions defined and reported to steering committee?	Product FMEA by use of Program										
4.8.4	Have the first process FMEAs been done? Are actions defined and reported to steering committee?	Process FMEA by use of Program										
4.8.5	Has a rough estimation of process capability been done?	Perhaps QS-STAT analysis onk value 50pcs										
4.8.6	Are all necessary test procedures defined and/or test devices available for evaluation of product performances and are they proofed?	MSA E.g. Q-DAS Solara analysis										
<b>4.9 Outputs</b>												
4.9.1	YES (go) / UNDERWAY (recycle) / UNDERWAY (hold) / NO (kill)? If "hold", save the Livelink Project file into the folder HOLD If "kill", save the Livelink Project file into the folder TERMINATED, If HOLD are TERMINATED inform the appropriate Q- and administration managers	Minutes Steering Committee Meeting										
4.9.2	Have the objectives for next stage been defined and the next milestone date?	Minutes Steering Committee Meeting										
4.9.3	Has the degree of satisfaction for the project been determined and forwarded to the R&D management assistance?	Minutes Steering Committee Meeting										

Appendix 3: Old gate checklist (excel format)


### Gate-Checklist (xRDC) and SGR

GATE 4 REVIEW MEETING	
Name of Project	
Business Unit	
Project Leader	
Team Members	
Steering Committee	
Present Stage	
Date of Meeting	



4.	Stage 3 > Gate 4 = Development	RESPONSIBLE	FUNCTION OF RESPONSIBLE	YES	UNDERWAY	NOT RELEVANT	VALIDATED BY	VALIDATION DATE	DOCUMENT	REMARK
<b>R&amp;D</b>										
4.1	<b>Management/Clearness/Strategy</b>									
4.1.1	Has the project plan and budget been updated ?								Project Plan	
4.2	<b>Technical feasibility</b>									
4.2.1	Has a final production site been identified ?								Feasibility statement (Update)	
4.2.2	Are the results of the trial production acceptable ? Is E0 validated by marketing, production and quality ?									
4.2.3	Have the detailed specifications of the product been defined?									
4.2.4	Has the technical benchmark of competitors' products been updated ?									
4.2.5	Has a rough estimation of process capability and production process been done?								Process/product specification in Livelink	
4.2.6	Is it necessary to modify the set up of the line or change the process ?								New process study	
4.2.7	Do we need additional process follow up on line ?									
4.3	<b>PURCHASING</b>									
4.3.1	If the purchasing sensitivity is confirmed, has the specific purchasing organization acted as requested by SC and what are the results?								Meeting reports with purchase targets	
4.3.2	If new suppliers or new type of components/raw materials will be purchased for this new product or process project, have you engaged specific contract with potential suppliers (NDA/JDA...)?								List of potential suppliers and contracts with SGG	
4.3.3	In case of specific purchase : Are the planned suppliers listed in the approved list of purchasing?								List of purchasing for provider. Printed SAP or Easy order	
4.4	<b>QUALITY</b>									
4.4.1	Does the product fulfill regulation compliances of SGG?								Compliance documents (e.g. CE, ECE, WEE, UL...)	
4.4.2	Have the first product (design) FMEAs been updated? Are actions defined and reported to steering committee?								Product FMEA	
4.4.3	Have the first process FMEAs been done? Are actions defined and reported to steering committee?								Process FMEA	
4.4.4	Is a control plan (tests and frequencies) defined?								Control plan sheet	
	Has the validation plan been implemented ?									
4.5	<b>PATENT ISSUES</b>									
4.5.1	Has the patent issues' analysis been updated ?								Patent watch (update)	
4.6	<b>Legal/ethical/environmental issues</b>									
4.6.1	EHS check-list: following rule applies - no "unknown" item (meaning that item has not been investigated) - no "very unfavourable" item; - "to be assessed" is tolerated (meaning that item has been investigated but information is not sufficient to yield								Updated HSE checklist	
<b>MARKETING</b>										
4.1	Has a competitive analysis been benchmarked?								Market study	
4.2	Have the intended selling price and sales volume been established and approved by Sales?								Rough volume plan & selling price update	
4.3	Has the marketing data (NPV /RBC /Volumes ...) been updated?								ROI/NPV calculation (Update)	
4.4	Have the target margins been met?									
<b>MANUFACTURING</b>										
4.1	Have the manufacturing costs been estimated ( fix and variables )/S volumes scenarios ?								Production costs	
4.2	Has the preparation with pilot production with industrialization team been done ?								Production Plan	
4.3	Do we need an investment to reach the volume mentioned by the commercial plan ? If yes Capex estimation ?								Potential CAPEX	
<b>DECISION</b>										
4.1	Go / No-Go (kill) / Rework / Put on hold?								Project review with steering committee	
4.2	Have the objectives for next stage been defined and the next milestone date?									

### Appendix 4: New gate checklist (excel format)

 <b>SAINT-GOBAIN</b>	<b>Formblatt</b> (Checkliste Projektaudit)		D-K01-FB-RD0106 Seite 1 von 1
	<b>Internal audit report (HRDC)</b>		
Document is not signed and is valid only in electronic form on the SGSD repositories. Copies are only informally and are not subject to document control!			
Question	Relevant? J / N	Deviation <b>yes/no</b>	Comment
Is the Flat Glass Tool correct and completed? When was the tool updated the last time?	J	no	
Is the EHSR Form in the FG Tool currently correct?	J	no	
Is the Purchasing sensitivity in the FG Tool evaluated?	J	no	
Is the NPV Calculation done (Power point NPV presentation and calculation of 2 szenario)	J	no	
Has been installed the Patent Watcher and has been done the Prior Art Search? Has been applied the FTO in stage 3.	J	no	
Are all datas on the page "Project data sheet" of the Gate Checklist accurate and correct fulfilled and is the defined timeline plausible?	J	no	
Is there a validation plan available? Is the validation plan implemented in the product specification? (Check samples)	?	no	
Is a feasibility statement of the last stage available (evidences) ?	J	no	
Is a product and a process specification available? Is product specification for raw materials available?	J	no	
Is the risk evaluation (Design & Process FMEA) done and are the actions in time?	?	no	
Is the project plan / and are all the detail action plans available and currently correct ?	J	no	
Are the measurement reports of the trial runs and product validations correct? (check measurement equipment, dates and goals and organisation of data saving in Livelink)	J	no	
Is the gate checklist fulfilled? (Check the hyperlinks and evidences of some questions)	J	no	
Has been considered the Initial Validation Run to be "Ready for RFQ" (Automotive Request)	J	no	
Check some older steering committee minutes and check the evidences of the defined objectives.	J	no	
What are the last 3 results of steering committee meetings and was the the right form for steering committee used?	J	no	
Is the project properly sorted and organized in Livelink? (Folders and datas easy to find for the Auditor?)	J	no	
Is the project manager able to find and open all the instructions of his service / department?	J	no	

### Appendix 5: Project Audit Checklist questionnaire