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Portfolio Management applied at manufacturing product
development pipe: a case of study

Professor
Paolo De Magistris

Candidate
Alessandro Bordoni

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Presentation of the context of incoming Sumiriko

This project is the summary of two important experiences and in the company SumiRiko Italy SpA of Chivasso:

- The first is the construction of a platform aimed at the reorganization, optimization, and digitization of one of the main strategic processes: the "Tests and Controls" portfolio process of the Laboratory area
- The second is the construction of an analysis' and monitoring' model for the main corporate projects' portfolios

Sumiriko is a Society of the Sumitomo Riko Group, a Japanese company that produces rubber and other synthetic resin products, designs, develops and manufactures a wide range of systems, subsystems, and components for engines and application platforms for all customers who are protagonists of the automotive sector at a global level. Sumitomo Riko Company Limited is a member of the Sumitomo Group (14th place in the ranking of the top 100 OEM suppliers) with over 80 years of experience in automotive components, founded in 1929 it currently has a Capital of ¥ 12,145 million (90 million euros), a Turnover of 3,542 billion euros (fiscal year 2014) and occupies about 24,000 worldwide. Listed on the First Section of the Tokyo and Nagoya Stock Exchanges, TOPIX index. Among its main brands: Dytech (which is part of the HOSE Business Unit) and Anvis which is part of the AVS (Anti Vibration System), Business Unit.

SumiRiko Italy SpA or other solutions for supply pipes, nozzles, carbon filters, SCR, TOC, Air conditioning, Hydro guide systems with a complete portfolio of solutions for Fluid & Gas supply. The company's product line is mainly dedicated to solutions for low power, but also heavy vehicles. It deals with the construction of pipes for the air conditioning circuit inside the car, high-pressure pipes for the flow of liquid substances such as oils or other types of materials and, various types of canisters for the transport of fuels. The main components produced are A/C Lines + IHX, Brake Booster, Canister, Clutch Lines, Cooling Lines, Filler Neck, Fittings, Fuel Damper, Fuel Lines, Hydraulic Hoses, P/S Lines, Rubber Hoses, SCR Lines, TOC & Oil Lines, Turbo Hoses, Vacuum Lines & Tanks Essa. SumiRiko is a key partner for major OEMs such as FCA, GM, VW Group, Renault Nissan, PSA, Mercedes, Toyota, Honda, Ford, Vaz, Gaz, CNHi, Paccar, Daimler, and Man.

The company considers "efficiency" a crucial element, both in terms of costs and timing, operating to meet the highest OEM standards and to improve service with the highest quality and reliability, integrating a "lean" production line aimed at zero contamination with a highly automated production line. **SumiRiko** has 80 people including designers, experts in R&D, quality, prototyping, and laboratories for materials, Proto-shops, and Road-Testing departments. Every year 4.5% of turnover is reinvested in innovation and research.

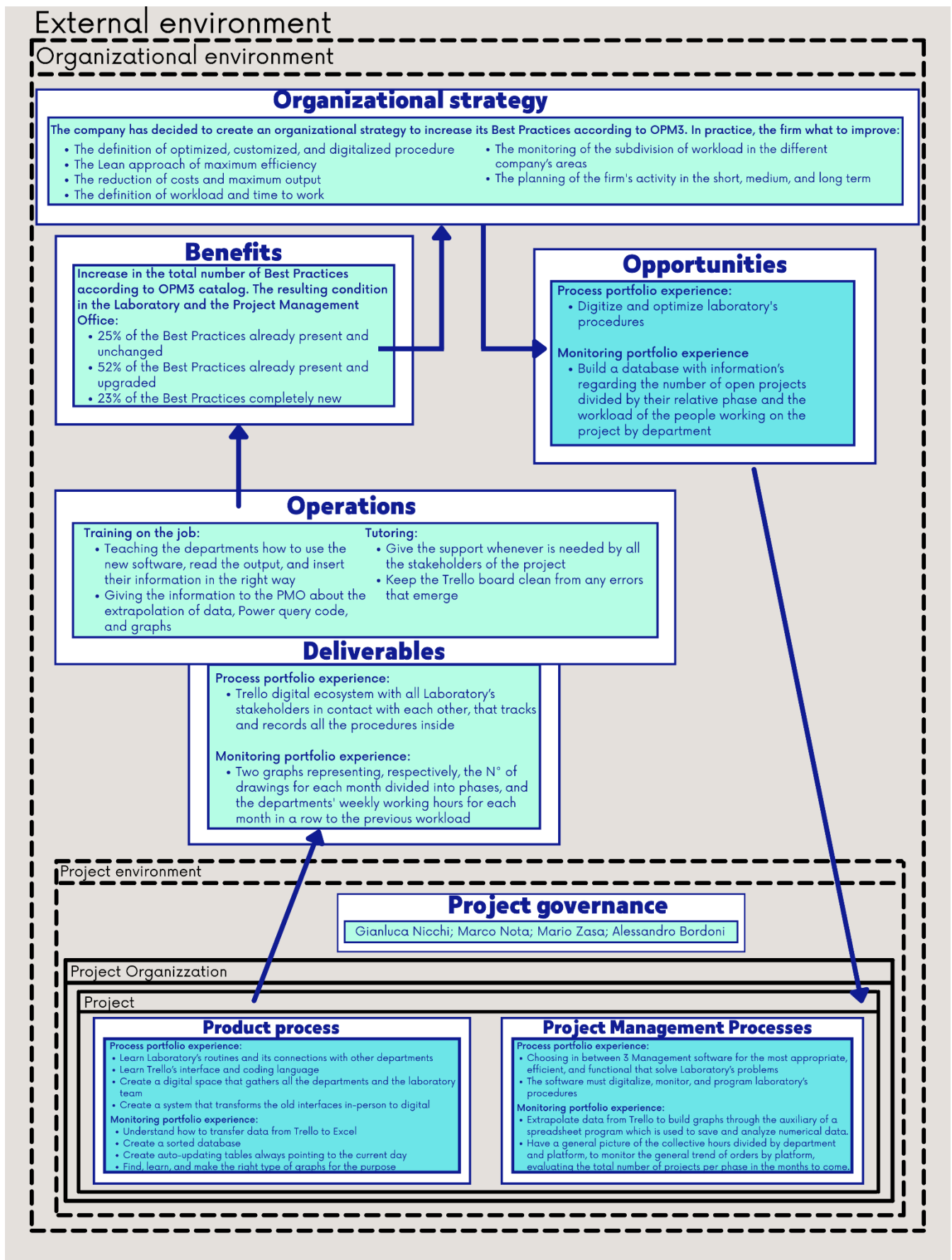
As a leader in Fuel&GAS technology, the company's activity includes product development with in-house design methodology, experimentation, and optimization of production capacity. Specifically, these last functions are carried out thanks to the key activity of the Research and Development process, in synergy with the company wing dedicated to Tests and Controls on Part Number, or laboratories. In fact, the competitive key of SumiRiko is the ability to support the global strategies of customers by offering customized solutions, products, and services at the forefront of the market, using innovative technologies that consider safety and costs, in constant collaboration between the divisions of the various platforms and the entire Sumitomo Riko Group. The strategic processes, therefore, of SumiRiko are R&D and "Tests and Controls" that allow designing prototyping create complete systems in close collaboration with the Manufacturers.

For this reason, the company's needs are focused on the constant improvement of activities in these processes, the definition of optimized, customized, and digitized procedures with a Lean approach of maximum efficiency and effectiveness, cost reduction, clear definition of working times, zero waste, maximum efficiency of operations. In this direction, a specific intervention was requested, a project capable of optimizing and making digital the procedures in the LABORATORY department in order on the one hand to define automated procedures that would guide the operators and allow them to contemplate all the phases of Tests & Controls of the various unique pieces, on the other to optimize the activities by creating planning capable of rigorously defining delivery times.

Therefore, the present work has focused on the analysis of the LABORATORY department, contemplating, and analyzing mainly the **Tests & Controls portfolio process**, with the various referents from the beginning of the analysis to share the innovations in a Bottom-up logic, making them operationally feasible and above all of the convenient application.

At the same time, the company, in its position as a "solution provider" thanks to which it designs, tests, and creates complete systems in close collaboration with the R&D departments of the Manufacturers, has demonstrated the need to monitor the various projects in place to analyze the phases, understand the division of workloads in the various business areas to effectively plan business activities in the short, medium and long term. The analysis and study carried out in this direction involved the Project Management Office which allowed to develop the part of the experience called **Portfolio Monitoring**.

Project overview scheme



Experience of the portfolio process “Tests & Controls”

As anticipated, the path within the Sumiriko company started from specific needs in the laboratory area.

The main need was to make changes to the planning of requests, monitoring delivery times. Requests for tests received by the laboratory refer to Tests on Part Number to verify the conformity of a material or the reliability to perform a certain function with certain boundary conditions.

Strategic relevance of the laboratory

The laboratory is a business area to which all areas of the company and partner companies can turn to ask for analysis on any component. The main processes that need these analyzes are:

- Research & Development
- Plant Quality
- Quality Acceptance
- Warranty & Client

Each of these bodies has the right and the duty to ask the laboratory for tests with the aim of "specific" analyzes that verify and confirm the assumptions "upstream" on the design and performance of the components, analyzing the specifications, the moments of structural failure and rupture identifying causes, durability, and other parameters of performance effectiveness.

The specifications are a series of written requirements that the component must meet in order to be consistent with the regulations in force in the various countries of destination and to be able to operate under certain conditions of use. These are presented as the answers to an ordered sequence of tests to be carried out, which must correspond to unambiguous and precise results at the end of the tests. Many times, the specifications are directly created by the customer who orders the pieces, other times they can refer to "standard" indicators that follow our ISO reference. When all the tests present on a specification are performed on a sample, then such a request is called "validation", otherwise, in case it is not necessary to request all the tests within the paragraphs, the request can also be called "special test".

The Research & Development area issues requests for the performance of tests on Part Number generally performed on specimens called "prototypes" with different purposes. The analyses on the prototypes are built and ad hoc to assess whether the sample meets the basic specifications requested by the customer and whether in the future this type of design could be suitable for the required function and are called "special analysis". The R&D area may require you to evaluate Off Tools (OT) or Off Tools of Process (OTOP) samples. OT specimens are samples that have passed the first phase of prototyping and have been built with the equipment that will then be used to produce the quantity requested by the customer, usually on the order of thousands. This step is essential to see if the equipment is compliant and if it can be used to create parts that meet the specifications and requirements agreed upstream with the customer. The OTOP specimens as well as being made with the equipment that is often used and will be used for the mass

production of the object, are also the result of a defined production process that, to be compliant, must also be respected during the production phase. In this way both the product and the process are tested, therefore both the conformity of production through the machinery and the production process and the production chain for the realization of that particular component, analyzing any illicit steps that lead to non-conformity.

The other area that makes a large number of requests to laboratories is Quality, divided into Plant Quality and Acceptance Quality. The first, Plant Quality, monitors the quality of the products coming out of the company's production line, makes sure that the production processes comply with the regulations imposed by the body that certifies it and interfaces with the customer in case of problems on the pieces shipped. This area may require tests to verify the quality of production at the request of the customer or periodically in order to see if there are problems along with the production and to monitor that each element continues to be produced as agreed. The tests requested by the customer have greater importance and are called "special analyzes", while the tests that are conducted periodically to evaluate the reliability of the machinery according to the standards required by the certifying body, are called "periodic requests", have specific tests to verify the peculiarities of the machinery and are often conducted twice for each machine present in the plant and which is placed on the production line (excluding those of minor importance). For this last test, the Plant Quality process can issue "urgent" requests, linked to a possible production block due to a failure or to feedback received from customers. The Quality Acceptance checks the incoming and departing goods. It may also require specific tests on batches from suppliers, periodically or subspecific indications of customers, who may have encountered problems with the products purchased. It goes without saying that even in this case it happens that requests for evidence take on the character of urgency.

Even the "Warranties and clients" area requires tests and checks on products in the laboratory area, which are almost always a priority because they serve the product sold. Warranties is the area that deals with returns whose operators are always in contact with customers and must verify the reason for the returned goods, justifying the incident or proving that the component has come to failure due to external forces independent of those for which it was designed. These requests are called "claims" and are always urgent. In fact, it happens that they often move forward to all the scheduled or other tests, having a higher priority. This is one of the mechanisms, together with that of urgent quality tests, that leads the laboratory to have planning problems, as it happens several times during the month that planned trials, or even ongoing, are postponed or interrupted to respond to the priorities of this area. It is an inevitable mechanism, as explained in this paragraph since these urgent tests, depending on the reactivation of production (in a state of partial or total downtime) and / or the evolution of a concurrence of faults that could also continue with important criminal complaints by customers. At the same time, the unexpected insertion of these tests causes great planning difficulties in the work of the laboratory with delays in deliveries and discrepancies in

time that make the whole company lose credibility due to its knock-on effects. The area that most of all suffers delays and complications is Research & Development, which sees many of its requests postponed compared to the agreed delivery date, with an obvious impact on the expiry date of the projects established with customers.

Situation before the project

The laboratory is managed by a few months to a manager who took over in Sumiriko with the role of monitoring, coordinating, and directing the activities of the laboratory to improve the organization. In the work area of the process "Tests & Controls" operate a manager and 10 technicians.

The manager receives requests, defines time, and resources, plans activities by delegating operational tasks to the operators daily, takes care of the definition of priorities, and controls the final reports. When the task is completed, the work is recorded in an Excel file that lists the jobs done and finished.

In particular: requests arrive at the test manager by email or, if urgent tests, by direct contact to the mobile phone to start the test immediately. The laboratory takes charge of the request and based on the urgencies and delays in the work, the manager decides what to carry out and what to start. The emails contain the "templates" for requesting the tests, with all the information necessary for the technician in order to perform the appropriate tests. The tasks are divided by the manager at the beginning of the day to the various laboratory technicians, following the main criterion of urgency. Each technician carries out the tests according to the criteria agreed with the manager and produces the reports of the end of work. Requests are collected and stored as word or Excel files in a folder differentiated according to the department: Research & Development, Quality, Warranty & Client. Once the request issued has been completed and the report for each test is finished, the latter is sent by email to the applicant and filed in folders according to the department. An Excel file is updated that shows all finished jobs.

Critical issues detected

This type of organization does not allow to predict delivery times with at least a good approximation, primarily for non-urgent requests. This stemmed mainly from the fact that, in the definition of delivery times, the multiple urgent requests are taken into account in a reductive and/or approximate way, since there is no method that allows estimating future urgent or non-urgent requests based on objective data and time series. There is no method to track future and potentially urgent requests nor to know in advance the saturation of the machinery and the laboratory except immediately. There is no planning method that reports the time needed on the various workbenches for each type of test so that estimates and analyzes can be made to plan the activities also based on the coverage of the resources present. There is no objective and shared vision of the situation of the activities, all in the hands of a person, since the work to be carried out is not traced with times, types of tests, machinery required, resources to be used. The requests are only described in the emails while the urgent ones sometimes do not even have writing to

refer to being made by telephone. There is therefore no planning of the work in progress, of the deadlines, of the resources, of the times, and above all the progress of the work, considering the fact that some tests can last months. The range of time, in fact, in which a work of "test and controls" is concluded can vary from one day to months.

To get an idea of the critical issues we wanted to understand the extent of the work in the laboratory, so how many jobs per day and how long a job lasts on average. We started from how many emails on average per day are presented in the mailbox, this analysis was conducted through a cross-check of the emails present in the mail folder of the managers of the laboratory area over the monthly period, then an average was made by dividing the total by the number of working days of the same month. It turned out that an average of about 37 emails arrive at the laboratory every day. From there, having ascertained the maximum number of requests issued between the year 2019 and 2020, it was possible to deduce that the emails concerning NEW REQUESTS for evidence are on average about 3 per day. A rather important number for which scheduling of the timing of requests is urgent and necessary for more reliable and safe execution of the work.

Another very important factor of which there is no objective trace is the average time that each type of test takes on the various benches or machinery to identify the saturation capacity of the laboratory in the short and medium-term and which machines are primarily involved based on tests and urgencies.

Job proposal and expected results

The project concerning "the management of the process portfolio" therefore starts from the request for a general efficiency improvement of the laboratory management area.

Given the difficult situation in which this area finds itself, always in trouble but always late with important consequences for the well-being of the operators and the credibility of the company, the team leader of the laboratory requires the management of prototyping that allows the monitoring of activities to define certain times and establish the progress of each project taken in charge by the Laboratory. Hence the inclusion of my figure, as a trainee, which would allow identifying a light planning system, shared with the operators so that it was then really used in a transversal, transparent and objective way so that the information did not reside in a single figure of the laboratory staff but was shared and traceable.

In the first place, the company needs a tool or a method that allows it to identify the works in progress, describing the times and methods of realization, a method that allows to optimize the flows of requests expiring the progress and potential delivery times. The optimization of requests must include the possibility of having a database in which in real-time all the required proofs can be found divided according to status and date. The expected result is to promptly identify the status of the test (concluded, started, or to be started) without having to check in several different folders and among a multitude of files to deduce it.

From here a database has been created that includes all the tests and allows, thanks to specialized functions, to understand the status of a test and its progress.

It is also necessary to create a "timeline" that allows you to monitor the influx of requests involving a certain type of bench or machinery. This is precisely to plan the use of internal equipment and possibly require the organized intervention of external suppliers. Therefore, avoid scenarios of overallocation of tests on a finite resource that lead to accumulating many similar requests on the same equipment with the consequent impossibility of completing everything without delay, with the awareness of the possible need to outsource certain tests by entrusting them to external laboratories and notifying them in advance. Organizing this type of work allows you to manage the tests in the long term and to know the workload, the division of tasks, and the saturation of the benches and machinery, controlling the allocation of testing resources based on a variable workload both in volume and characteristics. Each set of tests is considered as a project because the product development process is managed as projects and the tests fall within these.

Another need that must be managed by the system is to organize priority requests according to planning and urgencies to avoid forgetting imported requests or losing sight of those considered less urgent and at the same time give a more precise categorization of the types of tests and their deadlines. Precisely to keep track of all open and expiring requests, it is considered necessary to have an "alert" system capable of notifying with an email all the figures involved and interested at the agreed time of starting the test and at the scheduled closing of the test, according to the Validation Plan. An in-depth development on these requests leads to propose the implementation of the estimation of the duration and preparation of the single test, the number of resources allocated for each test, and the specific progress of the same. The expected result, in this case, is not only a broad view of the situation of the laboratory over time but above all a picture of the situation that perfectly reflects the progress of the individual works during the week and possibly the day.

It is also considered useful to manage the "failures", the remaking of the tests, and the related accumulated delays, keeping track of everything. This indicator is also useful for carrying out the activity of this thesis, inherent in the monitoring of the laboratory through KPIs. In this way, it is possible to extract, from the created history, the key information to ascertain the quantity and reasons for the delays. All this with a view to improving the performance of the laboratory and being able to direct efforts towards those specific areas in which problems have been encountered, and then solve them by knowing the causes that led to those results.

Gap analysis

- **Starting situation analysis**

As reported above, there are four company departments that interface with the Laboratory and have therefore been involved in the study of the project of reorganization, digitization, and optimization of the "Tests & Controls" process: Research & Development, Plant Quality, Acceptance Quality, Warranty & Client.

R&D requests are agreed upon with the laboratory on the available dates and then an end date is decided in unison. The requests to be made are sent and by mail in word format and uploaded to the company's Portland.

Quality requests follow the R&D process, but emails are sent in Excel format and with no expiration date. The most important of these are not periodic tests, conducted on the products of the plant, but usually special tests. These are communicated not only by e-mail with a call to the head of the laboratory since they tend to be urgent, but they also have a variable and unplanned deadline.

There are no procedures in which the working times for the various activities are defined and the planning is conveyed to the manager

The definition of the end and start dates of the work is entrusted to the men of the department to whom it is difficult to estimate the dates of delivery of the tests

Work is initiated based on the overall non-procedural framework of the manager

The tasks to be carried out for the operators are communicated daily by the laboratory head to the technicians.

The works are delivered according to the emergency stresses provided to the department; it often happens that the expected delivery times are not respected

- **The ideal situation, or "potential"**

Create a unique software that can:

Manage requests from the various departments based on estimated urgencies, the workloads of people and plants, the planning of the benches, and the types of work to be carried out

Plan work completion times

Monitor the progress and progress of requests in real-time, who works there, and the equipment and plants used.

Use a single platform that allows requests to be addressed to the laboratory by eliminating other communication channels (emails, attachments, company smartphones) and maintaining the memory of contacts with clients by storing the results

Plan the tests and the tools/benches used according to the times and types of work taking into account the man/plant workloads

Share with all the staff a system that allows all the components of the laboratory to know what work must be updated and by when

Create alerts and notifications that warn, based on the agreed end dates, when the tests must begin.

Keep track and monitor every situation, especially the special and out-of-the-norm ones that divert the times by pointing out the causes inside or outside the laboratory.

- **What needs to be done to get from performance to potential, or "bridging the gap":**

Initially, it was necessary to identify the best platform among those potentially on the market and consequently find a resource that had the right time and the necessary skills to fully analyze and evaluate the performance of each of the alternatives, pruning in the light the pros and cons. This was the first step of my work at Sumiriko Italy Spa.

At the same time, I created a process flow on potential platforms to make an objective analysis and identify the evaluation criteria based on business needs and the results they wanted to obtain. For this reason, teamwork with the managers of the various processes was necessary to fully understand the functioning of the company's procedures and routines. Once this knowledge has been acquired and an innovative routine model of this specific company section has been created, actions have been activated to involve the people who currently work there to make the platform consonant and functional to the needs and way of working of the operators, without prejudice to the results that were wanted to be achieved.

This sharing process becomes essential to make the platform usable, at the cost of some sacrifice in organicity or linearity.

The resources that have become necessary to create a bridge that covers the gap between the current situation and the one desired and shared with the staff are: a resource that deals with studying and evaluating the various software and their licenses, the company procedures of the processes under consideration, the most suitable evaluation criteria, which deals with creating a customized platform based on specific needs capable of contributing to achieving the results envisaged by the company management and shared with the operators of the "Tests & Controls" process, the means and economic resources to acquire the software tool identified, the time of the key figures to collaborate in defining the procedures and activities of business processes.

From what has been described it emerges that the current performance of the "Tests & Controls" process inherent in the Laboratory department could be improved thanks to the help of software programmed ad hoc on specific needs that makes more objective times and workloads, phases, procedures, and methods,

standardizing as much as possible a process that, due to its peculiarity, is not easily programmable and is equipped with specificities that make each operation and or test almost unique. In fact, until now the proposed digital solutions could not adapt to the fluidity of the process and the programming changes of the intrinsic activity of the laboratory. This is not only due to the occurrence of unscheduled events such as urgent tests that interrupt the ordinary programming and the daily life of the calendar but also for the multidisciplinary nature of the tests conducted in the laboratory, which are so many and so specific that they cannot be described in a single list, being divided into several thousand pages of the various specifications, different for each department and customer. Evidence for which the experience, competence, and fineness of the human intellect often make the difference in identifying the right mixture.

Despite this, in the face of the preliminary analysis carried out, it is believed that the implementation of a management software made ad hoc for the laboratory and shared with the operators and the management can definitely improve the situation by increasing the efficiency of all the steps until reaching a good level of reliability compared to what has been considered the main critical factor of the "Tests & Controls" process: delivery times.

Analyzed software

Choice's overview

In the two previous paragraphs, the requests made on the project for the management of the process portfolio of the laboratories were presented and what were the necessary steps and key resources to complete these expected results. This paragraph aims to make an overview of the IT solutions that the company has made available to create the bridge that would bridge the gap between the two situations, the starting one and the ideal one.

At the time of entry into the company, the ways that were being evaluated to meet these needs were: to create a program in Excel for the long-term planning of resources and requests and to apply for a call for tenders for the allocation of funds for the creation of ad hoc software for business management, delegating the creation of the system to an external company. Since the beginning of the project, the possibility of using the "Trello" software as a flexible tool and already widespread in the company, especially in the AREA OF PMO and by the various PMs of the various platforms, has been evaluated. Trello is mainly used for monitoring RFQs (request of quotation) and for planning the phases of a project, from Initiating to Release. The fact that the company had already invested in planning and monitoring software was a plus as it expanded the alternatives to choose from. Despite this, the management software in question was not widespread in the laboratory area and the operators showed a certain distrust in learning new software in an already complex and highly fickle work system. Precisely for this reason, for a long time, the two alternatives of the software licensed by the company (Excel and Trello) were carried out in parallel.

Call "Made"

The possibility of accessing the "Made" call was also studied, an allocation of funds for start-ups, small businesses, medium-sized enterprises, and large companies. The aim was to achieve innovation projects (product, process, and organization), industrial research, and experimental development on the themes of Industry 4.0. In the specific case of Sumiriko, the goal was to find a specialized company that could build a specific software for the laboratory area and that would respond to the requests made in the previous paragraphs.

After a careful analysis of the call, it emerged that it did not entirely cover the company's expenses for the implementation of the new software, and also there was no guarantee of being able to take the subsidy for the beginning of the project, consequently, not even to be among the companies that could have taken advantage of the budget allocated for the call. Despite this, it was decided to continue on this path and find an agreement with the supplier of the software that could allow facing the cost of implementation. By lowering the price many additional functions have been eliminated and the fundamental ones have remained skeleton less. As a result of this, a cost-benefit analysis was carried out and it emerged that even in the case of winning the tender, and therefore of allocating funds, the advantages that a management software with those basic functions would not have justified the investment. Precisely for this reason, the path of the call ended a few months after my arrival.

Excel

This alternative was born thanks to the communication with the accounting office, which possessed a very advanced Excel know-how. The system studied and taken into consideration was the one used by the accounting office to extract information from several parts among the data tables in their possession, to do this pivot tables were used. In the period in which the project has been carried out, the Excel software has always been a constant, since it is evaluated as more intuitive, simple, and known to all. The work carried out focused on the creation of a system that could make the most of the functions of the program, leading it to become a management software for monitoring tests and saturation of resources.

Trello

The opportunities offered by this program were widely discussed and considered in college with the PMO, all the features that could be managed by Trello were illustrated in order to monitor the flow of information entering and leaving the department, the division of labor, and the planning of deliveries. The availability of the people involved in the project in illustrating the internal procedures through a perspective of the organization through software, guaranteed the possibility that even this road could be traveled, despite the lack of practicality of the project members with the software in question.

The role of communication and interpersonal closeness

It is interesting to note how these alternatives have emerged for the efficiency of the management of portfolio processes, both arise from comparisons with people outside the organizational context of the

laboratory staff. It is in fact of fundamental importance to cite the publications and results of the MIT researcher, Tom Allen, who decided to focus on topics concerning the role of communication in innovation and projects, then publishing his findings in a seminal text that remains a key reference in the field (Allen 1977). Allen spoke of "communicative diversity" as the basis for the success of projects. The main idea behind this study was the recognition that interpersonal communication played a key role in suggesting solutions to technical problems, but what kind of communication could guarantee the best results? Going more specifically we find that the researcher was referring to communication concerning colleagues who are not part of the project team or in the same functional area, these interactions produced in his research positive impacts on the quality of the project. Aware of this, the team at the head of the project, as previously described, focused on collecting feedback and useful information in order to promote this phenomenon of "communicative diversity". In addition, it is useful to make a further brief passage on the communication flows between the team that was in charge of the project and the people who were involved and whose advice and indications were heard. Recent studies (Hansen and Lovas 2004) confirm that the exchange of knowledge between organizational units is supported by:

- Previous informal or formal contacts
- Related skills
- Geographical proximity

This means that there is a very important correlation between communication flows and office layouts, this is because there is a strong relationship between physical proximity and probability of communication. It is no coincidence, in fact, that the team was in close proximity to the people who made a great contribution, through their experience, to this project. In fact, all the entities that have had contact or that have interacted and participated in the project are located in the Open Space area. This organization of the layout has guaranteed great flexibility in case of need and not indifferent proximity, all this has contributed to deliver a high-quality project.

Excel Software Analysis

The solution that you wanted to implement on Excel enjoyed the fundamental advantage of using a system known by all, so the resistance to change was low and operators would have considered it already part of their set of work tools, therefore easy to learn.

First, an Excel sheet was created that contained all the important information that the laboratory needed to be able to distinguish the various requests after being issued. Then columns were created for each of the following items: n° request, PTF, CUSTOMER, SUPPLIER, PROJECT, STATUS, RPL, n° P/N, Qualification, Test, N° pieces, Product Eng., Type of request, Type of pieces, start date (Customer), End date (Customer), PRIORITY, Pieces available from, executed by, Start date (SRK), End date (SRK), Report Release, TYPE OF

BENCH, Laboratory.

This was to be the sheet containing all the information and its structure was this:

#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	n°	PTF	CLIENTE	FORNITORE	PROGETTO	STATUS	RPL n°	P/N	Qualifica	Test	N° pezzi	Product Eng.	Tipo di richiesta	Tipo pezzi	Data inizio (Cliente)	Data fine (Cliente)
2	0	PTF_GERMANIA	AUDI	AUDI_Q3_TOC	poe	A	R&D-20-210	5QF317801A	TL82048/15 TYPE B	Leak test	2	Novarese	periodical	OTOP	01/04/2021	05/04/2021
3	1	PTF_GERMANIA	AUDI	AUDI_Q3_TOC	poe	A	R&D-20-210	5QF317801A	TL82048/15 TYPE B	Cleanliness test	3	Prasti	warranties	OTOP	08/04/2021	12/04/2021
4	2	PTF_GERMANIA	AUDI	AUDI_Q3_TOC	poe	A	R&D-20-210	5QF317801A	TL82048/15 TYPE B	Surface protection testing	2	Novarese	special	OTOP	01/04/2021	05/04/2021
5	3	PTF_GERMANIA	AUDI	AUDI_Q3_TOC	poe	A	R&D-20-210	5QF317801A	TL82048/15 TYPE B	Tensile test	1	Prasti	warranties	OTOP	15/04/2021	16/04/2021
6	4	PTF_GERMANIA	AUDI	AUDI_Q3_TOC	poe	A	R&D-20-210	5QF317801A	TL82048/15 TYPE B	Burst test	3	Novarese	periodical	OTOP	01/04/2021	05/04/2021
7	5	PTF_GERMANIA	AUDI	AUDI_Q3_TOC	poe	A	R&D-20-210	5QF317820A	TL82048/15 TYPE B	Leak test	2	Sangiovanni	analysis	OTOP	01/04/2021	05/04/2021
8	6	PTF_GERMANIA	AUDI	AUDI_Q3_TOC	poe	A	R&D-20-210	5QF317820A	TL82048/15 TYPE B	Cleanliness test	3	Novarese	warranties	OTOP	08/04/2021	12/04/2021
9	7	PTF_GERMANIA	AUDI	AUDI_Q3_TOC	poe	A	R&D-20-210	5QF317820A	TL82048/15 TYPE B	Surface protection testing	1	Prasti	analysis	OTOP	01/04/2021	05/04/2021
10	8	PTF_GERMANIA	AUDI	AUDI_Q3_TOC	poe	A	R&D-20-210	5QF317820A	TL82048/15 TYPE B	Tensile test	5	Novarese	analysis	OTOP	15/04/2021	16/04/2021
11	9	PTF_GERMANIA	AUDI	AUDI_Q3_TOC	poe	A	R&D-20-210	5QF317820A	TL82048/15 TYPE B	Burst test	1	Prasti	analysis	OTOP	01/04/2021	05/04/2021
12	10	PTF_GERMANIA	PORSCHE	Periodical Canister	coir	???	R&D-20-36	7P5 201 801	TL 820 19	Pressure Drop	5	Novarese	periodical	OTOP	01/04/2021	05/04/2021
13	11	PTF_GERMANIA	PORSCHE	Periodical Canister	coir	???	R&D-20-36	7P5 201 801	CFR 40	NWC	1	Prasti	periodical	OTOP	08/04/2021	12/04/2021
14	12	PTF_GERMANIA	PORSCHE	Periodical Canister	coir	???	R&D-20-36	7P5 201 801	NPR150	Short Vibration	4	Novarese	periodical	OTOP	01/04/2021	05/04/2021
15	13	PTF_GERMANIA	PORSCHE	Tristone resourcing	coir		R&D-20-111	997.106.850.01	PTL 14052 §2.1	Thermogravimetry	3	Prasti	warranties	OTOP	15/04/2021	16/04/2021
16	14	PTF_GERMANIA	PORSCHE	Tristone resourcing	coir		R&D-20-111	997.106.850.01	PTL 14052 §2.3	Density	5	Novarese	warranties	OTOP	01/04/2021	05/04/2021
17	15	PTF_GERMANIA	PORSCHE	Tristone resourcing	coir		R&D-20-111	997.106.850.01	PTL 14052 §6.6	Diameter expansion	3	Prasti	periodical	OTOP	01/04/2021	05/04/2021
18	16	PTF_FRANCIA	PORSCHE	Tristone resourcing	coir		R&D-20-111	997.106.850.01	PTL 14052 §7.1	Operating loads simulation	1	Novarese	analysis	OTOP	08/04/2021	12/04/2021
19	17	PTF_FRANCIA	PORSCHE	Tristone resourcing	coir		R&D-20-111	997.106.850.01	PTL 14052 §7.3	Failure pressure	3	Prasti	warranties	OTOP	01/04/2021	05/04/2021
20	18	PTF_FRANCIA	PORSCHE	Tristone resourcing	coir		R&D-20-111	997.106.850.01	PTL 14052 §7.4	Pull-out forces	2	Diciotto	warranties	OTOP	15/04/2021	16/04/2021
21	19	PTF_FRANCIA	PORSCHE	Tristone resourcing	coir		R&D-20-111	997.106.850.01	PTL 14052 §7.5.2	Leak test - Water bath test	2	Prasti	warranties	OTOP	01/04/2021	05/04/2021
22	20	PTF_FRANCIA	PORSCHE	Tristone resourcing	coir		R&D-20-111	997.106.850.01	PTL 14052 §7.6	Deposit	5	Novarese	periodical	OTOP	01/04/2021	05/04/2021
23	21	PTF_FRANCIA	PORSCHE	Tristone resourcing	coir		R&D-20-146	997.106.850.01	????	Tomografia	4	Prasti	special	OTOP	08/04/2021	12/04/2021
24	22	PTF_FRANCIA	PORSCHE	Tristone resourcing	coir		R&D-20-147	P03321 - P03481	PTL 14052	CHECK OF HARDNESS (SUPPLI	3	Novarese	analysis	OTOP	01/04/2021	05/04/2021
25	23	PTF_FRANCIA	VW	Colorado Tristone resource soind			R&D-20-144	7L0201342Y	TL 52255 §4 TABLE 2	Extraction forces according t	4	Prasti	warranties	OTOP	15/04/2021	16/04/2021
26	24	PTF_FRANCIA	VW	Colorado Tristone resource soind			R&D-20-144	7L0201342Y	TL 52255 §4 TABLE 2	Extraction forces according t	1	Novarese	periodical	OTOP	01/04/2021	05/04/2021
27	25	PTF_FRANCIA	VW	Colorado Tristone resource soind			R&D-20-144	7L0201342Y	TL 52255 §4 TABLE 2	Extraction forces After FAM 2	2	Prasti	special	OTOP	01/04/2021	05/04/2021
28	26	PTF_FRANCIA	VW	Colorado Tristone resource soind			R&D-20-144	7L0201342Y	TL 52255 §4 TABLE 2	Separation force of the outer	4	Novarese	warranties	OTOP	08/04/2021	12/04/2021

Q	R	S	T	U	V	W	X
PRIORITA'	Pezzi disponibili dal	tecnici.Eseguito da	tecnici.Data inizio [SRK]	tecnici.Data fine [SRK]	tecnici.Report Release	tecnici.TIPO DI BANCO	tecnici.Laboratorio
Urgent	01/04/2021	BALLERINI	01/04/2021	05/04/2021	05/04/2021	TR01-111	Chivasso
Urgent	08/04/2021	BARUTELLO	08/04/2021	11/04/2021	11/04/2021	TR03-234	Chivasso
Urgent	01/04/2021	COMOTTO	03/04/2021	21/04/2021	21/04/2021	TR04-333	Chivasso
Urgent	17/04/2021	CAVANNA	17/04/2021	19/04/2021	19/04/2021	TR12-555	Chivasso
Urgent	01/04/2021	PICARIELLO	04/04/2021	29/04/2021	29/04/2021	TR03-456	Chivasso
Urgent	01/04/2021	DA ASSEGNARE	01/04/2021	09/05/2021	09/05/2021	TR01-111	Chivasso
Urgent	08/04/2021	DI FAZIO	08/04/2021	18/04/2021	19/05/2021	TR03-234	Chivasso
Urgent	05/04/2021	ROLANDO UMBERTO	05/04/2021	05/04/2021	29/05/2021	TR04-333	Chivasso
Urgent	13/04/2021	TERRANA	13/04/2021	22/04/2021	08/06/2021	TR12-555	Chivasso
Urgent	01/04/2021	PICARIELLO	01/04/2021	02/05/2021	18/06/2021	TR03-456	Chivasso
Urgent	01/04/2021	BALLERINI	01/04/2021	30/04/2021	28/06/2021	TR01-111	Chivasso
Urgent	08/04/2021	BARUTELLO	08/04/2021	11/04/2021	08/07/2021	TR03-234	Chivasso
Urgent	01/04/2021	COMOTTO	03/04/2021	21/04/2021	18/07/2021	TR04-333	Chivasso
Urgent	17/04/2021	CAVANNA	17/04/2021	19/04/2021	28/07/2021	TR12-555	Chivasso
Urgent	01/04/2021	FERRO	04/04/2021	29/04/2021	07/08/2021	TR03-456	Chivasso
Urgent	01/04/2021	PICARIELLO	01/04/2021	09/05/2021	17/08/2021	TR01-111	Chivasso
Urgent	08/04/2021	DI FAZIO	08/04/2021	18/04/2021	27/08/2021	TR03-234	Chivasso
Urgent	05/04/2021	PICARIELLO	05/04/2021	05/04/2021	06/09/2021	TR04-333	Chivasso
Urgent	13/04/2021	TERRANA	13/04/2021	22/04/2021	16/09/2021	TR12-555	Chivasso
Urgent	01/04/2021	LAURETTI	01/04/2021	02/05/2021	26/09/2021	TR03-456	Chivasso
Urgent	01/04/2021	BALLERINI	01/04/2021	01/04/2021	06/10/2021	TR01-111	Chivasso
Urgent	08/04/2021	BARUTELLO	08/04/2021	11/04/2021	16/10/2021	TR03-234	Chivasso
Urgent	01/04/2021	COMOTTO	03/04/2021	21/04/2021	26/10/2021	TR04-333	Chivasso
Urgent	17/04/2021	CAVANNA	17/04/2021	19/04/2021	05/11/2021	TR12-555	Chivasso
Urgent	01/04/2021	FERRO	04/04/2021	29/04/2021	15/11/2021	TR03-456	Chivasso
Urgent	01/04/2021	PICARIELLO	01/04/2021	09/05/2021	25/11/2021	TR01-111	Chivasso
Urgent	08/04/2021	DI FAZIO	08/04/2021	18/04/2021	05/12/2021	TR03-234	Chivasso

Fig. 1 general file containing all the necessary information

As can be seen from image 1, each line of the file contains a test to be done on a Part Number, and the information to the left of the "test" column is repeated the same within the same project since each project (i.e., test request) corresponds to more tests to be performed on a sample, they can range from one to thirty approximately. Only a few authorized people in the lab can access and edit this file. The intention is not to let you access the technicians who perform the tests and the requesting persons, from the various departments, who upload the requests upstream. In order to have this exclusivity and privacy, it is necessary to extrapolate all the information required from each Excel or Word file delivered by email to the laboratory. For these purposes, we considered using excel only as support for test requests, so we created an Excel template containing two sheets. The first was very similar to the one used up to that moment, while the second, hidden, had implemented programming algorithms that allowed to extrapolate the necessary information to be entered into the "requests" file. This sheet already had to create the strings of information that respected the formatting of the Excel worksheet "required", which were enough to be

copied and pasted. Below is the representation of what the file that the applicants filled out was like and in the next image the result that appeared in the second sheet automatically after some information had been entered in the first visible sheet.


	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R				
1	SumiRiko				Request And Internal Test Report (RpL)																	
2	In charge of Customer A carico dell'Ente Richiedente															In charge of Laboratory A carico del Laboratorio						
3	project progetto	Maserti 290	PTF	Italia																		
4	RpL No. RpL No.	R&D-21-190	Order Commessa	Periodical Periodica		Purpose of test Scopo della prova	RIQUALIFICA TUBI ACQUA FCA MESE DI MARZO									RpL No	T370/21	RpL date	07/04/2021			
5	RpL date RpL date		Signature Firma	Analysis Analisi	1	Drawing Code Disegno Codice	M29802	Customer Cliente	Maserati											Engineer	A. Lauretti	Engineer Signature Firma
6	Requester Richiedente	E. Diciotto		Special Speciale		Batch Lotto		Supplier Fornitore	SUMIRIKO											Engineer		
7	Department Reparto		Cost Center CdC	Cont. Conformance Conformità contin.		Date of batch Data del lotto		Material Materiale	PA12-PA66											Engineer		
8																						
9	In charge of Laboratory Manager			In charge of Customer A carico dell'Ente Richiedente						In charge of Laboratory A carico del Laboratorio												
10	Deviation Type (from Core request)	Deviation Reason	Item No	Standard Capitolato	Edition Edizione	Test Title Titolo della prova	Qty	Test description Descrizione della prova	Acceptance Criteria Criterio di accettazione	Test Results or comment Risultato della prova o commento				Aver. Media	Pass / Fail Deviation							
11			1	FPW.MAN050		CONTAMINAZIONE	1	CONTAMINAZIONE PER RIQUALIFICA	maximum weight of metal particles: 2mg	1							Pass					
12			1	FPW.MAN050		CONTAMINAZIONE	1	CONTAMINAZIONE PER RIQUALIFICA	maximum dimension of metal particles: 200µm	154,5	111,7	107,6		124,6			Pass					

Fig. 2 excel request sheet 1

n°	PTF	CLIENTE	FORNITORE	PROGETTO	STATUS	RPL n°	P/N	Qualifica	Test	N° pezzi	Product Eng.	Tipo di richiesta	Tipo pezzi	Data inizio (Cliente)	Data fine (Cliente)	PRIORITA'
1	Italia	Maserati	SUMIRIKO	Maserti 290	N	R&D-21-190	M29802	FPW.MAN050	CONTAMINAZIONE	1	E. Diciotto	analysis				
2								FPW.MAN050	CONTAMINAZIONE				0			
3	Italia	Maserati	SUMIRIKO	Maserti 290	N	R&D-21-190	M29802	FPW.MAN050	CONTAMINAZIONE	1	E. Diciotto	analysis	0			

Fig. 3 excel hidden sheet 2

The conclusion was that every day an excel sheet monitor had to take all the RPL, or requests, uploaded them throughout the day, and report them in the general sheet to complete half of the required information. One volta inserted in the sheet "requests" was given a unique incremental number. The other half of the information had to be entered by the technician who filled out the test and the general information required was n°, Executed by, Start date (SRK), End date (SRK), Report Release, TYPE OF BENCH, Laboratory.

n°	Eseguito da	Data inizio (SRK)	Data fine (SRK)	Report Release	TIPO DI BANC	Laboratorio
16	DI FAZIO	08/04/2021	18/04/2021	27/08/2021	TR03-234	Chivasso
36	DI FAZIO	01/04/2021	11/07/2021	15/03/2022	TR03-456	Chivasso
26	DI FAZIO	08/04/2021	18/04/2021	05/12/2021	TR03-234	Chivasso
6	DI FAZIO	08/04/2021	18/04/2021	19/05/2021	TR03-234	Chivasso
19	DI FAZIO	08/04/2021	18/04/2021	19/05/2021	TR03-235	Chivasso

Fig.4 technical sheet

Each laboratory technician was provided with quests or sheets or in which to insert the tests started or concluded during the day, and then upload the file again to the folder containing the files of all the technicians. At every, end of the day a person had to open all the files of the laboratory and copy their contents to update an additional "technical" worksheet, next to the "applicants" worksheet.

There was also the last worksheet called "general" which, through the use of software integrated with

Excel, performed the "merge" of the two previous tables, that is, it was able to exactly clone each specific test request in the "applicants" sheet with its corresponding date and execution in the "technical" sheet. This allowed a general table that integrated the basic information containing the required tests with the respective progress. If the start date box was empty, it could only mean that the test had not been started, while based on the dates that were available within the table, it could be understood whether the request had been started or finished.

In order to make the "merge", it was necessary that every morning the technicians checked from the "applicants" sheet the unique number of the test they were about to carry out. Then they had to filter the requests according to their name and then mark the corresponding number, in this way they created a continuity that the software recognized in order to be able to pair the two worktables.

Finally, there were the alerts, functions inside the table, always written through Power Query code, which had implemented algorithms that recognized if a test had started late or ended late or if the pieces to perform the test had been supplied late. In this way, it was not only possible to see in real-time if you were late on a test, but it was also possible to monitor KPIs regarding the timing of the tests, the number of tests delivered late and the number of pieces delivered late.

After collecting all the data in a single table (fig 1), through the functionality of the pivot tables a filter was generated that allowed to select and show only the most important information.

Filtering this information and organizing it in a more visually ordered layout results in the following result:

	A	B	C	D	E	F	G	H	I	J	K				
3	CLIENTE	PROGETTO	RPL n°	P/N	Test	TIPO DI BANCO	Data inizio (Cliente)	Data fine (Cliente)	Eseguito da	Data inizio (SRK)	Data fine (SRK)				
4	AUDI	poe	R&D-20-210	5QF317801A	Burst test	TR03-456	01/04/2021	05/04/2021	PICARIELLO	04/04/2021	29/04/2021				
5					Cleanliness test	TR03-234	08/04/2021	12/04/2021	BARUTELLO	08/04/2021	11/04/2021				
6					Leak test	TR01-111	01/04/2021	05/04/2021	BALLERINI	05/04/2021	01/04/2021				
7					Surface protection testing	TR04-333	01/04/2021	05/04/2021	COMOTTO	03/04/2021	21/04/2021				
8					Tensile test	TR12-555	15/04/2021	16/04/2021	CAVANNA	17/04/2021	19/04/2021				
9					Burst test	TR03-456	01/04/2021	05/04/2021	PICARIELLO	01/04/2021	02/05/2021				
10					Cleanliness test	TR03-234	08/04/2021	12/04/2021	DI FAZIO	08/04/2021	18/04/2021				
11					Surface protection testing	TR04-333	01/04/2021	05/04/2021	ROLANDO UMBERTO	05/04/2021	05/04/2021				
12					Tensile test	TR12-555	15/04/2021	16/04/2021	TERRANA	13/04/2021	22/04/2021				
13					PORSCHE	coir	R&D-20-111	997.106.850.01	Density	TR03-456	01/04/2021	05/04/2021	FERRO	04/04/2021	29/04/2021
14									Deposit	TR01-111	01/04/2021	05/04/2021	BALLERINI	01/04/2021	01/04/2021
15									Diameter expansion	TR01-111	01/04/2021	05/04/2021	PICARIELLO	01/04/2021	09/05/2021
16	Failure pressure	TR04-333	01/04/2021	05/04/2021					PICARIELLO	05/04/2021	05/04/2021				
17	Leak test - Water bath test	TR03-235	01/04/2021	05/04/2021					DI FAZIO	08/04/2021	19/04/2021				
18	Operating loads simulation	TR03-234	08/04/2021	12/04/2021					DI FAZIO	08/04/2021	18/04/2021				
19	Pull-out forces	TR12-555	15/04/2021	16/04/2021					TERRANA	13/04/2021	22/04/2021				
20	Thermogravimetry	TR12-555	15/04/2021	16/04/2021					CAVANNA	17/04/2021	19/04/2021				
21	Tomografia	TR03-234	08/04/2021	12/04/2021					BARUTELLO	08/04/2021	11/04/2021				
22	R&D-20-146	997.106.850.01	CHECK OF HARDNESS (S	TR04-333					01/04/2021	05/04/2021	COMOTTO	03/04/2021	21/04/2021		
23	R&D-20-147	PO3321 - PO3461	NVC	TR03-234					08/04/2021	12/04/2021	BARUTELLO	08/04/2021	11/04/2021		
24	R&D-20-36	7P5 201 801	Pressure Drop	TR01-111					01/04/2021	05/04/2021	BALLERINI	01/04/2021	30/04/2021		
25	VV	soind	R&D-20-144	7L0201342Y	Short Vibration	TR04-333	01/04/2021	05/04/2021	COMOTTO	03/04/2021	21/04/2021				
26					Broadcast behavior accor	TR03-456	01/04/2021	05/04/2021	PICARIELLO	01/04/2021	01/07/2021				
27					Cold resistance 24 h at -25	TR03-456	01/04/2021	05/04/2021	FERRO	01/04/2021	21/06/2021				
28					Deposit test see section 6.	TR03-456	01/04/2021	05/04/2021	ROLANDO UMBERTO	01/04/2021	21/07/2021				
29					Extraction forces accordin	TR03-456	01/04/2021	05/04/2021	FERRO	04/04/2021	29/04/2021				
30					Extraction forces accordin	TR12-555	15/04/2021	16/04/2021	CAVANNA	17/04/2021	19/04/2021				
31					Extraction forces After FAI	TR01-111	01/04/2021	05/04/2021	PICARIELLO	01/04/2021	09/05/2021				
32					Leak test at 0,55 bar	TR03-456	01/04/2021	05/04/2021	TERRANA	01/04/2021	31/07/2021				
33					Ozone resistance accordin	TR03-456	01/04/2021	05/04/2021	BARUTELLO	01/04/2021	22/05/2021				
34					Ozone resistance accordin	TR03-456	01/04/2021	05/04/2021	CAVANNA	01/04/2021	11/06/2021				

Fig. 5 pivot table.

SWOT analysis



Fig. 6 SWOT analysis' template

Conclusions

In the light of these data, it was concluded that the Excel software did not lend itself to the needs of the laboratory. First, there is a small number of advanced requests met, which is why the amount of information that can be accessed by following this process is reduced. Specifically, the surplus of information and the new features concerned only the collection of requests in the form of a database, an alert system on the program without notifications, the collection of KPIs. Of the requests made, it can be said that the following items were not met: the progress of the single test, the "timeline", both long-term and short-term, of the occupation of the banks at risk of saturation, the workload and the division of tasks by controlling the allocation of testing resources, to manage priority and urgent requests with alerts via email notification, the management of delays with the consequent motivations and therefore specific KPIs.

It was assessed at the end of these considerations that the advantage of implementing such a system did not outweigh the disadvantages of the time of use to maintain it. Specifically, the time and steps necessary to update this software daily were too expensive, both during the compilation of the "applicants" sheet and as regards the compilation of the "technical" sheet, in which it was necessary at each update to eliminate the old data and overwrite the new ones, with an obvious problem of space in the individual sheets

supplied to each laboratory technician. Finally, the way to archive the completed tests required the system maintainer to eliminate all tests manually and the laboratory technician to check test by test those opened or eliminated in the reference sheet.

Trello Software Analysis

Introduction

Trello is a management software based on the Agile methodology, using the Kanban and Scrum approaches. The latter is organized through "Workspaces", bulletin boards, and tabs. To understand the meaning of these functions, an explanatory metaphor will be illustrated; think of Trello as a school where you can find all the students, each "Workspace" would correspond to a class of which a certain number of people are part. Inside the classrooms, there are several blackboards, which correspond to the bulletin boards. In order to see the contents of the whiteboards, you must be part of the class team, that is, the "Workspace" team, and be enrolled on the board. It is only in this way that you can become part of the board team. Once you open the board, you can have access to all the tabs that have been created, in metaphor correspond to the post its attached to the board. On the bulletin board, the tabs do not have a random position, but are located within specific lists, each list corresponds to a certain phase of the task or project. Traditional formatting involves three lists in which tabs can be placed: "to do", "doing", "done".

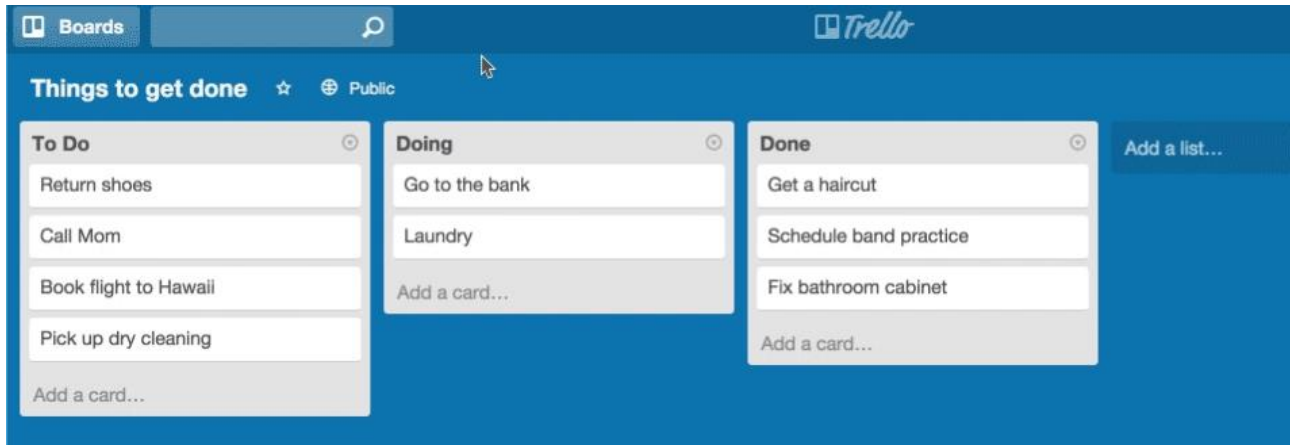


Fig. 7 Trello's basic interface

The tabs move within these lists from left to right according to their status, precisely following the Agile and Scrum approaches of the Agile methodology.

Agile Methodology

Agile is a set of methods and methodologies that help your team think more effectively, work more efficiently, and make better decisions. These methods and methodologies cover all areas of the company and can be adopted with the support of software that helps project management, routine design and architecture, and process improvement. Each of these methods and methodologies consists of practices that are streamlined and optimized to make them as easy as possible to adopt. An Agile mindset is about

opening up planning, designing, and improving processes to the entire team; in fact, the Agile team uses practices in a way where everyone shares the same information, and every person on the team has a say in how practices are applied. The key that makes the difference between teams that are successful and those that do not, is often the mindset that the team brings to each project. But what does "change of mentality" really mean? The practices used to carry out daily work depend a lot on the attitude that the team has towards such routines.

The story of Agile began when a small group of innovative people came together to try to find a different way of thinking about these issues. The first thing they did was come up with a set of four core values common to successful groups and their projects, which they called the Agile Software Development Manifesto:

- Individuals and interactions over processes and tools
- Working software over complete documentation
- Collaboration with the customer during the negotiation of the contract
- Respond to change by following a plan

The Agile Manifesto contains common values and ideas that lead teams to be effective. By examining the fundamentals of Agile, you can have a better understanding. In fact "Individuals and interactions over processes and tools" means that the team should focus first on the people in the team and how they communicate, then on the tools and practices they use, while "Working software over complete" implies that providing software that responds to the needs of the user is more important than providing a specification that describes it, so it reiterates the importance of creating software that returns value to the company, as has been done in this project. Instead "customer collaboration over contract negotiation" means treating everyone as if they were in the same team, in fact, many effective Agile teams also treat the product owner as a member of the project team to collaborate with rather than a supplier/customer to negotiate with. "Responding to change by a plan" means recognizing that plans become inaccurate and that it is more important to deliver the software than to draw up the plan.

Tools that help apply Agile Kanban & Scrum principles

There is a big gap between understanding the values in the Agile Manifesto (and the principles behind it) and the actual change of the company. Fortunately, there is another important aspect of Agile development that specifically helps in this. There are Agile methodologies that are intended to help teams adopt Agile and improve their projects. Agile methodologies are valuable because they help you see practices in context. Each methodology has been developed and improved over the years by experts in the field focused on all the different parts of possible problems. Fully adopting a methodology means following a proven path that takes you from the beginning to the end of a project, without the trial and error that can

lead to a fracture in the project, thanks precisely to the collections of practices combined with ideas, advice, knowledge, and a wealth of experience among Agile professionals. An Agile methodology will outline different roles and responsibilities for all project participants and recommend some practices for each of them in the various phases of the project. The results of the VersionOne State of Agile Development 2013 survey contain a list of the most popular methodologies and at the top of the list are Scrum, Lean, and Kanban, which are not real Agile methodologies, but are fundamental to understanding and adopting it.

Scrum Principles

Scrum can be summarized (but not executed) in a very simple way:

- The team and project sponsors create a priority list of all the things the team needs to do. It can be a list of tasks or a list of features. This is known as the product backlog.
- Every month, the group extracts the top section of the list, which according to them corresponds to a month of work. They expand it into a detailed task list, called a sprint backlog. The group promises to demonstrate or deliver the results to sponsors at the end of the month.
- Every day, the team meets face-to-face for five to ten minutes to update on their status and any obstacles that are slowing them down. This is called the daily standing encounter.
- One particular person is designated as a Scrum Master. It is the job of this person to remove or have someone remove, any obstacle mentioned by the team in the standing meeting.

For many teams starting their transition to Agile, this translates into specific practices:

- The product owner creates and maintains a product backlog, a list of requirements for the software.
- The team performs one-month timeboxed sprints, where they extract a month of requirements from the product backlog to create, test, and demo. The requirements for the current sprint are called sprint backlogs. (Some Scrum teams use sprints that last two to four weeks.)
- The team gathers for a daily standing meeting where everyone talks about the work done the day before, the work they intend to do today, and any obstacles in their way.
- The Scrum Master acts as a leader, coach, and pastor to guide the team through the project.

It is important to specify that the Scrum methodology lends itself very well to project management for software creation or monitoring, in which the tasks of doing do not have such a strict sequence. In fact, this framework was born in software design contexts and subsequently other people from other sectors have realized the benefits that could be drawn from bringing this methodology in the management of some projects within companies.

Lean and Kanban Principles

Lean is not a methodology. Rather, it's a name for a mindset: it has its own set of values and thinking tools to help you adopt it. Lean is as important in the Agile world as Scrum, and you can learn a lot about what it means to be Agile by understanding what's in common between you. Kanban is an Agile method to improve the way a team achieves its goals and subsequently moves towards the next. It is built on the values of Lean and includes its own practices to help a group improve and evolve. Kanban has its roots as a planning tool developed by Toyota for lean manufacturing to help improve production and inventory control. Making planning more visual (Kanban means "visual board" in Japanese) helps support Just-In-Time (JIT) production, reducing flow times within a production system and response times from suppliers and customers.

How is it possible that these different approaches to Agile can have a completely different focus and practices, yet they are all considered Agile? It is because all Agile methodologies are based on the same principles and rely on all members of the group to work together and collectively own every aspect of the project. The values and principles of the Agile Manifesto are what bind together all the methodologies and methods.

Scrum and Kanban in Trello

The two most popular ways agile and lean concepts were adopted in education were 1) applying Agile processes such as Scrum to manage learning, and 2) monitoring learning using lean Kanban boards. Scrum is a lightweight iterative process framework for

Agile development, as mentioned, consists of a series of sprints that each provide something useful, allows teams to self-organize and collaborate and provides a useful framework within which learning can take place, with requirements of users captured on story cards. It is a framework that has been successfully applied in schools, that is, the way to give students control over their learning. All these methodologies and the problem of learning are combined with Trello thanks to the Kanban tab. In fact, within the software, you can visualize the workflow by advancing the cards through different columns called, for example, "Backlog", "To do", "In progress" and "Done" (name similar to the base card that has already been mentioned). The number (and names) of the lists on the whiteboard may vary as the "In Progress" column can be divided into multiple steps if the context requires it. The key feature that differentiates a Kanban card from a typical Agile storyboard used in Scrum is that a Kanban board has a Work in Progress (WIP) limit, which means there is a limit to the number of tabs that can be processed at any given time. The story cards are then "pulled" into the "In Progress" column by the team, not inserted into that column by others. Since Kanban is not in itself a process method, it is typically used along with other Agile methods, usually with Scrum being a popular choice. Scrum and Kanban are formally reunited in 'Scrumban'. It favors just-in-time development and reduces release times; these features make it advantageous in some situations where the team finds Scrum too rigid compared to the flexibility required by the tasks to be performed.

HOW TO USE TRELLO TO SUPPORT THE PROCESS

Trello provides both visualization and conceptual support in the experience (and learning) of the methods described above, which has key features specifically mapped and related to the aspects of Agile and Lean. For explanatory purposes, an example is used that gives evidence of the connection that Trello has with Agile methodologies and its framework. In this example of a Trello board, the tabs were set with four columns; "Task backlog", "Things to be done", "Things we are doing" and "Things done" (Fig. 8).

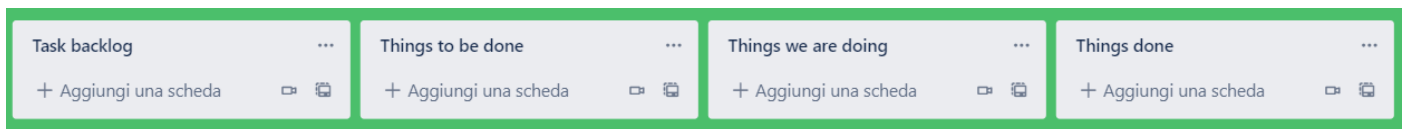


Figure 8. Columns on the Trello tab for the example.

This configuration allows the administrator to live the role of Scrum Master, who guides scrum meetings, identify the initial backlog to be completed in the sprint and record the team's decisions. In this way he can, through the role given to him by the team, manage the workflow using the Trello board and the available tabs.

This example provides a series of pre-created user stories to use for sprints. These can be entered in the "Task backlog" column. There are two ways to do things inside the board, first, the Scrum Master can be the one responsible for moving the cards through the Kanban board lists (Trello) using the simple drag function of the tool, while the other is to let each person on the team have the ability to move the cards. This allows the workload of monitoring and progressing tasks to be more distributed.

The Scrum Master is able to select and assign cards to their team, then move them to the "Task to be done" column. The software shows which team members have been added to a card using their Trello profile. This card assignment (or task assignment) feature is important since all teams in a given location will use the same Trello tab. This means that each team can view which cards the other teams are working on (and their progress).

Taking the specific case of developing software with Scrum methodology, user statements are often written on story cards using the format: How (role) I want (something) so that (benefit). This peculiarity of the Scrum methodology can be included in the "Description" of the card, in this way all the people who open it can see it, Fig. 9.

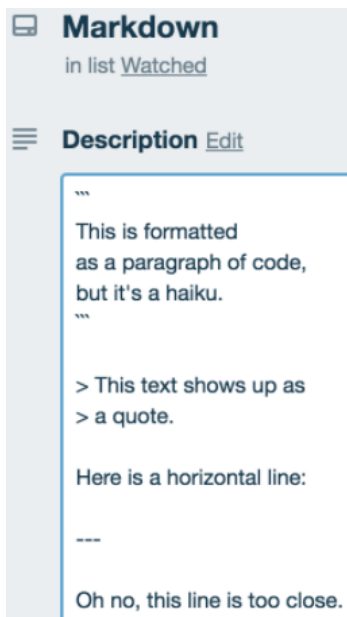


Fig 9 Photo description card

The visual nature of Kanban tabs is now evident, in fact, you can monitor the completion of progress, see where the next step is, see the beginning and end of a request or the path you follow, see people's progress, and ask questions. The whiteboard allows the visual representation of useful activities through simple access at any time and allows them to reflect on the process. In Trello boards, the Kanban method helps people achieve a higher and more efficient level of activity by ensuring that tasks are not left incomplete. The waste that results from unfinished tasks is generally believed to be partly caused by the constant feeding of tasks by senior management, who do not have a complete view of the things going on and those that need to begin, so they continue to increase the workload. This is a situation that the laboratory has often experienced. Using a Kanban whiteboard creates a sense of responsibility for a group and improves communication. Collaboration is more evident, visible to users and other stakeholders, thus increasing engagement.

Trello's capabilities can be used to enable the implementation of a technology-enhanced process with the Scrum methodology and provide a software-supported version of a Kanban board.

Troubleshooting Scheme

Types of requests

As anticipated in the previous paragraphs, the types of requests to the Laboratory can come from areas such as: R&D, Quality (Plant and Acceptance), Warranties, and Client. While requests from Warranties are always urgent, as they indicate a dispute with the client, quality demands are not always a priority. Most of the time, in fact, the requests issued by this sector are single tests or at most can contain two or three tests, precisely for this reason it happens that not even an expiration date is defined. Sometimes, however, even the Quality presents urgent tests whose failure to perform affects the ordinary course of production.

The requests from R&D, as anticipated, are the longest and most demanding. All provide for a date because this is connected to the one agreed with the customer and indicated in the contract shared between the parties and/or expressed in the assignment provided by the customer.

Order acquisition process

The process that leads the R&D department to acquire the most important orders starts from the adhesion and winning of a competition organized by the client company concerned. This process results in the drafting of a validation plan agreed with the customer, in which all the tests to be performed to complete a complete validation of the piece are written, aimed at placing it on the market.

The mechanism begins when an interested company issues a call for tenders or contacts several companies to have a forecast made on a contract. The first to move is therefore the commercial office that adheres to the requestor activates a dialogue for which the customer asks for the quote. Subsequently, the proposal is evaluated to verify if it falls within the "know-how" of the company, in this first phase of skimming the feasibility of the proposal is also evaluated based on the history of the previous ones. If this first phase passes, the sales department asks the customer for parts, drawings, bill of materials, specifications, tests to be performed, and required timing and creates a Request of Quotation (RFQ) to be delivered to the customer by a certain established date. To make the proposal, the sales representative convenes the referents of the various business processes involved who then, if successful, will have to take charge of part of the request. The following are contacted:

- Plant Quality
- Shopping
- Technical office
- R&D and laboratory
- Cost engineering
- Process Office
- Project Management Office (PMO)

Each of these entities submits a proposal following a general comparison and a specific analysis of the request in question. Only then does Cost Engineering collect all the reports and create an offer to be proposed for the customer's approval, which obviously passes through the sales office. At this point there are two possible developments, either Sumiriko's offer is discarded in favor of others, or it is taken into consideration and in this case, a dialogue with the customer starts that generally leads to reformulating the offer to create a proposal that meets the needs of the customer. This process is delicate and important, here the sales office and Cost Engineering are mainly involved, who continue to communicate with other bodies to understand how far it is possible to go in the balance between quality, costs, and revenues. Then follows a long negotiation in which the two parties seek an agreement at the end of which, if the

negotiation has been effective, there is the "technical review", where technicians on both sides meet and still discuss the project and the processes. You may need to generate a new RFQ and then your plans will change again. If this phase is also concluded so that both parties perceive an advantage, then the contract is signed with methods and times and the order begins its journey within the company.

Request flow

At this point, the order will follow the flow of the various processes among which, inevitably, the strategic process "Tests & Controls" will be involved. After careful analysis and thanks to the help of some members of the laboratory, the life cycle of a request inherent to the order was identified: a department (R&D, Quality, Warranties & Client) formulates the request to the Laboratory, the manager to whom all the requests converge analyzes it and verifies the expiration date, the number of total tests and the number of Part Numbers on which to do the test and therefore the time necessary to execute the entire order. From the final date and knowing the number of hours needed to carry it out, based on the availability of the laboratory, the date for the start of the test is defined. The tests inside are assigned to a single person or several people depending on their quantity and timing. In the first case, a laboratory technician takes charge of the entire request, while in the second case he does it only partially. The next steps move from the area where requests are issued and assigned to the area where the tests are conducted, and the results drawn up in reports. In fact, after a test has been assigned, the people who take care of it must finish it before the agreed date, in order to have time to draw up the report at the end of the test. The end-of-test report can be unique and thus include all the tests of the required test, or it can be single and include a single report for each test of the test.

Having become aware of this, we tried to force the purely abstract system, into a system that could bring objective evidence and that lent itself to being used and understood by all. The goal is always to effectively manage the requests made by adopting a digital and shared methodology at the same time it is believed useful that the system lends itself with simplicity and intuitiveness to the practical needs of individual workers.

With this imprinting, we tried to converge the organizational system of Trello to the needs and phases of the project, understood as a set of proofs of each request. The product development process is managed as projects and the tests are part of these. The result was to identify lists in which the projects are divided, which represent the degree of progress of the latter; therefore, the test based on the spatial position within the bulletin board can give specific indications on the state of the test.

It was decided to create two boards, one that would only accommodate R&D requests and the other that would include all the rest. This is because even if R&D emits 30% of the total requests that reach the laboratory, it is undoubtedly the most complex and articulated to the point that, considering the number of tests per test, R&D exceeds any other sector and consequently deserves specific attention.

R&D bulletin board structure

The structure is analyzed starting from the R&D bulletin board and then moving on to that of Quality and Warranties. The R&D bulletin board includes all members of the Research and Development and the laboratory, including the relevant leaders and managers. Five key lists have been created here: "model", "RPL pending", "scheduled requests", "requests taken care of", "we are doing the test", "archive". Fig 10

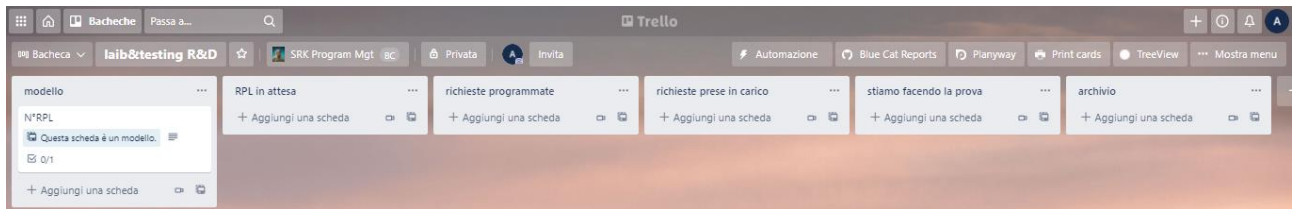


Fig 10 R&D bulletin board's list

In the "RPL pending" list you can find all the requests that, issued by the sector, have been consulted. This step is fundamental since in this way you keep track of all the requests that come to obviate the problem of forgetting some projects or losing sight of their deadline. This is the first major and important innovation that the software has brought. The next list "scheduled requests" represents the place where all the projects that have been seen and planned reside, that is, in order to assess the capacity of the benches at risk of saturation (as per expected results) it is important to monitor already months before all the tests involving one or more. In this list reside the requests that have not yet been started and that are waiting (in power they are at the same state as the previous list) but some of its tests have already been assigned to be able to monitor the duration and the bench they will occupy in the future. The variable "requests taken in charge" represents all the projects that have been taken over, whose tests have each been assigned to a person. This list is the last before the archive and therefore there are all the cards that are about to be started or that have been started or that are even about to close. Each project that is about to start moves here and then when it is concluded from this list it passes to that "archive" where all the concluded evidence is located. To be analyzed remain the lists "we are doing the test" and "model". The first is a completely empty list and so it must remain, it is necessary for the head of the laboratory when he has to create and entrust the test cards of the reference tests, it is used as a support and is connected to another "Prove lab" bulletin board that will be presented later. The "model" list is also support for applicants, inside there is a card called N° RPL which acts as a model and allows you to create the RPL requests that reach the laboratory.

Quality and Warranties bulletin board structure

The structure of the Quality and Warranties bulletin board is very similar to that of R&D, both in terms of the names of the lists and in terms of the flow that presents the implemented system. Here all members participate in the Quality process (plant and acceptance), warranties & customers, and the laboratory, including repetitive garments and managers.



fig. 11 Quality and Warranties bulletin board

There are also on this bulletin board the lists "model", "archive", "scheduled requests", "requests taken care of", "we are doing the test". All these lists are the same and perform the same task. The differences lie in the "RPL pending" list, in fact, while in the R&D bulletin board there is only one list that represents the requests issued and not yet taken over, in the Quality bulletin board there are three, see Fig. 11. The subdivision of the requests was made according to the type of proof requested; therefore, they are divided between periodic tests and special tests, the difference of which was explained above. Finally, there is the separation from the RPL pending the Warranties and Client section. In doing so it was possible to immediately identify the type of test and the relative urgency, in fact, it is usually true that the priority of execution is of the Warranties requests, while the tests that create less problems if they are postponed are the periodic ones.

R&D card structure

Each card that populates the board is a project, that is, a test that contains one or more tests and considering that this is the R&D bulletin board. This hypothesis is also justified by the level of complexity that the evidence can have; in fact, some may contain tests on more than five different part numbers for a total of more than sixty total tests, thus justifying the assumption of treating them as projects in their own right given the high complexity in managing them.

The identifying information inserted within the cards is the same as that found within the requests in Word or Excel format. Shown in Fig 12 there is the structure of the N°RPL tab in the "model" list. From this tab begins the first step of the process that will be described in the following paragraphs.

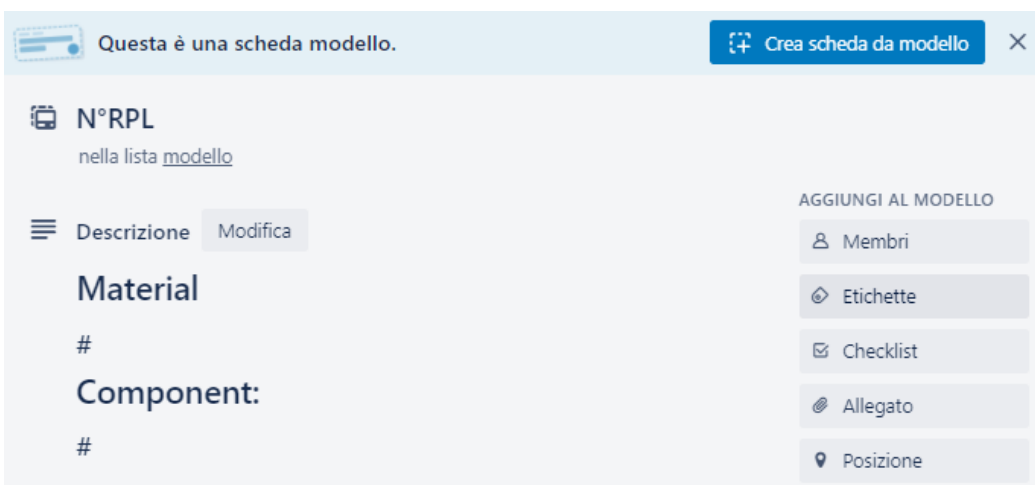


Fig. 12 Card's name

and description

First, this tab in the model list should not be changed, no changes should be made; so, the name of the card must remain "N°RPL", deliberately generic so that it is understood that this is a model to be replicated. In the description, there are two entries: material and component. Subsequently, after copying the card, the description will be specified with the necessary information after the '#'.

Custom fields

"Custom fields" are a feature of Trello that allows you to store information easily, conveniently, and quickly. Thanks to the drop-down menus, located at the down arrow (Fig. 13), the operator who fills out the request saves time and is guided in the

The screenshot displays the 'Campi personalizzati' (Custom Fields) section of a Trello card. The fields are organized into a grid:

- Top Row:**
 - N° RICHIESTA:** 216
 - SUPPLIER:** Selezione...
 - PROGETTO:** Aggiungi progetto...
- Second Row:**
 - FAMIGLIE PRODOTTI:** Selezione...
 - CUSTOMER:** Selezione...
 - DEPARTMENT:** Selezione...
- Third Row:**
 - TYPE OF SAMPLE:** Selezione...
 - DATA OF REQUEST:** + Aggiungi data...
 - ENDING SET DATE:** + Aggiungi data...
- Fourth Row:**
 - DATE OF SAMPLES ...:** + Aggiungi data...
 - LOCAZIONE DEI PE...:** Aggiungi locazione ...
 - SAMPLES:** Selezione...
- Checkboxes (Left Column):**
 - INTERROMPE/POST... ☐
 - MACCHINA ROTTA ☐
 - TEST FALLITO ☐
 - PROVA SPOSTATA ☐
- Checkboxes (Middle Column):**
 - PEZZI CON NON CO... ☐
 - PROVA POSTICIPAT... ☐
 - FINISHING DATE: + Aggiungi data...
 - FINE: + Aggiungi data...
- Checkboxes (Right Column):**
 - NO MAT. DI CONSU... ☐
 - MONTAGGIO SBAG... ☐
 - RICHIESTA CONSEG...: Selezione...
 - RPL: Aggiungi rpl...
- Right Sidebar (Actions):**
 - Copertina
 - POWER-UP:
 - Campi personalizz...
 - Plan on timeline
 - Print card
 - + Aggiungi Power-Up
 - AUTOMAZIONE (Info icon):
 - insert P/N
 - prendi in carico
 - programma prova
 - stampa
 - + Aggiungi pulsante
 - AZIONI:
 - Sposta
 - Copia
 - Modello (checked with green checkmark)
 - Segui

Fig 13 Card's

custom fields

The first field "Request number" represents the corresponding request number, this numbering is started from the first request issued by the R&D sector and serves to have a clear history of the number of requests issued. There is a different numbering that involves R&D and Quality, which is also divided into two boards, their count is not sequential but rather parallel.

"Supplier" is a drop-down menu that contains all the suppliers from which the pieces can be produced, even the same Sumiriko plants in different parts of the globe.

The name of the project, on the other hand, is agreed with the customer and is unique. It must be entered in the custom field as text to be typed and the title of the card is automatically updated, also inserting the name of the project according to this pattern: "title of the card"/"project inserted". In addition, the newly inserted project is also added and reported to the description.

"Product families", "Customer", "Department" and "Type of sample" are all drop-down menus. The product family indicates the main families into which the specimens can be divided, namely: Fuel, Vapor, DPF, Coolant, Brake, Vacuum, SCR, AC, PS, TOC, Canister, VL, BBY. Each of these categories has different associated tests, different specifications, and different tests. "Customer" and "Department" represent respectively all the customers that Sumiriko provides and the reference business sector that issues the test (R&D, Quality - Plant and Acceptance-, Warranties and Client). Finally, "Type of sample" indicates the status of the specimen, which is the reference phase in which it is located. The types of samples obtained with different phrases are:

- OFFTOOLS: they are specimens obtained through the use of their own machinery for production, but they do not follow the production process, they stop only at the use of these machines without also arriving from the chain-production
- OTOP: of tool of process. They are specimens obtained using the machinery that will be used during production and in which the production process itself is also established; therefore, those specimens that are obtained at the end of the chain production and are about to be put on the market are tested.
- PROTO: they are the Prototype pieces and can be manufactured by internal or external departments in Sumiriko, for their function it is not yet important to understand how they were built and with which plant since we are in the preliminary step to engineering, we are still in prototyping.
- SPECIMEN (to be explored)
- SLAB (to be investigated)

An automatism similar to that of the "project" field has also been implemented for "Product families". In fact, when it is inserted at the bottom of the tab, the above description automatically updates, and the entry is added.

The next field is "data of request", it is a field programmed to be automatic, it is automatically inserted when the request is created by putting the date of the current day.

"Ending set date" is the date agreed with the client of when the tests are to be finished and the reports issued. When the new automatism is added, it puts an end date to the entire card, and immediately after in conjunction it is possible to enter the start date of the tests, always agreed by the R.F.Q.

The field "date of samples availability" must be entered to identify the date on which the pieces will be available and to send alerts when certain conditions are not met, or if the "location of the pieces" field is

not filled in. This field is very important because it is the duty of the requesting department to procure the pieces on which to test the laboratory technicians, precisely for this reason when they have the certainty of the arrival of the pieces they must write in the field "location of the pieces" the place where they will be found, with the number of shelves and the department. If it is not inserted close to the date of execution of the test, warning emails will be sent to the applicant, to make sure that the pieces arrive late and to fill in the discriminated field.

The following fields are used to collect data and then create KPIs:

- Samples: Indicates whether the samples arrived late or not. It is an automated process and is based on data entered by laboratory technicians
- interrupt/postpone timeline indicates if the test that is requested is urgent and consequently postpones ongoing tests, changing the plans and the programming previously made. It is an automated process and is based on data entered by laboratory technicians
- parts with non-conformity indicate whether the required test presents samples with non-conformities that have affected the outcome of the test or even prevented its initiation. It is an automated process and is based on data entered by laboratory technicians
- no mat. consumption: indicates that a test has not started due to the lack of material to be able to conduct the tests or operate the machines. It is an automated process and is based on data entered by laboratory technicians
- broken machine: means an unusable broken machine that has affected the start of the test. It is an automated process and is based on data entered by laboratory technicians
- postponed test for urgency indicates a postponed test for an urgency. It is an automated process and is based on data entered by laboratory technicians
- wrong assembly: indicates a wrong assembly of the pieces, which has affected the outcome of the test or even prevented its start. It is an automated process and is based on data entered by laboratory technicians
- Failed test: It is an automated process and is based on data entered by laboratory technicians
- finishing date indicates the actual end date of the test, when all the tests have been finished and the reports delivered. It is an automatism created to mark exactly the actual delivery, it clicks at the moment when all the elements of the checklist are complete and marks the current date.
- Request Delivered: Indicates whether the request was delivered late or on time. It is an automatism closely linked to the "finishing date" field, in fact, it compares the latter, or the actual end date, with the expiration date of the card, which corresponds to the expiration date agreed with the customer. Once this is done, it inserts one of the two entries: delay if the "finishing date" is greater than the two dates from the card, in time if the "finishing date" is less than the two dates from the card

-

Fig. 14 Prove Lab's list: "the test still have to start"

Checklists are a peculiarity of the Trello management program. They allow you to introduce into the card a sequence of things to be concluded to monitor the relative and absolute progress of the same.

☒

"P\N" "N° lotto e DATA" Capitolato:

Elimina

0%

☐

"test" / capitolo: / N° di pezzi: / note:

Aggiungi un elemento

:☰

Attività

Mostra Dettagli

A

Scrivi un commento...

Fig. 15 Cards' checklist in Prove Lab's bulletin board

As can be seen from Figure 15, the checklists have a precise structure, the title must contain the name of the part number, the lot, and the date of the issue lot (if necessary), and finally the specifications. This

structure should be remembered that it belongs to the "N°RPL" tab of the model list, consequently, it contains the general indications with which to fill in each real case of request. The indication in this case is to replace all the words in quotation marks with the respective specific information in possession (Ex: instead of "P \ N" the sequence of identification numbers of the piece "52209430" must be inserted). Next, you complete the checklist entries, called items. The items follow a pattern similar to the one above, also in this case it is necessary to make changes. In fact, all the necessary information must be entered after the ":", while the word "test" must be replaced with the test you intend to request. Clearly you will have more items for a single checklist, for this reason, it will be necessary to add as many items as tests as you intend to have the laboratory technician perform. If you want to study and analyze more P\N, you will need to add more checklists via the intended button.

Finally, there are the comments, in which you can write information to remember or quote someone to have a conversation or update them on something. In this case, the comments are mainly used to indicate the progress of each test and therefore of each item, through automatic messages that are written immediately below the checklist describing the beginning and end of each test and the issuance of the report.

Quality card structure

The structure of the card in the Quality and Warranties bulletin board is almost identical to that of R&D, it has only a few changes in the description, in which the "purpose of the test" is inserted, or the reason why you want to conduct tests on the part number and what you want to verify. In addition, custom fields such as: "cost center", "type of request" and "Warranties request number" have been added, while "project" have been removed, no longer being necessary for the customer or Sumiriko itself and "type of samples".

- "Cost center": indicates a serial number of origins within the company
- "type of request": indicates the type of request by dividing it according to periodic, special, claim
- "Warranties Request No.": the incremental request number for the warranties portion, which is unrelated to both R&D and Quality

"Prove lab" bulletin board structure

In this bulletin board, there are all the technicians of the laboratory, the head of the laboratory, and the manager of the laboratory, also there are in the form of cards all the items of all the checklists of all the cards in the lists "request taking charge". It can be said that this bulletin board contains as tabs all the individual tests on part numbers that the laboratory must do in about three months, consequently, the lists are organized so that they present the absolute progress of each test or the current condition in which it is located. The conditions can be five: the first is the condition in which a test of a test has been assigned but has not been started, the second instead it reflects the situation in which the assigned test is actually started and consequently the next is when the test is finished. The last two conditions refer to the beginning of the report and the end of the report, which coincides with the archive. A test can only be said

to be finished when all test reports have been completed, so a test can only be said to be completed when the report has been delivered. Precisely to follow these conditions, the lists were created: "the test must begin", "the test has begun", "the test is over", "the report has begun", "archive".

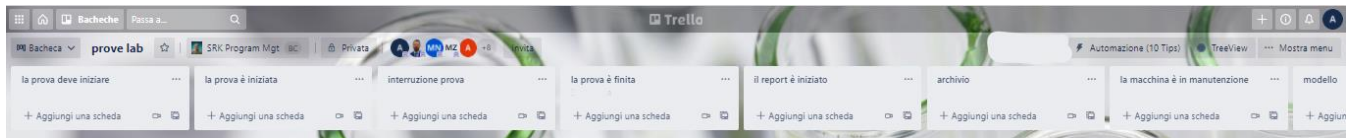


Fig. 16 Prove Lab's bulletin board

the lists listed above correspond to the absolute progress of the test and therefore the relative progress of the reference test, but as can be seen from Figure 16 there are also other lists. In fact, the lists "test interruption" and "machine under maintenance" symbolize respectively the list in which the tests that have stopped for different reasons are placed, while in the second is a list reside cards connected to the machines in maintenance or broken, which are unusable. Thanks to this last list it is possible to monitor even the currently non-functioning benches and therefore not accept requests involving those machines.

Structure tab "test lab"

Each card that arrives inside the "test lab" bulletin board is the equivalent of a test to be carried out belonging to a request provided by a department. The not opened tabs are composed of a title containing the number of the P\N and all the information on the test (type of test, specifications and reference chapter, number of pieces and additional notes), a label with an inscription, and color between green, blue, and red (see paragraph "labels"), a highlighted custom field that contains the number and the project of the RPL. Fig. 17. Thanks to these elements the laboratory technician is able to immediately identify the test in question, not be confused with other similar tests. The inside of the card, or when it opens, has a description equal to that of the reference parent board and also some custom fields always the same as the starting test. Fig. 18

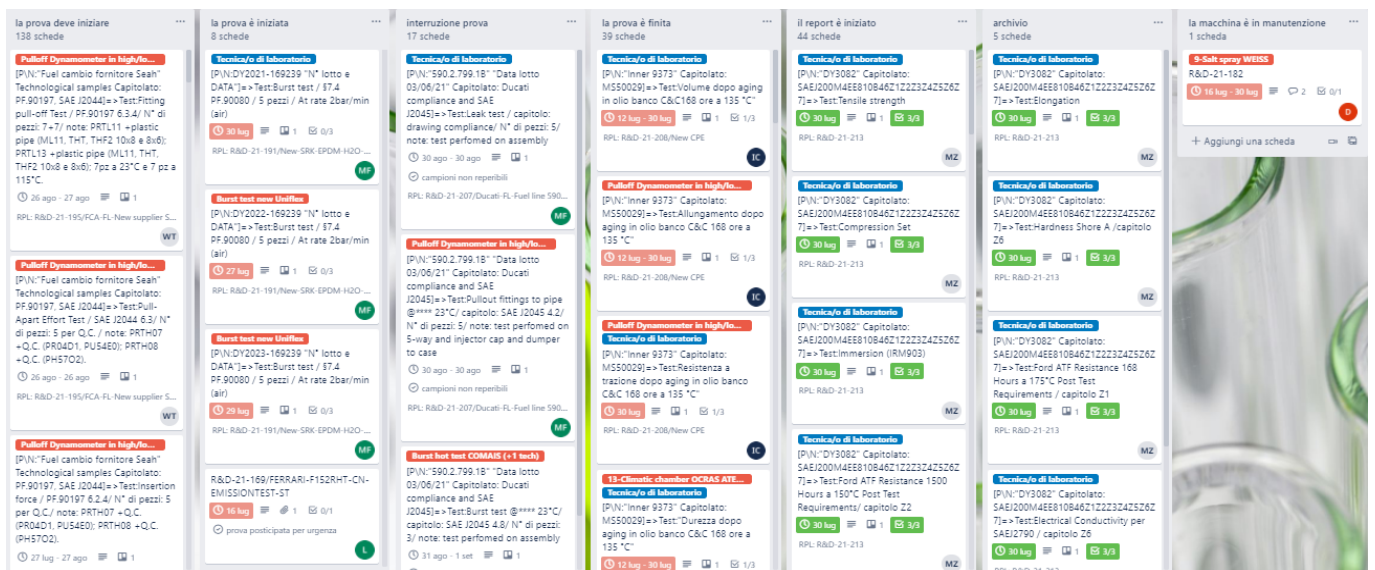


Fig 17 Prove Lab's bulletin board populated

Fig 18 Prove

Alert from laboratory technicians

Specifically, as shown in Figure 18, the technician may report the following problems: • parts with non-conformities • no mat. consumption • broken machine • postponed test for urgency • wrong assembly • test failed • unavailable parts Each of these flags is connected to the same flag as the generating parent board. Consequently, every time the laboratory technician inserts a flag in these garments, a programming is activated that acts in two directions: firstly, he inserts a flag in the parent board under the same heading as the one marked by the technician, secondly, he sends an email to the head of the laboratories to warn him of the problem that has emerged. The email sent returns to the head of the laboratories the name of the RPL or starting request, the name of the test in which the problem was found, reports the problem based on the flag, and inserts a link to immediately access the card. Within this procedure, the software is also programmed to move the child card in the "the test is interrupted" list in the test lab board and to report in the comments of the parent board of the department boards the problem encountered. This sequence of actions is the same for all the items mentioned above except for the item "unavailable pieces", which is when the samples have not arrived in time for the start of the test. In this case, not only do you activate all the codes that allow the sequence of actions previously described, but also contact the applicant responsible for issuing the parent request, informing him of the fact that the pieces for the test have not arrived and consequently the test has not begun. Then he urges him to fill in the custom field "location of the pieces" of the test of the parent card by inserting a special link that leads directly to the card. The software has implemented a sophisticated algorithm that tracks all the cards connected to the parent board when you enter the custom field "location of the pieces", then rewrites the description of each connected card by adding the item location of the pieces and moves the card back to the list "the test must begin", sending a notification to the reference technician where it is specified that the test can start now. The act of marking these entries, not only informs the head of the laboratories and the applicant (by email or comment under the parent card) that the test has run into problems but keeps track of everything that happens inside the laboratories and why. This means that the above mechanisms are all used to create laboratory KPIs in order to increase awareness of areas for improvement and act accordingly through an effective and targeted suture. Checklist The technicians' cards also have a checklist that is activated every time the "procedures" button is pressed.



Fig. 19

procedure text

This button, present in each tab, recalls a checklist present in the model tab of the current bulletin board and proposes it again within the open tab. As can be seen from the image above, the checklist is composed of several flags: test done, report starts, report done. Unlike the checklists encountered so far in the other bulletin boards, this one is unique and should not be changed. This means that each laboratory technician will have the same checklist on each card, since the steps to conclude the tests are always the same, that is, start the test with the machinery, finish the test, start the repost and conclude the report.

Description of the operation of the management software

Applicants' stage

In the first phase, the applicant creates a copy of the N° RPL card in the model list; then, create a card from the reference model mentioned above, fig 20

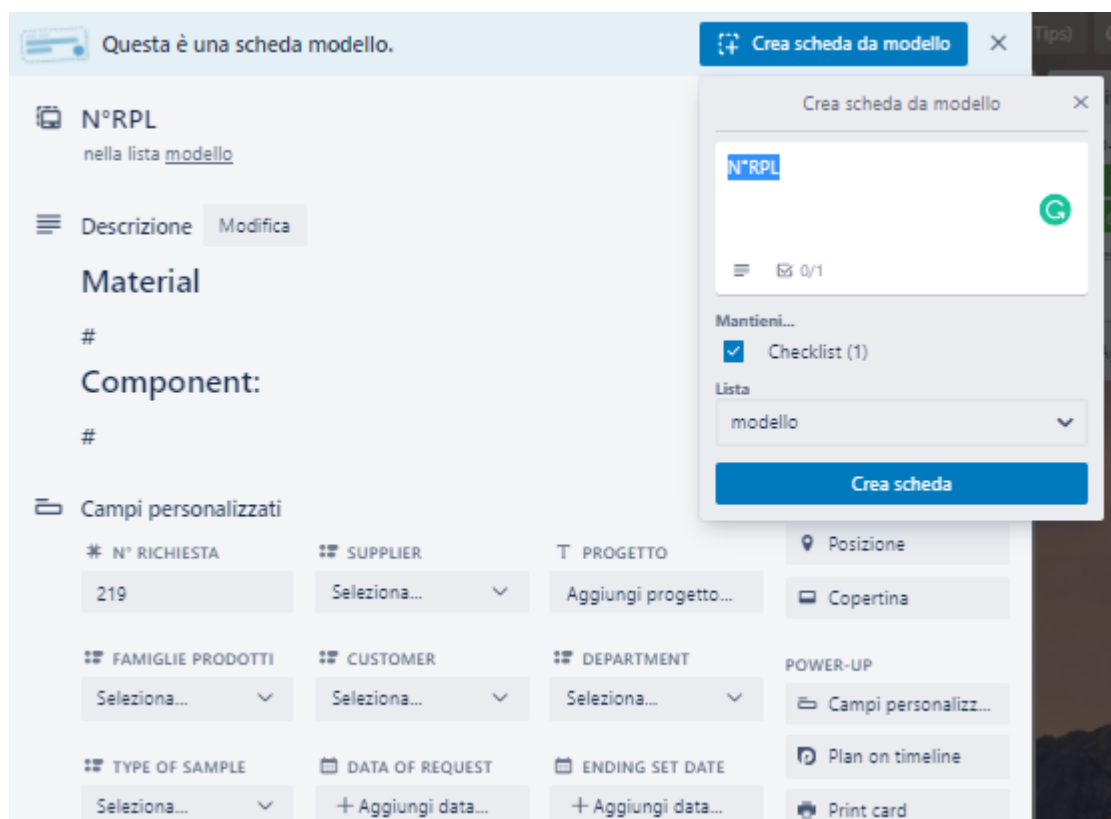


Fig. 20 First

step to create an RPL

At this point the system creates a card exactly the same as the original one and activates a programmed rule that renames the card created according to the R&D-21-"N° of request" pattern, moves the newly renamed card to the waiting request list, and after tracking the original card N° RPL increases the value "N° request" by one unit, to allow the next card that will be created to have the next number.

The applicant joins the card, through a special command, this will in fact allow him to receive notifications via email and software relating to the progress and problems of the test. Once this is done, start filling out the form, entering the required fields and starting from the description. Remember that by entering the name of the project it will also appear in the title and the description, the "product family" and the

"location of the pieces" will also appear in the description. The applicant is in charge of entering the end and start dates, finishing filling in the custom fields to "lease the pieces". To conclude, enter the checklist or the checklist carrying the part number and the tests to be carried out.

Head of the laboratory's phase

From this moment on, the management passes to the head of the laboratories, who, based on the deadlines of the tests and their importance, decides which one to take charge of. Once the cards have been moved from the waiting list to the one taken in charge, the head of the laboratory begins to create the cards that contain the tests of the requests. The method of creating these cards involves an automatism created specifically for this situation: by programming the software it was possible, through a small input, to create a child descent from the parent board, in a similar way to how the N° RPL card had been duplicated. In fact, in this case, by clicking twice in a row an item of the checklist, the software has been programmed to create a tab from the item in position one of the list "we are doing the test", it takes its name from the union between the name of the checklist and the name of the item selected and then deselected following this pattern: [P\N: "checklist name"]=>Test: "checklist item name". Precisely for this reason it is very important that the information in the name of the checklist also applies to all the items below it. At this point, the two tabs are connected and become attachments, so that they can communicate and update automatically, also the name of the item in the "parent" tab (the one from which the cards are created with the double flag command) changes in order to be equal to the name of the "child" tab (the one created at the command), in this way the two tabs are in communication. Finally, the end date of the parent card is shown on the child card and the description of the previous one is always copied to the child card. This is why it is important that some entries are reported not only in the custom fields, but also in the description since the custom fields cannot be copied at the time of creation, but the description can. Summing up, thanks to a double flag to an item in a checklist of an RPL, it is possible to create a new tab containing information about the type of test, the specifications, and the part number, in position one of the lists "we are doing the test".

With this rule it is possible to create child cards from the items of the parent board, connecting them, reporting the description, the end date and the information of the test and the part number. The next step that the head of the laboratories must take is to entrust the card to a member of the laboratory technicians, change or leave the expiration date of the card unchanged, also inserting the start date. In this way, the laboratory technician will be updated and contacted automatically at each beginning and end of each test. Finally, it must add a label to the card, this active step of the parts of code that carry the card in the "test lab" bulletin board in the "test must begin" list.



Fig. 21 Moving card

from the “we are doing the test” of R&D’s bulletin board to the “the test still need to start” of Prove lab’s bulletin board

This mechanism implies that the list "we are doing the test" of the quality and R&D boards must remain white, consequently the actual role and only one is of buffer, this allows the system to be able to temporarily support the newly created cards that will be entrusted and changed into another bulletin board.

Laboratory technical phase

After this part with the passage of the cards from one board to another (the same mechanism is identical both for the cards from the R&D board to lab tests, and from Quality to lab tests), the baton is passed to the laboratory technicians, who find all the new tests to be performed in the first list "the test must begin". As anticipated, the cards containing the tests to be carried out must follow a path along with the board according to their progress. The first phase, described above, corresponds to the entry into the list "the test must begin", while the subsequent phases are identified by the position of the card on the bulletin board and the progress of the relative checklist. In fact, each tab in the lab test board contains a button called "butler" that allows you to insert a checklist named "procedures", as in Fig. 20

As can be seen from Fig. 18, the entries in the checklist are: test done, report starts, report done. All the rules related to the completion of each element of the checklist have a double effect: firstly, they move the card through the lists of the bulletin board, secondly, they look for the parent card to which the test is entrusted and write a comment containing the phase in which the specific test of a checklist contained by the parent request is located. Specifically, when the test begins, the operator will have to click the procedures button, the software has been programmed to insert the "procedures" checklist, move the tab from the "the test must begin" list to the "the test has begun" list and finally writes a comment in the relative parent card saying that the test has started and by whom.

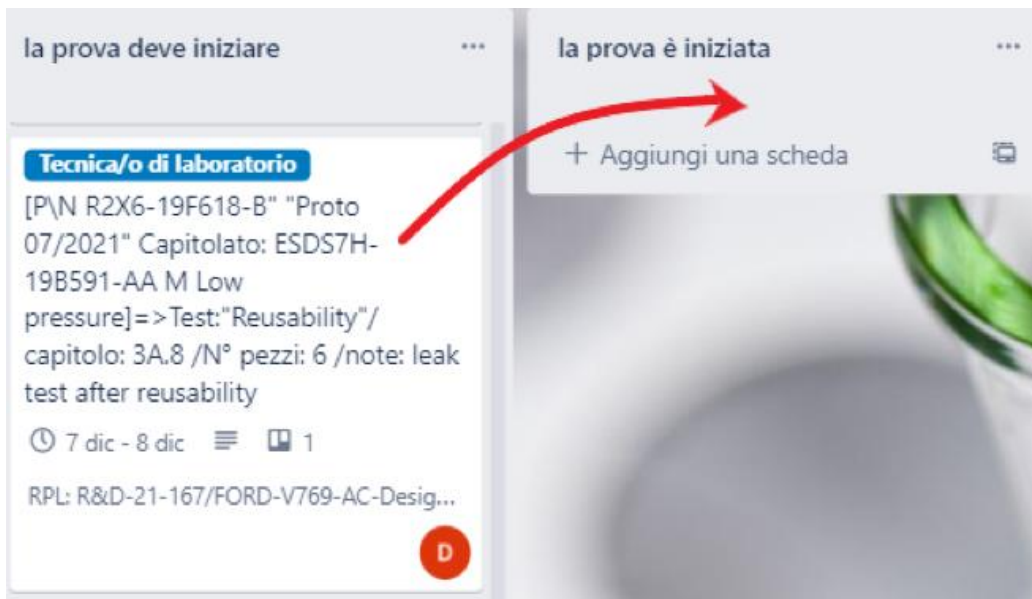


Fig 22 Moving card

between two lists: from “the test still needs to start” to “the test is started”

Putting the flag on the first item of the checklist, the tab changes position further and passes into the list "the test is over", then writes a comment in the parent card that justifies this progress



Fig 23 Moving card

between two lists: from “the test is started” to "the test is over"

Placing an additional flag on the item "report starts" the test passes into the list "the report has started" and The further comment will be inserted in the parent tab



Fig. 24 Moving

card between two lists: from "the test is over" to "report starts"

Finally, the "report done" flag moves the tab to the archive, since it indicates the end of the test. He writes a comment at the end of the report and thanks to a further rule he tracks the entry in the checklist to which the child card belongs and activates the flag. When a test in the requests list taken in charge gets all the elements of the checklists completed, that is, with a flag, it automatically passes into the archive list and puts the status of test delivered on time or delay, enters the actual end date, and puts a flag on the date to mark the finished card.

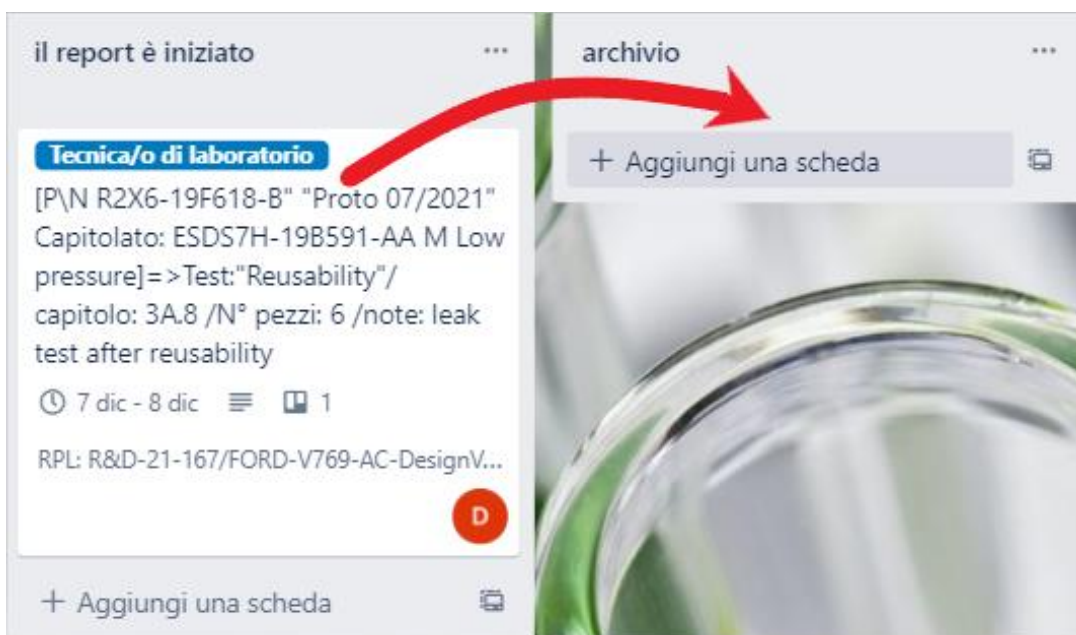


Fig. 25 Moving

card between two lists: from "report starts" to "archive"

Function of Labels

Labels are a tool that Trello makes available and have different features. First, they allow you to filter the cards according to the color of the label owned by the card, as well as being a visual aid in tracing or immediately understanding the cards on the board. In the case study, the use of labels acts as a trigger key for moving the cards from the "we are doing the test" list of the lab&testing R&D board (or lab&testing Quality) to the "test must begin" tab of the "test lab" bulletin board. Above all these features, labels were created to monitor the banks. In fact, the labels contain all the names of the benches and instruments in the possession of the laboratory and are divided into three colors: blue, red, and green.

So, each label has a color and a name. The blue labels have the name "laboratory technician" and there is only one, it is inserted when the card with the required test does not require the use of a specific machine or a machine at risk of high saturation, or when the machine or bench in question does not worry about the future organization, so there is no risk that multiple tests involve the same bench at the same time or that despite several tests involving the same bench or instrument at the same time the delivery of each test on time is not affected. Usually, these tests involve instruments and not benches and the time of completion of the test is short.

The red labels, on the other hand, bear the names of all the machines at risk of saturation, or the benches that over time have compromised the organization of the tests in the laboratory, bringing delays due to close tests that involved the same machinery. These instruments are usually benches and the time of completion of the tests is long, so much so that it lasts even several months.

Finally, the green labels bear the name of all the remaining benches that are not at risk of saturation over time. They are not triggered keys to transfer the boards between the boards but can be used to help the technician in identifying the machinery or instrument with which to conduct the test (when necessary) or to place the machine in the "under maintenance" list. This allows you to track all the benches or instruments that are under maintenance and act, accordingly, no longer accepting requests involving those machines or deciding to take the test to an external laboratory.

The entire subdivision with the labels has a very precise ultimate goal, which is to monitor the trend of saturation of the laboratory machinery in the long term and the short term. This is so as not to incur the possibility of having an overlap of several tests on the same bench, with the consequence of inevitable delays on most requests. In addition to this, also keep monitored the benches in maintenance, so as not to have delays related to their inefficient management. The ultimate goal is to respond to the requests made and create a monitoring system thanks to which you can accept or reject the requests of the different bodies, be able to understand with adequate advance already in the R.F.Q. which tests will be able to do and by when to have detailed planning not only of the present situation but also of the future one in the months to come. All this is possible thanks to Trello's timeline tool.

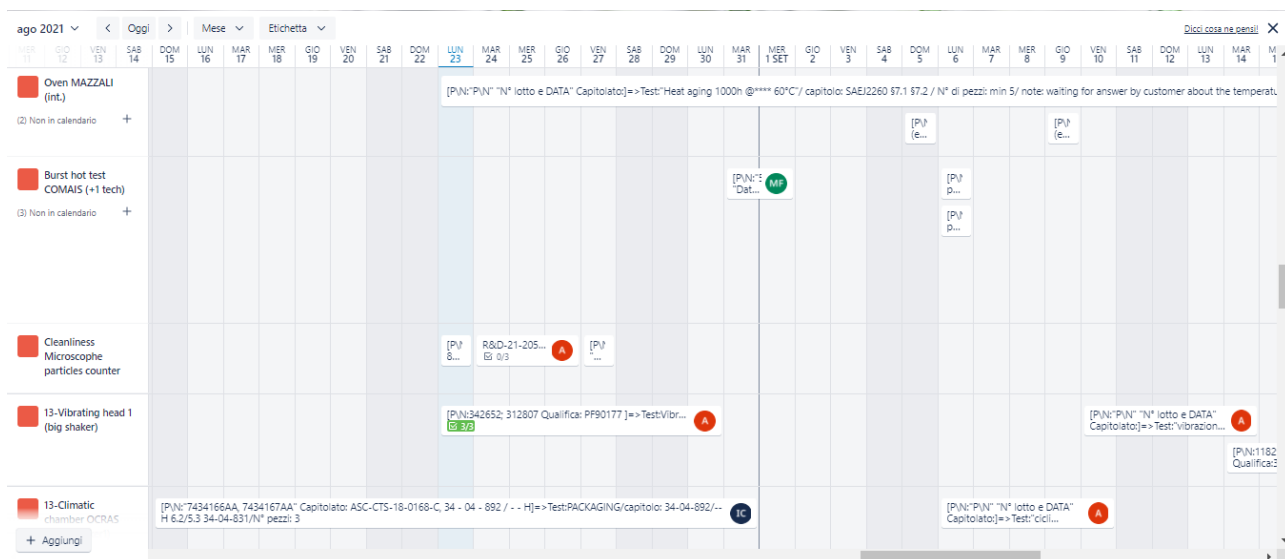


Fig 26 Trello's timeline tool

It provides a program similar to the one used by Microsoft Project, with the difference that each entry can have more than one bar that marks the execution time. As can be seen from Figure 26, on the vertical axis there are the names of all the red labels, that is, all the banks at risk of saturation, and on the horizontal axis at the top the time. This method is very visual, it allows to immediately identify overlapping tests involving the same machine. In fact, the ideal programming would be one in which each entry does not even have an overlap of lines, leaving a space between the beginning and the end of the tests, as in fig 27

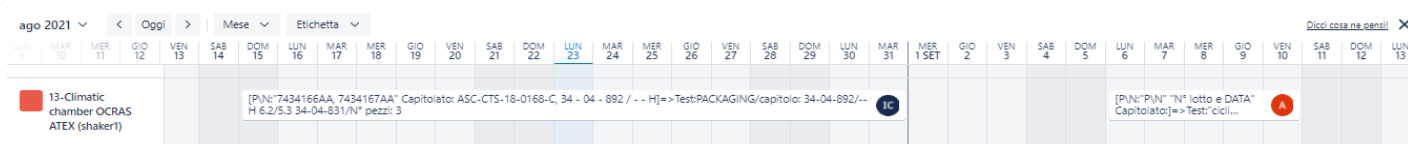


Fig. 27 Right way of scheduling test over one machine



Fig. 28 Wrong way of scheduling test over one machine: overlapping tests involving the same machine

It is evident that when two-time bars overlap on the same item or bench, in this case the head of the laboratory must intervene to smooth out the programming. This method is also useful to immediately assess whether or not to take charge of one test by consulting the laboratory loads in the timeline.

Filters

Trello allows you to filter tabs by tab name, the entry in custom fields, labels, board members, expiration date. This feature is useful for all boards since different members can filter the tabs and keep only the ones, they are interested in. There are two methods to obtain the same results in filtering the tabs: the first is to reach the commands through the "filter tabs" item of the board menu, the second, instead, can be reached through the dashboard functionality from the dashboard menu.

Menu filter figure

This mode can be used both by the laboratory manager and by all the people within the board in question. In fact, the manager can search through the "Search tabs" filter for the name of a tab and find it immediately. At the same time, applicants or laboratory technicians can, in the relevant reference board, easily filter all the cards by person, keeping only their own and eliminating the others from view. In this way the board is much more ordered, and it is also possible to combine the filter by expiration date and then leave on the board all the cards entrusted to a specific person that expire near a date or that have already expired.

Dashboard filters

This version of the filters is much more like an Excel sheet, so it is much more user friendly. As you can see from the image above, you can see all the information of a card: card name, labels, board members, expiration date. Note that at the top right are the filters that will keep the tabs meeting the requirements in the open dashboard. This method is particularly useful and fast when used by the head of the laboratories, who before assigning a test must have the general picture of the workload of each person. In this way by filtering by person, in a simple and fast way, it is possible to understand who the most available person is.

Archive system

On the first of each month the system is programmed to store the archive list in each bulletin board of the laboratory workspace. The software is programmed to make a change of lists take place at 00:00 on the first day of each month, that is, the first code changes the name of the archive list, inserting the current date, the name of the bulletin board, and the word "archive", then archives the aforementioned list and finally adds a new list with the name "archive" that will replace the previous one. This method is necessary to be able to keep the information for the KPIs, in fact leaving the tabs inside the lists even in the archive it is possible to retain the information in an orderly way and have them read to the "BlueCat report" software that will create the KPIs.

KPIs

The KPIs of the platform have been extrapolated thanks to a specific interface program with Trello, namely Bluecat Report. Through a careful analysis, the information necessary to make the best use of the history and data in possession has been identified, then through the programming of this interface application with

Trello graphs, numbers and lists have been created that can be useful for the work of process improvement, resource development and identification of problems. Each of the entries in the next figure was created with the aim of monitoring a possible critical environment that could bring out problems or that has already given evidence of this. One of the most important resources of this analysis is the division by department, thanks to this it is possible to trace the company area in which the most problems have been encountered, consequently acting directly and only in that direction, healing the problems that will emerge. In addition to this is even added the possibility of tracing the person who creates the requests and the technicians who carry them out. This possibility has also been examined and explored but being the next step to a first and general identification of the problems has not been reported. Despite this, this additional feature offers an in-depth and targeted second-level analysis that directly tracks the root causes of errors such as machines or people directly. The idea behind this two-level analysis is to understand the macro-areas of improvement through the KPIs shown in fig 29 and then understand the department or situation in which the outliers occur, finally with a secondary analysis the efficiency of people or machines in that specific area is evaluated. Identifying them solves the problem at the root, which may be a misunderstanding of the procedures or a malfunction of the system in use.

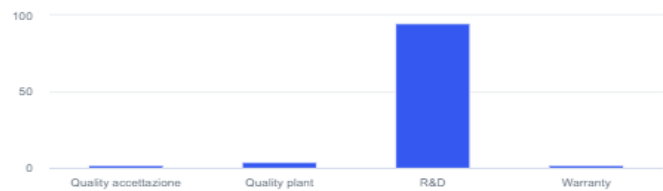
total number of requests

118
Cards

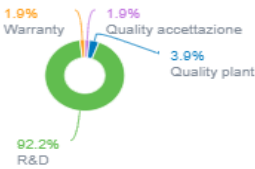
total number of open request

43
Cards

N° of requests for departament



% of requests for department



requests delivered late R&D

34
Cards

requests delivered late quality plant

0
Cards

requests delivered late quality acc.

0
Cards

requests delivered late warrenty&clier

2
Cards

% of delay requests for R&D



% of delay requests for quality plant



% of delay requests for quality acc.



% of delay requests for W&C



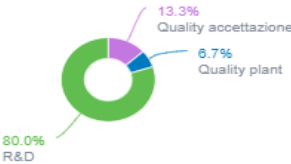
samples status number



samples status %



samples delay for departament



N° of RPL with samples delay



tests failed

3
Cards

no material to consume

3
Cards

Pieces with non-conformity

0
Cards

broken machines

2
Cards

wrong assembly

0
Cards

Fig. 29 Laboratory's KPI

In the first, the first two numbers that appear are respectively the number of total requests issued during the year and the number of open requests to be carried out immediately. In this way it is possible to immediately see the situation of the current and historical laboratory and its overall workload.

Immediately below, you can find the breakdown of requests according to the origin, that is, according to the department of issue. This step is also important because it gives a clear and crystal-clear idea of the area with which you have more contact, and you can evaluate the increases or decreases in requests over the years or even months. This could also be used as a performance indicator for various business sectors.

In the third line are reported the number of requests delivered late divided by applicant, in this way it is possible to objectively evaluate the areas of improvement through neutral indications and not through word of mouth and the dislike of people within the system. In the next line, the number of tests with a delay in the delivery of the specimens to perform the tests is analyzed; then, the number of tests with samples delivered late against those in which they were delivered on time. The result is two graphs that display the situation very well. In the first, the bar chart, you can find the exact number of samples delivered late against the exact number of those delivered on time, while the second graph is pie and contains the of the two types of delivery expressed as a percentage.

The sixth line has a structure similar to the previous one, the fifth; in fact, even here it is possible to find the two pie and bar graphs, while the first delivers the overall percentages that are more visually understandable, the second from a precise unit of measurement, a term of comparison and a precise number of the data you want to search. This line aims to conduct a first analysis on the causes of the problem and identify the area where these events occur most compared to the total number of requests issued. It is important to keep in mind that this data is purely explanatory, and it is not possible to report the true KPIs of the company for a matter of privacy. It is however important to reason about the fact that, in these specific data of delays in the delivery of the specimens, the calculation is made on the total; therefore, it may be that the department that issues the most requests may also be the one with the arrival of the most delayed auditions. The next step is to make a weighted average from the different company areas of the percentage of samples received on time or late coming, compared to the total of requests they have issued, as was done for the tests delivered. Since this is part of the second phase of the analysis, in order not to weigh down the explanation it was decided not to report it.

Finally, there are the causes of the tests that have been delayed, with their number. In this way it is possible to immediately identify the critical area of the laboratories and act by investigating the percentage of failures of people in that problem, so as to ascertain if it is a problem of the system or of the person.

Limits

Some issues have been raised, perhaps the most important of which is that Trello does not support a fully collaborative editing process. If technicians or applicants are used to working with fully collaborative tools,

this can lead to misunderstandings, then clear communication about roles and responsibilities is required. Especially if until now the main means of communication was the word and a meeting in person, changing paradigms and routines can lead to disorientation in seeking information. This is also due to the high processing of information, in fact, it can be difficult to always remember where to find the information you are looking for within the bulletin board or tab.

Another potential problem is the dependence on the browser, the articulated rules; in fact, even many rules can cause crashes or slowdowns. Some people may misunderstand their roles and duties, and this can cause two types of problems. The first problem could arise when a person within a team takes liberties that he does not have, such as changing the start or end date of a test or inserting the flags of delay or time of delivery test or auditions, etc. ... this would be a problem especially for the laboratory that would see its KPIs untrue. On the other hand, you can have the opposite situation, where too many rules annoy the people who have to fill out the test or run the test, leading them not to perceive the software as an advantage for them but a way to control them.

However, overall, Trello currently provides the best balance between usability and functionality to support technology-enhanced monitoring activities such as the Agile and Lean processes.

1. Portfolio monitoring experience
2. Current situation
3. Advanced requests and expected results
4. Troubleshooting Scheme
5. Description of methodologies
6. Process limits

Portfolio Monitoring Experience

Unlike the Portfolio process experience inherent in the company area of the Laboratory, the Portfolio monitoring project developed from needs that emerged during the journey within Sumiriko. In fact, this possibility was born thanks to the close contact with the PMO of the company Gianluca Nicchi. The latter, given the role he plays and his knowledge in the field of Project Management and Trello software, has been a reference for the development of the platform in the field of laboratories. As the first Portfolio process project progressed, latent needs emerged in the field of Project Management, a need that PMO Gianluca Nicchi had been trying to solve for years with the help of the Trello management software.

The interest of the PMO was to be able to have a database with the workloads of all the departments within Sumiriko, so we talk not only about the areas that interface with the laboratory, but all the areas that take part in the development of the project from the beginning, then from the taking over of the project until its end.

Such long and complex projects can take years to deliver and feature a breakdown into several stages. The departments analyzed are:

- Project Manager

- Quality Engineering
- Process Engineering
- Technical Office
- Product Buyer
- Logistics

This is where the Portfolio monitoring experience begins, the ultimate goal of which is to understand the breakdown of the workloads of these business areas through reliable data and illustrative graphs

Context Overview

Platform concept

First, it is important to know that work is organized according to platforms. The concept of the platform is a key element in business strategy. Companies develop by-products or derivatives using the platform, this allows to reduce the time and costs of new product projects. The advantages are a reduction in time and costs, also due to the use of some common elements between one project and another and the establishment of economies of scale. In addition, the use of a platform allows you to be responsive and respond quickly to market needs. A final advantage is that the platform allows you to separate more innovative activities from the more traditional ones, it can be used to test new technologies and create a base of know-how.

It can therefore be said that a "Platform Product" is a set of repeated assets, the value of which lies in the fact that these assets are put together functionally and are the basis, the starting point of derivative products. The advantages of a platform are:

- Reduction of production costs and therefore the economy of scale in the production phase, but also the economy of scale in the purchase phase
- Reduction of the TTM of a deriving product
- Reduction of development costs

While the disadvantages are:

- Complexity in the management of the platform
- Possible need to postpone the launch of the derived product, as the TTM of the derived product is reduced and has been absorbed by the design of the platform
- consequences generated by increasingly large platforms that produce derivative products that share a large number of components, this leads to a poor product differentiation
- increase in costs caused by possible mismatches between the strategy and the platform

Subdivision of platforms within Sumiriko

This preamble introduces the subdivision of Sumiriko and its platforms whose subdivision is as follows:

- Platform Italy: this platform works with all the most famous brands in the Italian territory, is the most numerous, and holds the largest number of resources involved. FCA, Ducati, CNH, etc...
- Special Platform: in this platform, we find the car manufacturers of the highest or most prestigious quality, name, and prices such as Piaggio and Ferrari.
- Platform Germany: from here you have the collaborations that come from Germany, including brands such as McLaren, Porsche, and Volkswagen.
- Platform France: Finally, similar to the German platform, in this platform there are some of the most important French car brands such as Renault.

Phases of the project

The intent of this paragraph is to outline the sequential phases followed by the projects and their construction. As previously written the projects involve all the departments listed above, but each at a different stage, at a different time, and for a different duration. Specifically, there are five:

- Initialization: the first and also the shortest of the phases, at this stage there are all the Feasibility analysis processes that lead to R.F.Q. To complete this task, all bodies are involved, but especially Product Buyers.
- Design: once the negotiation with the customer has been concluded and the work and with his authorization has been obtained, we start with an analysis of the requests through software. This analysis is conducted by the technical department that designs the piece requested by the customer through CAD. In addition, all the tests are conducted on the specimens necessary to validate the piece, that is, to ensure a certain behavior in an environment with certain external stimuli.
- Launch: Process Engineering is most involved in this phase since this is where the actual process of building the pieces is built. As a result, logistics and Quality Engineering are involved to support and follow this phase.
- Industrialization: this is the last step before placing the product on the market or supplying it directly to a BtoB customer. In this phase the piece is produced with the machinery that is the main actor in the production process, consequently, the Quality Engineering area is more involved in the control of production, to verify if indeed the assumptions and the results obtained from the previous tests are to be considered reliable. In addition, this department also supervises the production verifying that everything is as established by the standard
- Release: the last step that marks the end of the project, usually does not last more than three months and does not involve the business areas concerned in a very demanding way. In this phase the project is followed up to its destination, that is, until the delivery of the goods to the customer.

Each of these phases involves the departments with a different commitment and duration; The subdivision was created on an empirical basis, this means that through an intense study of the routines of the various people and a statistical survey that involved each department, it was possible to create percentages that reflect the average time taken by the individual in each phase compared to the sum of the time spent on a project design.

% of time spent for each phase of the same drawing					
	Initiating	design	launch	industrialization	release
Project Manager	17%	25%	25%	25%	8%
Quality Engineering	10%	14%	24%	43%	10%
Process Engineering	22%	11%	33%	28%	6%
Ufficio Tecnico	25%	75%	0%	0%	0%
Product Buyer	46%	36%	18%	0%	0%
Logistica	0%	13%	25%	38%	25%

Fig. 30 Percentage workload of departments distributed per project phases

It is now important to specify the role of the drawings within the projects: being a project usually connected to a product that must arrive on the market it is necessary to define the structure of the piece to be produced, as well as the specifications containing the information necessary for each business area to carry out its task in the best way. Given this, the work activity of the project changes according to the number of drawings present, so the commitment for each project can only be calculated considering the number of drawings present in each project. For this reason, the indicators necessary to monitor the workloads within the company do not take as a unit of measurement the projects but the drawings.

From here indicators have been created that identify the workload or commitment for each department in a certain period necessary to carry out the project and indicators that express the monthly commitment (calculated based on the number of drawings per project) that each project brings with respect to the various project phases.

Advanced requests and expected results

The requests made by the company's PMO were to create indicators that can be represented in a visual and intuitive way that can summarize the workloads to which people are subjected within the departments over the months and that can create a precise scheme with the number of projects over time divided by phase. The monitoring indicators must be differentiated according to the department and platform and must explicitly report the total weekly number of hours of all people within that workspace. They must also make it immediately clear visually the number of drawings for each phase at a given moment in time.

Considering this, the expected results are those of being able to first have a general picture of the collective number of hours divided by department and platform to monitor the surplus of hours to be employed and paid as overtime. Secondly, to be able to also evaluate the under-employment, in which the hours needed are less than those paid per week and for this reason to be able to intervene by moving the resource where

it is needed or using the layoff. It is also expected to be able to monitor the general trend of orders per platform, evaluating, therefore, the number of total projects per phase over a fairly wide time. This allows you to analyze the performance of the company at present and in the short and medium-term by evaluating whether it is appropriate to insert new resources within the company, if the business prospects are profitable, or whether to expect a more demanding period and reallocate resources where they can be exploited to the maximum potential.

Troubleshooting Scheme

First, we looked for the data necessary to be able to respond to the requests made and create a self-sufficient system that was within the reach of the expected results, that is, it was necessary to identify the database from which to extrapolate all the specific data necessary to be able to build the required indicators.

The data sought necessary for the completion of the Portfolio monitoring project were the drawing number per project, the beginning and end of the Initiating phase, the Design, Launch, Industrializing and Release phases. If in possession of this data it would be possible to create a graph containing the number of projects in the different phases, divided into the chosen time frame.

Precisely for this reason, it is extremely important to be able to find data in an easy, fast, and automated way.

The ideal place from which to extract them is once again the Trello management software, this is because, as mentioned above, the company's PMO has created for years a vast network of Trello boards divided according to the four platforms and other needs such as prototyping. Within these boards, the implemented system presents all the information necessary for the purposes of our project within each board. Then, in each of the four platform boards are inserted, monitored, and controlled all the projects, in progress and concluded, through the cards, each tab a project, a project a customer. From image 31 it is possible to extrapolate all the necessary information the Total P\NS entry refers to the number of drawings to be viewed by project or order, while the item "Award date SRK" corresponds to the beginning of the Initiating phase, the first; instead, the field "Design phase SRK" contains the end date Start and start phase Design, the same thing for the phase "Launch phase SRK" which marks the end of the Design and start Launch and "Industrialization phase SRK". The phases "Project Release phase" and "Customer SOP/J1" both indicate the end of the Release phase, they are two since the "Project Release phase" is not always present, consequently by convention if it is missing you can use the date in the "Customer SOP/J1" field and add three months, thus obtaining the end of the Release phase.

Thanks to the acquisition of these data, it is possible, theoretically, to create the graphs required to meet the expected results, but looking within Trello there were no support programs, internal or external, that could respond to the need to plan in the future by acquiring data from "custom fields". Although Trello is a cutting-edge management software, this is one of the biggest limitations, that is, apart from the starting

date and two dates, it does not allow you to store data in any timescale that has not passed over time, for now.

Precisely for this reason it turned out not to be useless to work on Trello to conclude this task, consequently the most plausible option was to find a way to extrapolate the data from the context and use them to rework them in another software in which it was possible to use the data with more freedom, without the constraints imposed by the management program.

Campi personalizzati

PROJECT KIND	COMPLEXITY	R&D PROJECT NUM...
New Business	Standard	400362
SRK PROJECT RELE...	CUSTOMER	PICK VOLUMES/YEAR
+ Aggiungi data...	MASERATI	6000
AWARD DATE	CUSTOMER PRODU...	OT CUSTOMER PHA...
8 mag 2020 alle 12:00	CASSINO	5 feb alle 12:00
OTOP CUSTOMER P...	CUSTOMER SOP/J1	SRK PRODUCTION ...
24 giu alle 12:00	30 nov alle 12:00	HP
SRK DESIGN PHASE	SRK LAUNCH PHASE	SRK INDUSTRIALIZ...
22 giu 2020 alle 12:00	18 dic 2020 alle 12:00	15 feb alle 12:00
SRK PPAP FORECAST	SRK PROJECT RELE...	TOTAL P/NS
5 apr alle 12:00	22 lug alle 12:00	2
% DEL. INITIATING	% DEL. DESIGN	% DEL. LAUNCH
100	106.25	100
% DEL. INDUSTRIAL...	% DEL. PROJECT RE...	PROJECT RISK LEVEL
100	50	Aggiungi project ris...
PROJECT OVERALL ...	PROJECT OVERALL ...	PPAP: NBR OF FULL...
500	On schedule	2
PPAP: NBR OF INTE...	PPAP: NBR OF PEN...	PPAP: NBR OF DELAY
Aggiungi ppap: nbr ...	Aggiungi ppap: nbr ...	Aggiungi ppap: nbr ...

POWER-UP

- Smart Fields
- View on timeline
- + Aggiungi Power-Up

AUTOMAZIONE

- Design
- Industrialization
- Initiating
- Launch
- Project release
- + Aggiungi pulsante

AZIONI

- Sposta
- Copia
- Crea modello
- Segui
- Archivia
- Condividi

Fig. 31

Customs fields of Platforms bulletin boards

Data extrapolation

It was chosen, as the target software, to use the Excel platform to analyze the system, for the intrinsic peculiarities of the program. In fact, Excel lends itself very well to working with external data, moreover its

computing power, the skills previously acquired in the field, and the various visualization tools make it perfect to fulfill the set purpose. In order to have the data in a simple, easy and automatic way, many methodologies have been examined that would allow them to be exported from Trello to insert them into Excel. First, we worked with the intrinsic code of Programming Trello's boards, to visualize the data and extract it, but it turned out to be a burdensome and difficult path to continue. Secondly, we relied on programs that would allow the conversion of cards from the management software in preset excel boxes, but even in this case there were impediments such as the rules for the privacy of corporate data and the complexity of the system. Finally, we chose to solve the problem of exporting data by relying on an additional program supported by Trello: Pivot Table (by Conjoint.ly).

The screenshot shows the Trello Pivot Table interface. On the left, there are several filter categories: Card ID, List, List Index, Labels, PPAP: Backlog, Project Overall Status, Project Overall Score, Project Kind, % Del. Design, % Del. Initiating, Customer production site, SRK PPAP forecast, SRK Production Site, OTOP Customer phase, OT Customer Phase, Pick volumes/year, Customer, R&D Project number, and SRK Project Release Phase. The main table has columns for Card Name, Members, Award date, SRK Design phase, SRK Launch phase, SRK Industrialization phase, SRK Project Release phase, Customer SOP/J1, Total p/ns, Complexity, and Totals. The table lists various projects such as 225 - CANISTER, 332 - Duplicazione produttiva (SRK HTN-SRK ITA), 332-ODM3794 / 312-ODM6013 / 846-ODM272 (Modifica gommini), 520 MHEV - IHX (ODM6064), 520 MHEV - LIQUID LINE, 520 MHEV - ODM7193 (Additional canals + grommets), 520 RHD MHEV IHX - ODM7348, 520/334/560 MHEV - FUEL, 560 MHEV - ODM1284 (Sensata sensor shifting), 592 - COOLANT, 592 - TOC, 965 - Blow by, and CAB 405 - modifica pn EB.0151411.C -> 411.D.

Card Name	Members	Award date	SRK Design phase	SRK Launch phase	SRK Industrialization phase	SRK Project Release phase	Customer SOP/J1	Total p/ns	Complexity	Totals
225 - CANISTER	Alperen Aksay, Luca Lo Greco	2020-06-08T10:00:00.000Z	2020-06-15T10:00:00.000Z	2021-01-14T11:00:00.000Z	2021-03-11T11:00:00.000Z	2021-07-16T10:00:00.000Z	2021-09-30T10:00:00.000Z	1	Standard	2,020
332 - Duplicazione produttiva (SRK HTN-SRK ITA)	Luca Lo Greco	2021-04-05T10:00:00.000Z	2021-04-12T10:00:00.000Z	2021-05-11T10:00:00.000Z	2021-06-03T10:00:00.000Z	2021-09-17T10:00:00.000Z	2020-06-19T10:00:00.000Z	2	Standard	2,021
332-ODM3794 / 312-ODM6013 / 846-ODM272 (Modifica gommini)	marco chiavero	2021-04-23T10:00:00.000Z	2021-05-17T10:00:00.000Z	2021-09-10T10:00:00.000Z	2021-09-22T10:00:00.000Z	2021-11-29T11:00:00.000Z	null	3	Easy	2,021
520 MHEV - IHX (ODM6064)	Luca Lo Greco	2020-07-15T10:00:00.000Z	2020-07-17T10:00:00.000Z	2020-11-09T11:00:00.000Z	2020-12-21T11:00:00.000Z	2021-05-21T10:00:00.000Z	2021-11-29T11:00:00.000Z	1	Easy	2,020
520 MHEV - LIQUID LINE	Luca Lo Greco	2020-02-12T11:00:00.000Z	2020-02-27T11:00:00.000Z	2020-10-23T10:00:00.000Z	2020-11-18T11:00:00.000Z	2021-03-26T11:00:00.000Z	2021-11-29T11:00:00.000Z	1	Easy	2,020
520 MHEV - ODM7193 (Additional canals + grommets)	Luca Lo Greco	2021-03-29T10:00:00.000Z	2021-05-03T10:00:00.000Z	2021-06-10T10:00:00.000Z	2021-08-06T10:00:00.000Z	2021-11-23T11:00:00.000Z	2021-11-29T11:00:00.000Z	1	Easy	2,021
520 RHD MHEV IHX - ODM7348	Luca Lo Greco	2021-06-09T10:00:00.000Z	2021-06-23T10:00:00.000Z	2021-07-30T10:00:00.000Z	2021-09-24T10:00:00.000Z	2022-01-10T11:00:00.000Z	2021-11-29T11:00:00.000Z	1	Easy	2,021
520/334/560 MHEV - FUEL	Luca Lo Greco	2019-10-31T11:00:00.000Z	2019-11-07T11:00:00.000Z	2020-10-05T10:00:00.000Z	2020-12-21T11:00:00.000Z	2021-06-18T10:00:00.000Z	2021-11-29T11:00:00.000Z	6	Standard	2,019
560 MHEV - ODM1284 (Sensata sensor shifting)	Luca Lo Greco	2020-11-27T11:00:00.000Z	2020-12-17T11:00:00.000Z	2021-03-29T10:00:00.000Z	2021-04-19T10:00:00.000Z	2021-08-05T10:00:00.000Z	2021-11-29T11:00:00.000Z	2	Easy	2,020
592 - COOLANT	Alperen Aksay, marco chiavero	2021-04-16T10:00:00.000Z	2021-06-10T10:00:00.000Z	2021-11-05T11:00:00.000Z	2021-12-07T11:00:00.000Z	2022-05-25T10:00:00.000Z	2022-07-22T10:00:00.000Z	1	Standard	2,021
592 - TOC	marco chiavero	2021-03-02T11:00:00.000Z	2021-03-15T11:00:00.000Z	2021-09-08T10:00:00.000Z	2021-11-04T11:00:00.000Z	2022-03-31T10:00:00.000Z	2022-05-23T10:00:00.000Z	1	Easy	2,021
965 - Blow by	Luca Lo Greco	2020-11-11T11:00:00.000Z	2021-01-18T11:00:00.000Z	2021-04-30T10:00:00.000Z	2021-06-18T10:00:00.000Z	2021-10-18T10:00:00.000Z	2022-03-01T11:00:00.000Z	1	Standard	2,021
CAB 405 - modifica pn EB.0151411.C -> 411.D	marco chiavero	2020-06-2020-09	2021-01-2021-03	2021-01-2021-03	2021-10-2021-10	2021-07-2021-07		1	Standard	2,020

Fig 32 Trello's power-up: Pivot Table

In this way, through a simple copy and paste of the green part to the right of Figure 32 it is possible to box all the necessary data, namely:

- Card Name: project name
- Members: PM entrusted to the project
- Award date: start date of the Initiating phase
- SRK Design phase: end date of Initiating and start of the Design phase
- SRK Launch phase: date end of Design and start of the Launch phase
- SRK Industrialization phase: date end of Launch and start of the Industrialization phase
- SRK Project Release phase: end date of Industrialization and start of Release phase, as well as early possible end date of the Release phase
- Customer SOP/J1: second possible date to be used for the end of the Release phase

- Total p/ns: number of drawings per project
- Complexity: difficulties of the project

This last entry, Complexity, was inserted later to take into account the intrinsic difficulty of the drawings within the project and not just the quantity. It will be used later to normalize the number of projects and can be: Easy, Standard, Complex.

Troubleshooting

Once the data was extracted, from the initial database simply copying it, you began to design the structure of the programming to be executed. First, it is important to remember that all four platforms (Italy, Germany, France, and Specials) are identical in their intrinsic structure; this means that once you have created the mechanism of extrapolation, calculation, and creation of graphs for a platform, you can automatically recreate the same system for the three remaining platforms, in exactly the same way. Having as already mentioned, found the necessary data and found the arrival platform, the next necessary step is to identify the structure of the code, or to understand how to obtain the two types of graphs: the first that presents the number of drawings divided by phase over a wide period, while the second that represents the weekly number of hours of people within the departments that deal with that specific platform, or the representation of the workloads of the departments of the company most involved in the project phases. First of all, a convention was agreed that could allow establishing unequivocally in which phase the project was located. In other words, it was decided that a project should, at a precise moment in time, unequivocally belong to one and only one phase, consequently its number of drawings will be analyzed, at that stage at that specific time, by the various departments in the corresponding ways. The chosen convention is as follows: the project is in a specific phase (among those provided: Initiating, Design, Launch, Industrializing, and Release) if the current day is between the first day of the beginning of a phase of the project and the penultimate day of the end of the phase. This clarification, which might seem redundant, has made it possible to identify at a given day, the current one, the total number of drawings (for open projects) for each individual phase. This is thanks to the information obtained from the start and end dates; taking it a step further it is possible to understand that by replacing the current day with any day of the year, the rule still exists. This intuition has made it possible to create a normalized chronological time axis capable of evaluating workloads in terms of the number of drawings, from the most recent past to the less near future.

Graphic: N° drawings per phase

Including the mechanism explained above, the further step to be taken is to decode the data obtained from Trello through Pivot Table and create an automatic, self-sufficient, and user-friendly mechanism that can extrapolate the number of drawings divided by each phase in the given moment of time of interest. First, as you can see from Figure 32, the dates corresponding to the beginning and end of each phase are not written with the formatting required by the software to be able to analyze and compare them with other

numbers and to build graphs. Secondly, it was decided to take a calendar regularly interspersed with a month. This, however, means creating pre-established reference dates which, compared with the dates of the project phases, create a static system that does not update itself. In other words, taking as fixed dates of the calendar the first of each month, at the beginning the system would not have data on the previous months (although in the database there is most likely the necessary information), while the closer you get to the end of the year, the more the future time horizon is lowered and the history of the past months is raised instead (which serves very little), until the first of December with a future perspective of only 30 days. Hence the need for a calendar that is automatically renewed, always leaving always unchanged both, the number of future months thanks to which to understand the company's performance, and the past ones, which serve only as a historical and consequently not many are needed. In order to meet these two needs and to be able to create a system that is self-sufficient and automated, it was decided to use the Power Query interface.

Programming in Power Query

Power Query is a data transformation and preparation engine. Power Query provides a graphical interface for obtaining data from sources and a Power Query editor for applying transformations. Because the engine is available in many products and services, the destination where the data will be stored depends on the Power Query location you use, in this case it is Excel. Using Power Query, you can perform "extract, transform, and load (ETL) data" processing. The first step carried out with this system, was to create an Excel table with the data extracted from the Trello Pivot Table, identifying a result very similar to figure 32 but on Excel. At this point, the transformation engine was controlled to work with only the data in the table and so the actual programming began. We started by making a transformation that brought the dates written in Trello's language into a formatting understandable to Excel and Power Query, as shown in Figure 33.

ABC 123	Card Name	ABC 123	Members	ABC 123	Award date	ABC 123	SRK Design phase	ABC 123	SRK Launch phase	ABC 123	SRK Industrialization phase	ABC 123	SRK Project Re
1	225 - CANISTER		Luca Lo Greco		2020-06-08T10:00:00.000Z		2020-06-15T10:00:00.000Z		2021-01-14T11:00:00.000Z		2021-03-11T11:00:00.000Z		2021-07-16T10:00:00.000Z
2	332 - Duplicazione produttiva (SRK HTN-SRK ITA)		Luca Lo Greco		2021-04-05T10:00:00.000Z		2021-04-12T10:00:00.000Z		2021-05-11T10:00:00.000Z		2021-06-03T10:00:00.000Z		2021-09-17T10:00:00.000Z
3	332-ODM3794 / 312-ODM6013 / 846-ODM272 (Modifica gommino)		Luca Lo Greco		2021-04-23T10:00:00.000Z		2021-05-17T10:00:00.000Z		2021-09-10T10:00:00.000Z		2021-09-22T10:00:00.000Z		2021-11-29T11:00:00.000Z
4	520 MHEV - IHX (ODM6064)		Luca Lo Greco		2020-07-15T10:00:00.000Z		2020-07-17T10:00:00.000Z		2020-11-09T11:00:00.000Z		2020-12-21T11:00:00.000Z		2021-05-21T10:00:00.000Z
5	520 MHEV - LIQUID LINE		Luca Lo Greco		2020-02-12T11:00:00.000Z		2020-02-27T11:00:00.000Z		2020-10-23T10:00:00.000Z		2020-11-18T11:00:00.000Z		2021-03-26T11:00:00.000Z

ABC 123	Card Name	ABC 123	Members	ABC 123	Award date	ABC 123	SRK Design phase	ABC 123	SRK Launch phase	ABC 123	SRK Industrialization phase	ABC 123	SRK Project Re
1	225 - CANISTER		Luca Lo Greco		08/06/2020		15/06/2020		14/01/2021		11/03/2021		
2	332 - Duplicazione produttiva (SRK HTN-SRK ITA)		Luca Lo Greco		05/04/2021		12/04/2021		11/05/2021		03/06/2021		
3	332-ODM3794 / 312-ODM6013 / 846-ODM272 (Modifica gommino)		Luca Lo Greco		23/04/2021		17/05/2021		10/09/2021		22/09/2021		
4	520 MHEV - IHX (ODM6064)		Luca Lo Greco		15/07/2020		17/07/2020		09/11/2020		21/12/2020		
5	520 MHEV - LIQUID LINE		Luca Lo Greco		12/02/2020		27/02/2020		23/10/2020		18/11/2020		

Fig 33 Power query first data analysis

In order to have a graph that presents at each moment chosen the corresponding number of drawings in the different phases it is at least necessary to have a table with the sum of the drawings for each phase divided into a time frame at regular intervals. Precisely for this reason, five "fundamental" tables have been created containing the number of drawings per month, one for each phase. The programming of the latter uses lines of code very similar to each other, in this way it has simplified the work to create the subsequent

tables of the other phases. Once you have successfully transitioned between formatting, the next step in the table code of a phase is to delete all entries that do not belong to that stage. For example, if you are creating the Initiation phase table, the columns "SRK Launch phase", "SRK Industrialization phase", "SRK Project Release phase", "Customer SOP/J1" and "Totals" contain information that is not necessary for the purpose to be realized. Precisely for this reason, they must be eliminated, so as not to weigh down the code. Next, we renamed the two cells containing the names of the dates marking the beginning and end of each project for that specific phase. If you wanted to continue the previous example, you would change the column with the name "Award date" to "start date" and the column with the as "SRK Design phase" to "end date". Finally, the last step, before the construction of the table with the drawings per month of each project, is to create the corrective coefficient from the "Complexity" column that will be useful to quantify the real hours of work or workloads of people within the entities working in the platform. The calculation used was as follows: a degree of "Complexity" corresponding to "Easy" was assigned a corrective coefficient equal to 0.6, as regards, instead, the degree "Complex" was attributed a coefficient equal to 1.3, while, finally, the "standard" degree corresponds to the coefficient 1.

	Card Name	Members	data inizio	data fine	Total p/ns	tipo
1	225 - CANISTER	Luca Lo Greco	08/06/2020	15/06/2020	1	1
2	332 - Duplicazione produttiva (SRK HTN-SRK ITA)	Luca Lo Greco	05/04/2021	12/04/2021	2	1
3	332-ODM3794 / 312-ODM6013 / 846-ODM272 (Modifica gommino)	Luca Lo Greco	23/04/2021	17/05/2021	3	0,6
4	520 MHEV - IHX (ODM6064)	Luca Lo Greco	15/07/2020	17/07/2020	1	0,6
5	520 MHEV - LIQUID LINE	Luca Lo Greco	12/02/2020	27/02/2020	1	0,6
6	520 MHEV - ODM7103 (Additional canalina + grommet)	Luca Lo Greco	29/03/2021	03/05/2021	1	0,6
7	520 RHD MHEV IHX - ODM7348	Luca Lo Greco	09/06/2021	23/06/2021	1	0,6
8	520/334/560 MHEV - FUEL	Luca Lo Greco	31/10/2019	07/11/2019	6	1
9	560 MHEV - ODM1284 (Sensata sensor shifting)	Luca Lo Greco	27/11/2020	17/12/2020	2	0,6
10	592 - COOLANT	Alperen Aksoy, Luca Lo Greco	16/04/2021	10/06/2021	1	1

Fig. 34 Power query finals data corrections

After this step it was necessary to deal with the second need, that is to create a chronological table for each phase that would be updated automatically and always project the same time frame, updating day by day. In response to this, an algorithm was created that read the current date of the computer and from this created the regularized intervals, thirty days from each other. As a result, as many columns as the months of the year plus three (for retrospective months) have been inserted. In this way, through optimal software programming, a table was created for each phase that presented for each project the number of drawings during the year and that was automatically updated every time the file was opened. The result is visible in Figure 35, where the months are not expressed by the proper name, but as a deviation from the current day. It does not matter, therefore, what month is "Month 1", but it certainly represents the current day in the month following this.

Card Name	Month -3	Month -2	Month -1	today	Month 1	Month 2	Month 3	Month 4	Month 5
225 - CANISTER									
332 - Duplicazione produttiva (SRK HTN-SRK ITA)		2							
332-ODM3794 / 312-ODM6013 / 846-ODM272 (Modifica gommino)			2	2	2	2			
520 MHEV - IHX (ODM6064)									
520 MHEV - LIQUID LINE									
520 MHEV - ODM7103 (Additional canalina + grommet)			1						
520 RHD MHEV IHX - ODM7348				1					
520/334/560 MHEV - FUEL									
560 MHEV - ODM1284 (Sensata sensor shifting)									
592 - COOLANT				1	1	1	1	1	
592 - TOC	1	1	1	1	1	1			
965 - Blow by	1								
CAB 405 - modifica pn EB.0151411.C --> 411.D									
Cambio fornitore O-ring canister									
Cambio fornitore TPS (da SL a GAMM)									
Cambio fornitore innesto maschio PM81T									
Cambio manicotti VERITAS --> SRK (CRF 2020-2111)				8					
Canister 520 , 334 , 560 MHEV - ODM6819 + 965 MHEV ODM1657 + 356 - ODM2572 - raddoppio attrezzamento HTR									
Canister 636									
DAILY MY 2021									
Estensione volumi 965 BLOW BY - ODM6833	1	1	1	1	1				

Fig. 35 Excel output

Figure 35 shows the "Starting" phase of the projects on the Italia platform, the numbers in the cells represent the drawings per project and finally the number of cells containing numbers corresponds for each project to the length from the phase (Ex: the phase of the "592-COOLANT" project began this month and will end in four months). In the reference Excel sheet of each platform, there are five tables like the one in figure 35, one for each phase. From these tables, divided precisely by phase, it is possible to derive the sum per month of projects. Thanks to this, the first graph required in figure 36 was created, where the first three months correspond to a retrospective look, in order to create a history of the work done, while the following months are the planning of what will have to be done. Thanks to the implemented algorithm, every time the program is launched, the software retrieves the data of the Trello raw table, previously loaded, and interpolates them creating the graph in the figure 36. In the meantime, it checks the current date and recalculates everything based on it, allowing automatic, fast programming that responds to the need to have the dates that are updated from time to time in a sequential way.

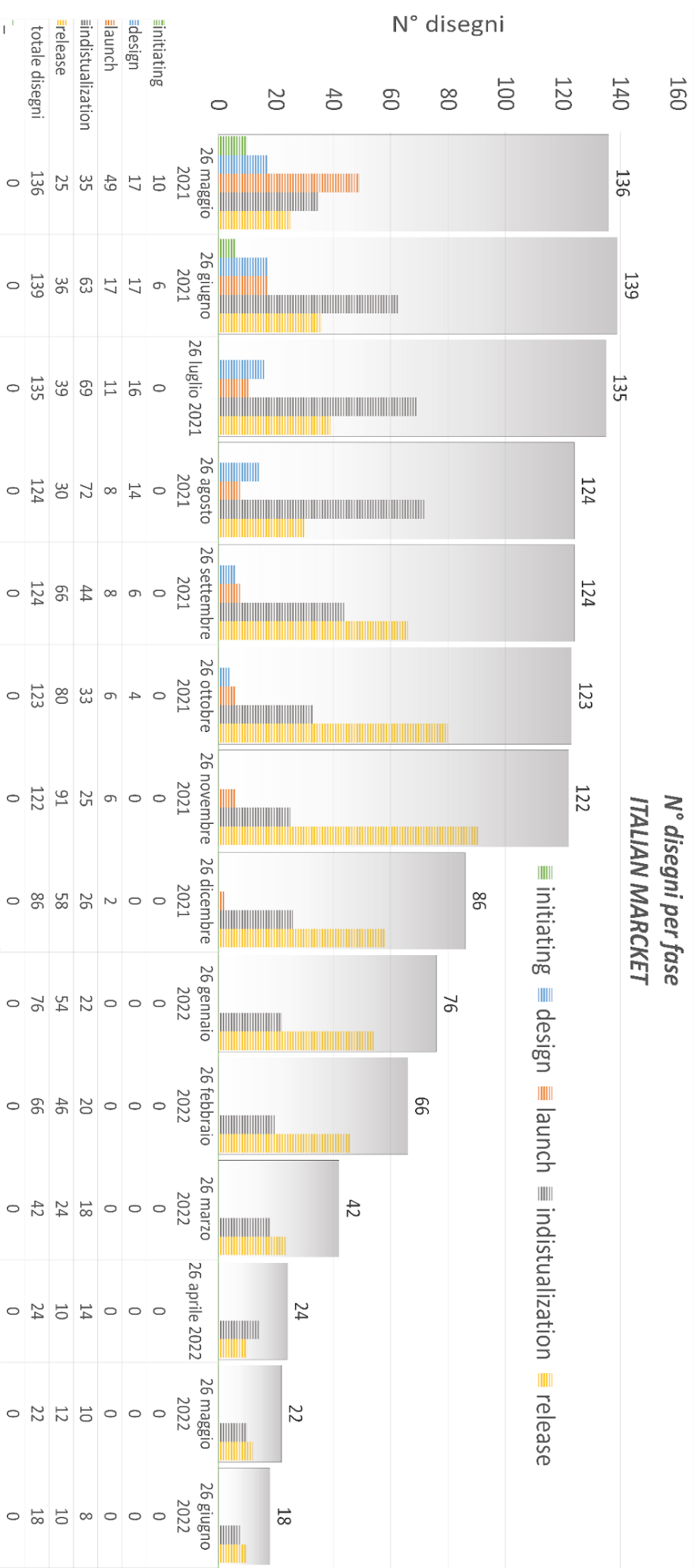


Fig 36 First graph: number of drawings for each phase at a given moment in time.

Graph: Workloads and weekly hours

By combining the table in Figure 30 and the tables obtained from programming in Power Query, it was possible to create a graph that reported the weekly hours during the weeks of the reference month, for the various months to come. In order to do this, it was necessary to know the average time in hours spent by each person of the various departments to complete or view a drawing of a project along with all the phases. That is, how long it takes on average a person to follow a drawing along all its stages, of course, this varies not only according to people. It was possible to know this thanks to a specific statistical survey involving all the people in each area. In fact, the average number of hours spent by each person in the department following a drawing, over a week, in all five phases was found. The data are collected in the following table:

hours needed for one person of department to get done one drawing thought all the phases in one week	
Project Manager	3,00
Quality Engineering	5,25
Process Engineering	9,00
Ufficio Tecnico	8,00
Product Buyer	14,00
Logistica	2,00

fig 37 hours needed to conclude one drawing for a department

Thanks to these data and the occupancy rates of each stage in Figure 30, it was possible to create the table in Figure 38 simply by multiplying the percentages with the respective hours.

Hour needed to complete one technical drawing	Initiating	design	launch	indistualization	release
Project Manager	0,50	0,75	0,75	0,75	0,25
Quality Engineering	0,50	0,75	1,25	2,25	0,50
Process Engineering	2,00	1,00	3,00	2,50	0,50
Ufficio Tecnico	2,00	6,00	0,00	0,00	0,00
Product Buyer	6,50	5,00	2,50	0,00	0,00
Logistica	0,00	0,25	0,50	0,75	0,50

Fig. 38 hours needed to conclude one drawing for department divided for project phases

Having this last information and the sum of the drawings divided by phase over the various months (fig 35), it was then easy to obtain the hours that the departments would have to do in total over a week. It was enough, in fact, to multiply the hours needed to supervise a drawing in one phase with the sum of the drawings in that phase in the various months for each department. The result was the graphs in Figure 39. The red limit corresponds to the forty hours per week allowed by law and refers to a single person, most likely for each company area in the platform more people work, consequently, the forty hours per week must be multiplied by the number of workers.

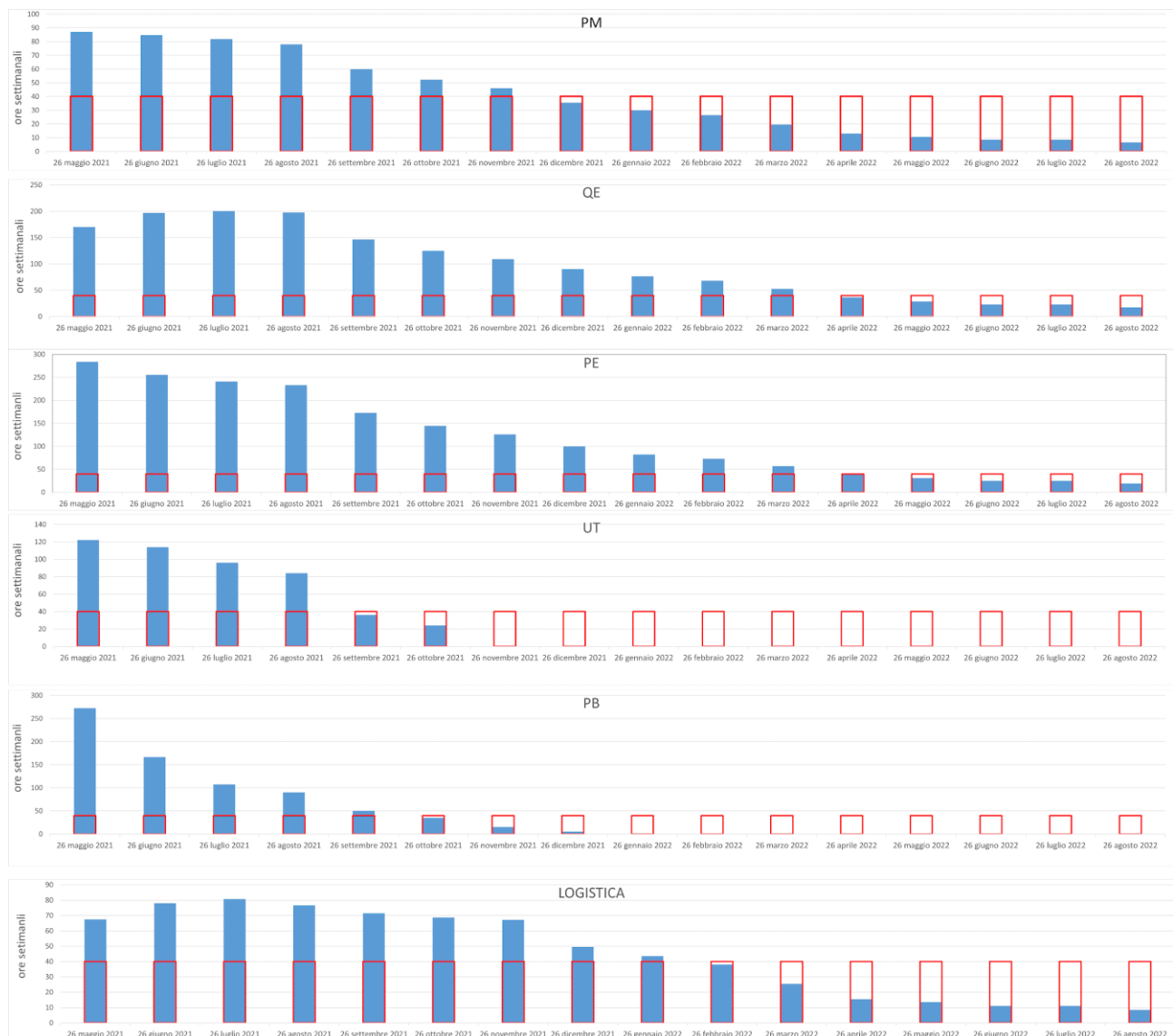
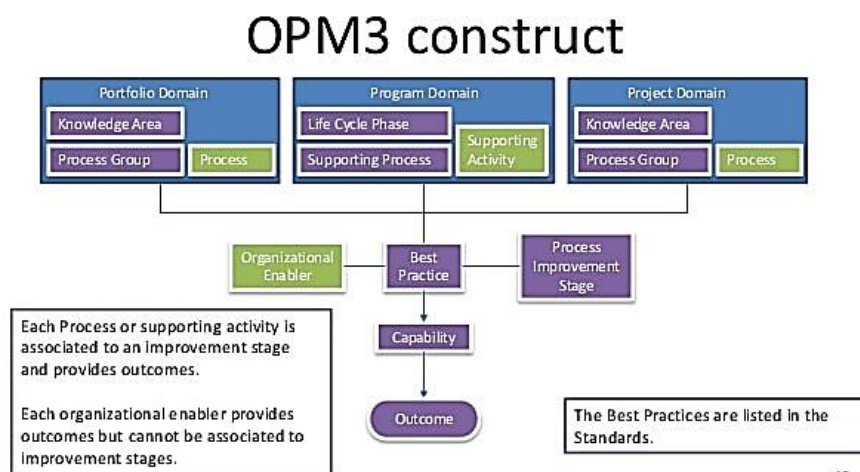


Fig. 39 Second graph: total weekly number of hours of all people within that workspace divided for departments

OPM3 Best Practices

An implementation of a successful strategy can turn an organization into a large organization. However, it can also damage an organization's reputation and brand if it doesn't generate strong results. The OPM3 framework is a conceptual approach that helps organizations develop a strategy and implement a project management process that supports the achievement of Best Practices in each of the domains. The execution of the strategy is an integral part of the operations of any organization, it is responsible for driving sustainable results and achieving strategic objectives. Best Practices help organizations manage investments that support their change initiatives; therefore, by joining OPM3, they are also compatible with other international standards.

As mentioned, the Office of the Prime Minister's Best Practices (OPM3) is a framework that can help organizations achieve their strategic goals and build a strong, reliable, and capable management team. It is a framework composed of three related components: (1) Best Practices, (2) Capabilities, and (3) Outcomes, all within the portfolio, program, and project management domains. This framework has been developed on the basis of the principles of the Prime Minister's Best Practices.



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Fig. 40 OPM3 construct

Best Practices

As defined in OPM3: A Best Practice is a grouping of related organizational skills. They are methods that are used to achieve a stated goal. In fact, the very concept of Best Practice is used to describe the methods necessary to achieve the goal. There are two categories of OPM3 best practices:

1. SMCI best practices or Process improvement
2. Best practices for Organizational Enablers [structural, cultural, technological, and human resources]

Capability

A project management capability is a specific set of skills or competencies that an organization needs to perform its tasks and provide its products and services. It is an incremental step in the development of a Best Practices framework. Thus, it is a set of people, processes, and technologies that allow an organization to provide effective management of organizational projects.

Outcome

A Result is a result (tangible or intangible) of an organization that exhibits a Capacity. The purpose of incorporating results into OPM3 is that these results are evidence that a certain capability exists or has been achieved in the organization. In other words, if you have a certain Capability, there must be some objective evidence that this is the case, for example, an OPM3 Key Performance Indicator (KPI), that is, a metric that can tell us, quantitatively or qualitatively, the degree of existence of the Result.

Domains

OPM3 uses the construct of Project, Program and Portfolio Management domains, which represent increasing levels of sophistication and control and increasingly complex communities of practice as a fundamental dimension within which OPM3 Best Practices are framed. The Program Management Domain provides the processes to manage a group of related projects in a coordinated manner to gain unavailable benefits and control from their management. The portfolio management domain includes the management of a set of projects and/or programs and other work that may not be related but which benefit from general control and allocation of organizational priorities and resources. Project management standards order and describe the good practices that guide project management processes. The Project Management Domain describes the areas of knowledge and groups of processes that guide the conduct of individual projects. Each of the OPM3 domains includes domain-specific processes that can be run to gain the control, efficiency, and consistency needed to implement strategic initiatives and achieve the desired organizational outcomes.

Organizational Enabler

Organizational project management includes an organization's business execution strategy, providing a high-level perspective to focus on project selection and the allocation of critical resources to implement goals through initiatives that have a direct impact on financial results. Next, organizational project management helps ensure that all levels of the organization understand the relationships between the strategic vision, the initiatives that support the vision and goals, and the end results. The presence of Organizational Enabler indicates that an organization has matured to the point of establishing a stable

environment of OPM practice and has embraced the disciplines of project, program, and portfolio management to achieve this goal. Organizational Project Management (OPM) is the systematic management of projects, programs, and portfolios in line with the organization's strategic business objectives. OE Best Practices describe the general management processes that should be developed in an organization to support the management of organizational projects. The purpose of organizational project management is to ensure that the organization undertakes the right projects and allocates critical resources appropriately.

Process Improvement

The capabilities of the SMCI or Best Practice of Process improvement for each group of processes in each domain are organized to refer to the process improvement paths through the phases of: Standardize, Measure, Control, and Continuously Improve as shown in Figure 41.

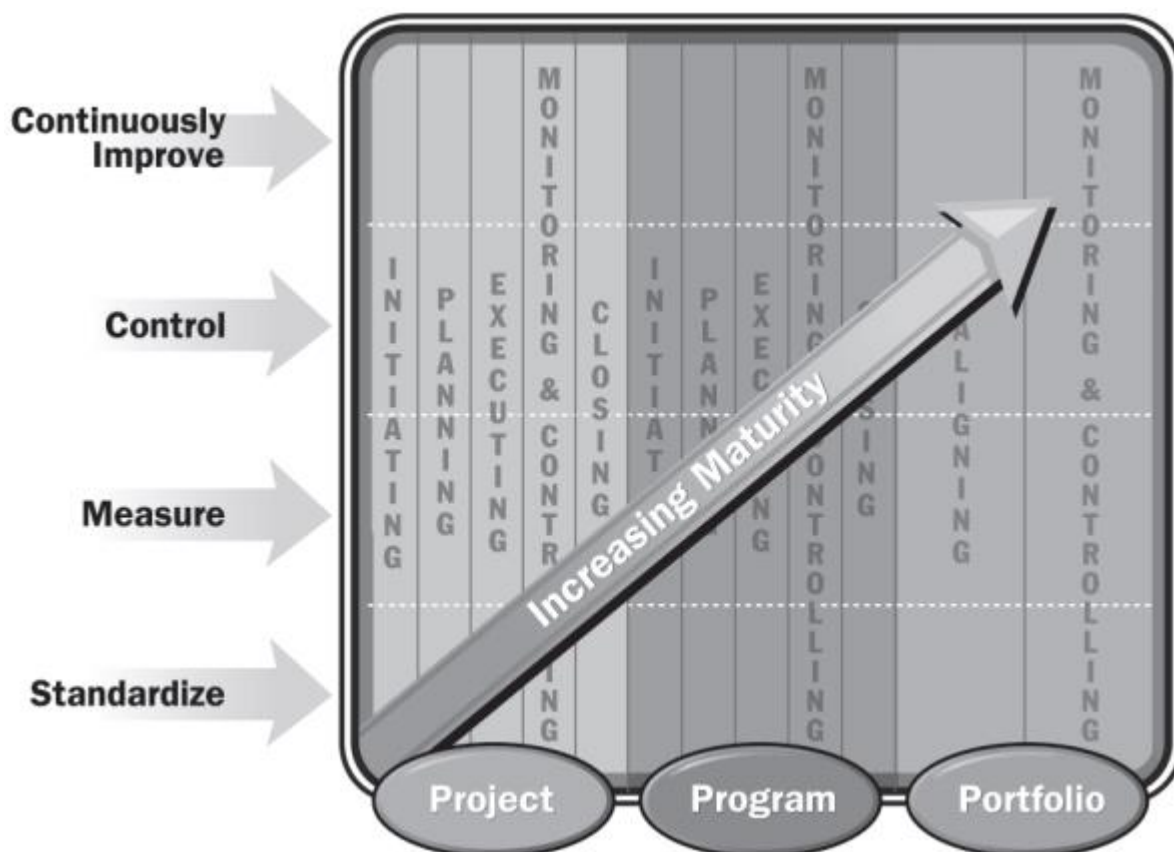


Fig. 41

Phases of: Standardize, Measure, Control, and Continuously Improve

For example, to achieve standardization, the organization should not only demonstrate that the capacity related to the governing body of the management of the process discussed above is documented but should also demonstrate that the organization actually has such a governing body and has communicated and implemented the capacity. The sequence implies a preliminary relationship between the phases, as the

most advanced stage, continuous improvement, depends on a control state that is in turn dependent on measurement, which is dependent on standardization. The concept of process improvement consists of maturing a process through the sequential stages of standardization, measurement, control, and improvement (also known as continuous improvement). The following capacity results should be demonstrated for the full achievement of each stage of process improvement:

Standardize:

o Governing Body of the Active Process, o Documented, o Communicated, and Standardized (implemented in a consistent and repeatable manner).

Measure:

o Customer requirements incorporated into measurements, o Identified critical characteristics, o Measured critical characteristics, o Result inputs, and measured critical inputs.

Control (note that the control is related to the measures established above):

o Control plan developed, o Control plan implemented, and Stability achieved.

Improve:

o Identified problems, o Improvements implemented (indicated by widespread participation), and sustainable improvements.

Best Practices Analysis

In the previous paragraphs we discussed what it meant to belong to the OPM3 Best Practices, we can summarize by saying that the company must adopt a series of behaviors, routines and controls that lead to an increase in overall efficiency, also lowering interpersonal conflicts and improving the daily life of each person within the company, eliminating errors already committed and unused time, for the targeted and efficient conduct of work.

The reference manual Organizational Project Management Maturity Model (OPM3®) – Second Edition provided a series of tables that included all the solutions to be adapted to follow the OPM3 standard. The following is an example of the work context; then, the structure of the tables with the Best Practices.

BP_Id	BP_Name	BP_Description	Project	Program	Portfolio	Standardize	Measure	Control	Improve	OE
3385	Measure Develop Program Architecture Process	Develop Program Architecture Process measures are established, assembled, and analyzed.		Program			Measure			
3395	Control Develop Program Architecture Process	Develop Program Architecture Process controls are established and executed to control the stability of the process.		Program				Control		
3400	Standardize Administer Program Procurements Process	Administer Program Procurements Process standards are established.		Program		Standardize				
3405	Improve Develop Program Architecture Process	Develop Program Architecture Process problem areas are assessed, root causes are identified, process improvement recommendations are collected, and process improvements are implemented.		Program					Improve	
3410	Standardize Report Program Performance	Report Program Performance Process standards are established.		Program		Standardize				

Fig. 43 OPM3 Best Practices' table

Each entry, as can be seen from the photo, can belong to the Portfolio Domain, Program Domain, or Project Domain, or all three. In addition, each type of "name" belongs to one and only one of the following classes written immediately after: standardize, measure, control, and continuously improve. This outlines the range of action of that voice and characterizes the area in which it is applied. In this way, each entry can be outlined through its own description, domain, and its scope of Process Improvement. The last step to be performed is to evaluate how many of these Best Practices are adopted within the company, making a differentiation between before and after the introduction of the Trello management software and the method of monitoring workloads through Excel.

As a result, all the items were examined to see which of these were already present before the Portfolio process and Portfolio monitoring operation. This means that we have tried to outline the benefits that have brought the implementation of the software and the monitoring of workloads through Excel, evaluating

how much this implementation has brought the company closer to the Best Practices reported and in the tables. The results were provided through graphs:

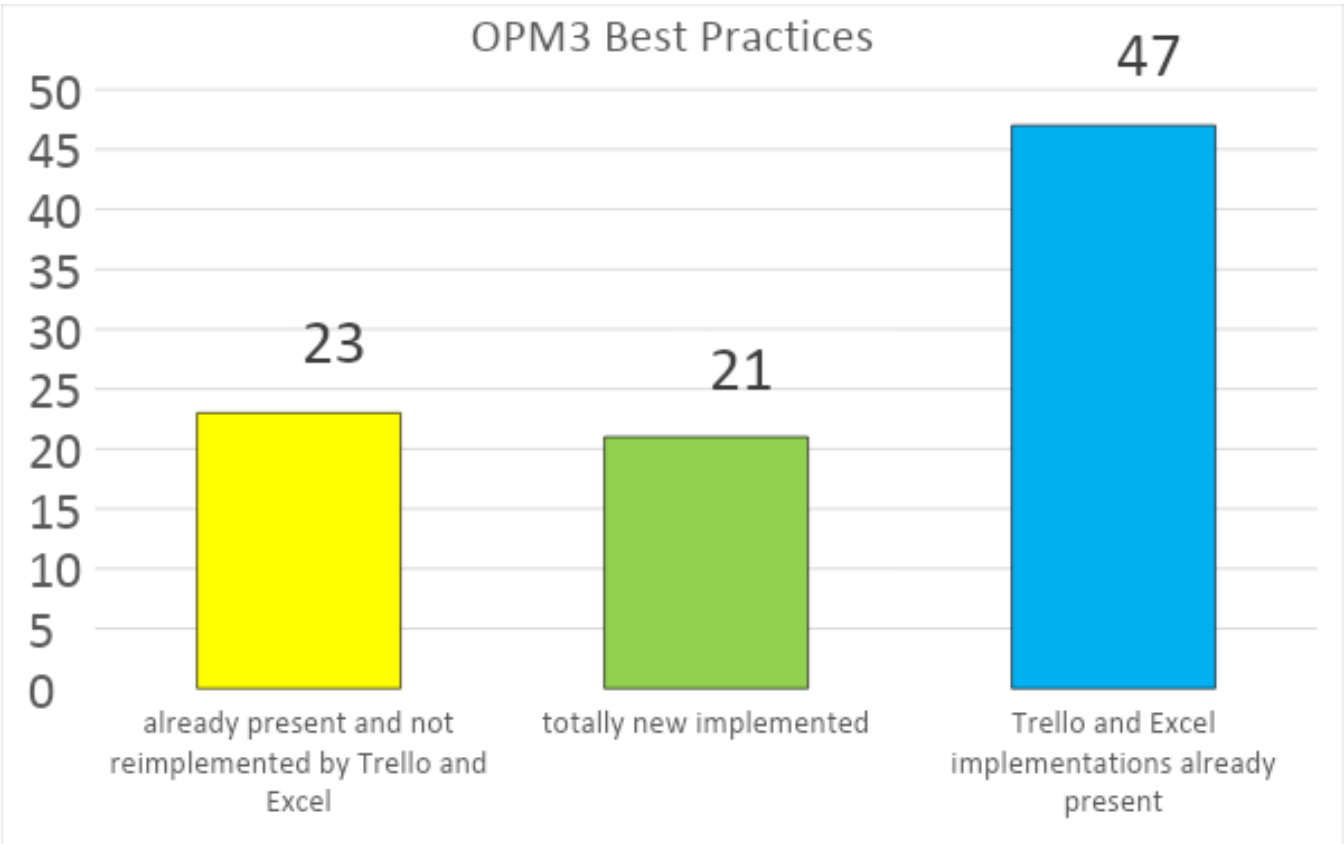


Fig. 44 Total numbers of OPM3 Best Practices possesd by Sumiriko at the end of the work

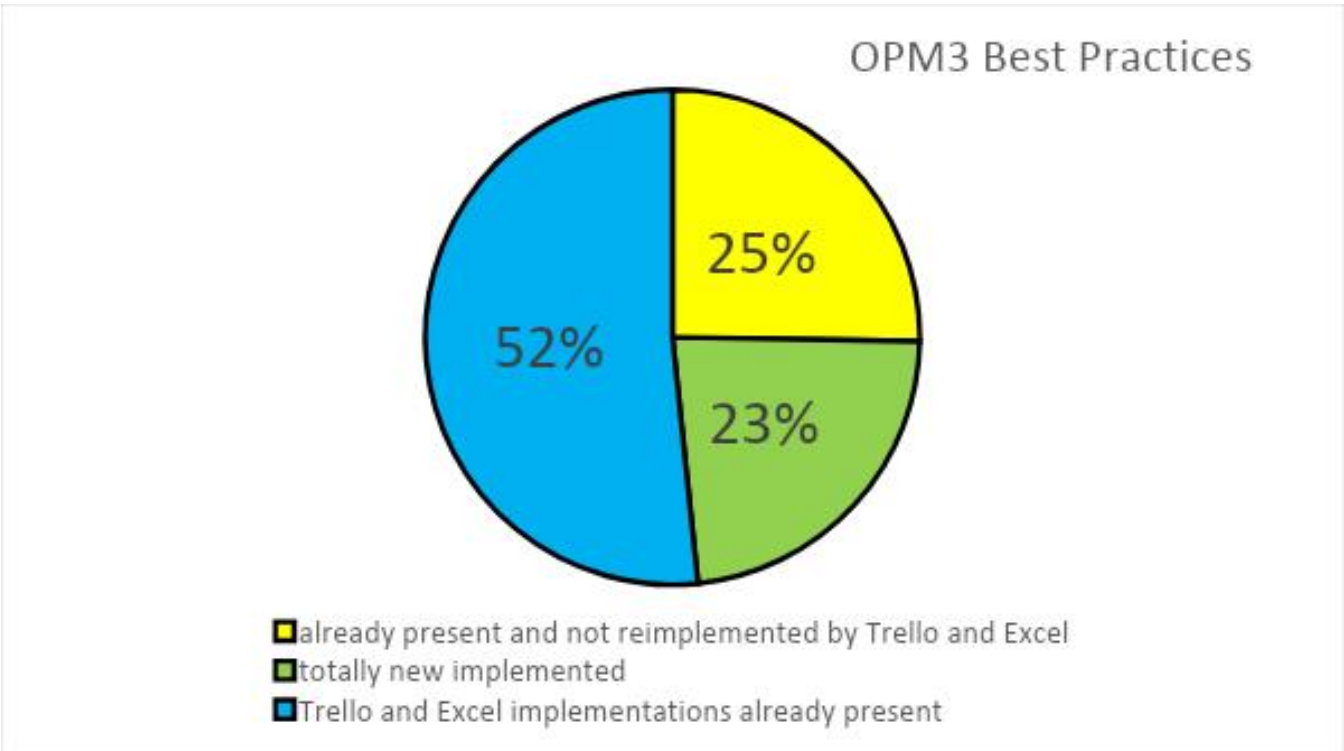


Fig. 45 Total percentage numbers of OPM3 Best Practices possesd by Sumiriko at the end of the work

Comment and conclusion

Analyzing the graphs it is clear that the company had already implemented 23 Best Practices that have not been strengthened through the intervention of the analyzed software, while 47 Best Practices are shared; therefore, this means that they were already present within the company in some areas but not in all, consequently, it can be said that in this case the completed projects have improved in these areas through the use of software, which has expanded, in fact, the range of activities in which these Best Practices are used (such as the laboratory area). Finally, 23 Best Practices were added that were previously completely missing, both in the laboratory area and in Project Management. The second graph gives us relative percentages, created based on the data held by the Best Practices received during this analysis. It is important to point out that the company undoubtedly has additional entries in the tables, which would bring it closer to the objectives of the OPM3 but have ascertained the limits of time and information it has not been possible to carry out a more precise analysis on all areas of the company except the PMO and the laboratories. Despite this, it is evident how the implementation of these software has benefited the whole complex.

BIBLIOGRAPHY

Learning Agile by Andrew Stellman and Jennifer Greene Published by O'Reilly Media, Inc., 1005 Gravenstein Highway North, Sebastopol, CA 95472.

G. Melnik, and F. Maurer, "Introducing Agile methods in learning environments: Lessons learned," in Conf. on Extreme Programming and Agile Methods. Springer Berlin Heidelberg, 2003, pp. 172-184.

B. Bruegge, M. Reiss, and J. Schiller, "Agile principles in academic education: A case study," in Sixth Int. Conf. on Information Technology: New Generations, IEEE, 2009, pp. 1684-1686.

V. Mahnic, "A capstone course on Agile software development using Scrum," IEEE Trans. Edu., vol. 55, no. 1, pp. 99-106, 2012.

A. Nicolettou, and S. Soulis, "Creating Agile Curriculum Design Patterns: The Global Learning by Design Project," In Proc. ASCILITE 2014, Dunedin, 2014, pp. 726-729.

L. Layman, T. Cornwell, and L. Williams, "Personality types, learning styles, and an Agile approach to software engineering education." ACM SIGCSE Bulletin, vol. 38, no. 1, pp. 428-432, 2006.

D. F. Rico, and H. H. Sayani, "Use of Agile methods in software engineering education," Agile Conf. 2009. IEEE. 2009, August, pp. 174-179.

A. Delhij, R. van Solingen, and W. Wijnands. (2015). The eduScrum Guide. [Online] Available: http://eduscrum.nl/en/file/CKFiles/The_eduScrum_Guide_EN_1.2.pdf

S. Breakspear, A. Peterson, A. Alfadala, and M. Khair, Developing Agile Leaders of Learning: School leadership policy for dynamic times. Qatar: World Innovation Summit for Education. 2017

J. P. Womack, D. T. Jones, and D. Roos, The Machine that Changed the World. Simon and Schuster. 1990.

C. Ebert, P. Abrahamsson, and N. Oza, "Lean software development." IEEE Softw., vol. 29, no. 5, pp. 22-25, 2012.

B. Ziskovsky and J. Ziskovsky, doing more with less – Going Lean in education: Process Improvement in K12 Education. Shoreview, Minnesota: Lean Education Enterprises Inc., 2007.

D. Parsons and K. MacCallum, Agile and Lean Concepts for Teaching and Learning: Bringing Methodologies from Industry to the Classroom. Singapore: Springer, 2019.

K. Schwaber and M. Beedle, Agile software development with Scrum. Upper Saddle River: Prentice Hall, 2002.

M. O. Ahmad, K. Liukkunen, and J. Markkula, "Student perceptions and attitudes towards the software factory as a learning environment," in IEEE Global Engineering Education Conf. (EDUCON), 2014, April, pp. 422-428. [15] C. Ladas, Scrumban - essays on kanban systems for lean software development. Lulu.Com, 2009.

C. Anslow and F. Maurer, "An Experience Report at Teaching a Group Based Agile Software Development Project Course," 46th ACM Tech. Symp. On Comput. Sci. Education, 2015.

V. Heikkilä, M. Paasivaara, and C. Lassenius, "Teaching university students Kanban with a collaborative board game," 38th Int. Conf. On Software Eng. 2016.

M. O. Ahmad, J. Markkula, and M. Oivo, "Kanban in software development: A systematic literature review," 39th EUROMICRO Conf. on Software Eng. and Advanced Applicat., IEEE, 2013, September, pp. 9-16,

S. Goldman, "The Educational Kanban: promoting effective selfdirected adult learning in medical education." Academic Medicine, vol. 84, no. 7, pp. 927-934, 2009.

A. Cockburn, Agile Software Development: The cooperative game. Pearson Education, 2006

D. Anderson, Kanban: Successful Evolutionary Change for Your Technology Business. Sequim, WA: Blue Hole Press, 2010.

H. A. Johnson, "Trello." Journal of the Medical Library Association, vol. 105, no. 2, p. 209, 2017.

N. Ray, "Prioritize, Plan, and Maintain Motivation with Trello." The Agricultural Education Magazine, vol. 88, no. 6, p. 16, 2016.

A. Littlefield. (2016, September). The Beginner's Guide to Scrum and Agile Project Management. [Online]. Available: <https://blog.trello.com/beginners-guide-scrum-and-agile-projectmanagement>,

E. Jaleniauskiene, "Revitalizing foreign language learning in higher education using a PBL curriculum." Procedia-Social and Behavioral Sciences, no. 232, pp. 265-275, 2016.

O. Almughram, and S. Alyahya, "Coordination support for integrating user centered design in distributed Agile projects," 15th Int. Conf. on Software Eng. Research, Manage. and Applicat., IEEE, 2017, pp. 229-238.

R. Jeffries. (2001). Essential XP: Card, Conversation, Confirmation. [Online]. Available: <http://ronjeffries.com/xprog/articles/expcardconversationconfirmation/>.

M. Cantamessa and F. Montagna, Management of Innovation and Product Development, DOI 10.1007/978-1-4471-6723-5_1 Dyer JH, Gregersen HB, Christensen CM (2009) The Innovator's DNA: five "discovery skills" separate true innovators from the rest of us. Harvard Bus Rev 87(12):60–67

Gunther J, Ehrlenspiel K (1999) Comparing designers from practice and designers with systematic education. Des Stud 20(5):439–452

Hansen MT, Løvås B (2004) How do multinational companies leverage technological competencies? Moving from single to interdependent explanations. Strateg Manage J 25(8–9):801–822

Hardy B, Graham R, Stansall P, White A, Harrison A, Bell A, Hutton L (2008) Working beyond walls: the government workspace as agent of change. OGC and DEGW, London

Hirsch PM (2006) A master reflects on the sociology of work and the discipline. William Form's legacy, Work Occupations 33(1):5–7 Hofstede G (1983) The cultural relativity of organizational practices and theories. J Int Bus Stud 14(2):75–89

Potocnik K, Anderson N, Latorre F (2014) Selecting for innovation: methods of assessment and the criterion problem. In: Nikolaou I, Oostrom J (eds) Recent and new developments in recruitment and selection. Taylor & Francis, UK

Organizational Project Management Maturity Model (OPM3®) – Second Edition

Schmidt JB, Sarangee K, Montoya MM (2009) Exploring new product development project review practices. J Prod Innov Manage 26(5):520–535

Meyer MH, Lehnerd AP (1997) The power of product platforms. Free Press, New York

Krishnan V, Gupta S (2001) Appropriateness and impact of platform-based product development. Manage Sci 47(1):52–68

Cantamessa M (2005) Fundamentals of product portfolio management. In: Clarkson J, Ekert C (eds) Design process improvement. Springer, London