POLITECNICO MILANO 1863

Master degree in Management Engineering

NIPPON GASES The Gas Professionals | RIVOIRA

Master Thesis in collaboration with Rivoira Group

"Financial Performance Management Tool" in Rivoira Group

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Summary

1. Executive summary

The project partner for this project is the Rivoira Group, an Italian company member of Nippon Gases. With a turnover in 2018 of over €287,7 million, it is one of the biggest companies in the production and distribution of technical gas sector, with a wide portfolio that includes industrial, medical and cryogenic gases.

1.1. The problem and the starting situation

The top management has identified general inefficiencies in the use of the company's resources, from the overloading of the company's system to the waste of the employees' time. But there is a lack of visibility and they have difficulties in identifying the causes that generate these issues. The software utilized by the accounting department is more than twenty y.o. and it has never been updated.

This project aims to realize a clear mapping of the processes, step by step, in order to provide a clear understanding of the procedure currently used. Furthermore, this project will foster the current willingness of the company to make improvements, acting in synergy with the new accounting tool that will be purchased in the following months.

In order to have a clear mapping of the overall process, it was decided to focus the attention on the creation of the Order Request, generated every time there is a request for the purchase of a physical item or service, both from external clients and entities of the Rivoira Group. At the end of every OR creation, the system generates a Key Account, the most important code used in the accounting department that not only manages all the information related to the transactions but also it drafts the P&L account of the company.

In particular, there are two codes, the Business Unit (or Cost Centre) and the Item Code that generate 16 of the 21 digits of the Key Account, that means they influence more than the 76% of the process. This is why the analysis carried out are focused on these two components.

1.2. The Analysis and the Solutions

Once identified the elements of the project, it was necessary to quantify the inefficiencies. For this reason, three different KPIs were set:

- KPI for the Business Unit codes, to measure which percentage is used;
- KPI for the Item codes, to measure which percentage is used;
- KPI for the errors, to quantify how much does it cost to the company to correct the errors, both in terms of time and money.

The results showed that a very small percentage of the codes available are actually used:

- 15.449 Business Unit codes open, but less than 12% are used;
- 161.802 Item Codes open, but only 1,65% are used.

While for the errors, it was necessary to divide them in two classes:

- "Visible" errors: those ones that can be found with a visual check, confronting the code used with the nominal list. Inside this class there are BU and Item Codes used but not present in the system, and combination of the two that are not allowed;
- "Hidden" errors: in this category there all the codes that are used and are present in the system, but that provide a wrong information. For instance, the purchase of a tank maintenance service registered in Milan where is present only the administrative centre.

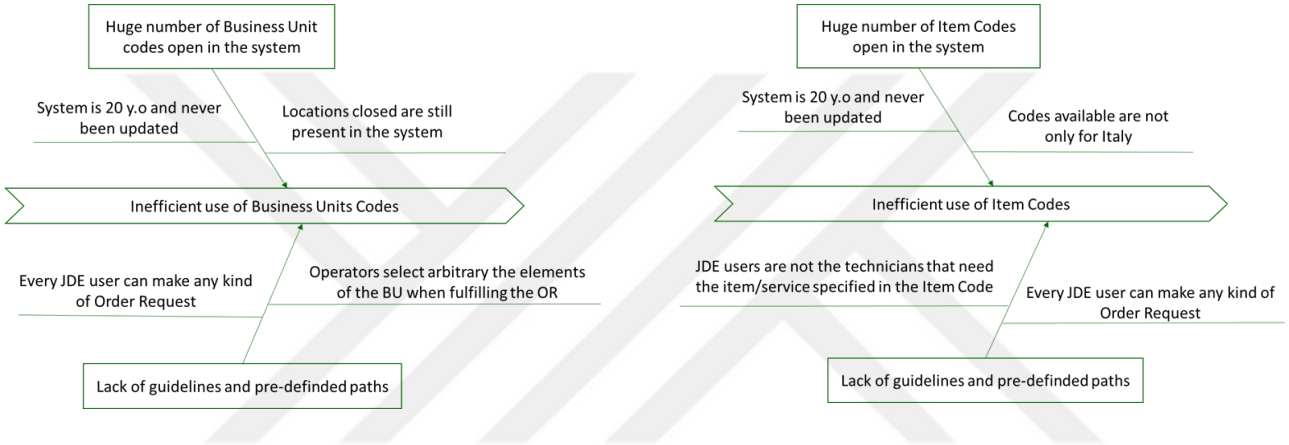
Due to the short duration of the project and the lack of deeper knowledge of the codes, it was possible to analyse and quantify only the visible errors. Then, it was estimated the average time required to identify and fix an error. By multiplying the number of errors per year with the time to fix each error, it was possible to quantity the employees' time wasted every year for the errors correction. Moreover, multiplying this value with the hourly wage of an operator, the result showed how much does it cost for the company this inefficiency. In reality this is not an additional cost, since their wages represent

a fixed cost currently sustained by the company, but it could be interesting to know how much of this scarce resource, the employees' time, is allocated to this task.

After identified the KPIs and set ad hoc targets, two root-cause analysis were performed. Here, the main problem was divided in two parts, according to the type of resource wasted:

- Overloading of the company's system
- Waste of the employees' time

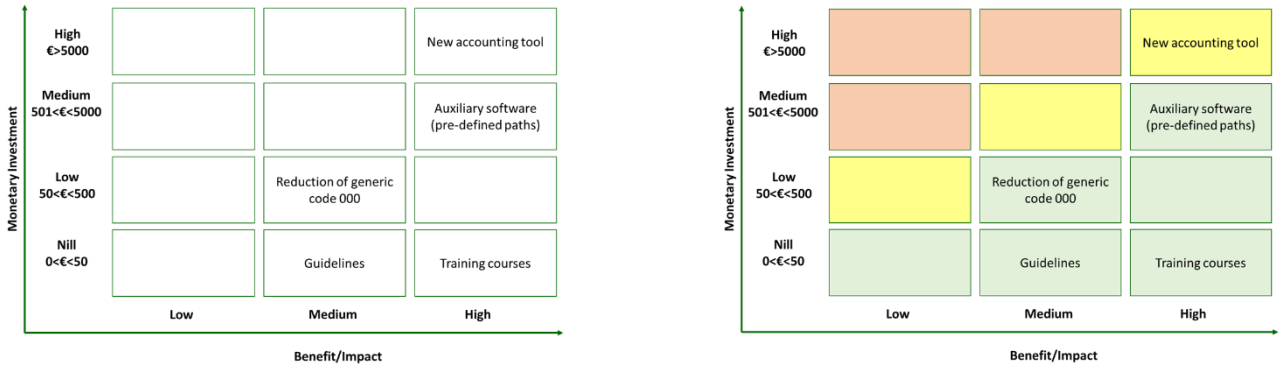
Particular attention was posed on the root-causes of the two main codes: the BU and the Item Code.



Then, it was assigned to each root-cause a score, from 1 to 5, in order to create a ranking of priority, to understand which causes have higher impact on the main problem and need to be tackled first.

Finally, for each root-cause, specific countermeasures were proposed, highlighting the main benefits that they can bring but also the effort required, in terms of time and money.

Since the resources that a company can invest in an improvement project are always constrained, it was created an effort-benefit matrix in order to prioritize the various countermeasures proposed.



2. Accounting

From the day humanity exists, there has been a constant interaction and exchange. It is better to remind that even the Egyptians used accounting information. It is a fact that in every exchange procedure, also without money, the issues regarding receivables and payables were processed.

As a technical and economic entity, businesses are engaged in production and commercial activities to meet both the needs of the society and to provide incomes to the shareholders.

It is possible to define the enterprises' accountability as the organization that aim to produce goods and services and provide incomes. This organization represents the management tool that has the purpose to control the businesses through the account.

The accounting is described as a recording technique of business activities and also a presentation art. Accounting, which is more than 7.000 years old, has been developed from the most primitive recording technique to today's technology in parallel. The accountants who recorded the enterprise's activities were always in line with the recording methods, so the shapes and conditions changed in time according to the evolution of the writing techniques.

Accounting is defined as the systematic recording, sorting, summarizing and presenting of the transactions which can be expressed with money in the enterprise; in addition to provide analysis, synthesis and interpretation of information related to the operations.

In accordance to the changing economic trends, the accounting functions passed from the mere registration of transactions to undertake a wider range of duties. Accounting nowadays assists business executives in decision-making and control functions and gains importance as a system that provides them with the necessary information.

Business managers will take into account whether the enterprises are developing in accordance with predetermined objectives, how proper activities are performed, what are the unitary costs of the products they produce, working efficiently, what is the actual profitability of the enterprise, whether

the costs of loans are met with investments and answers to similar questions. Of course, for managers to make the right decision, the information provided by the accounting must be accurate and healthy. The validity and accuracy of the documents on which the accounting records are based will ensure that the accounting reports are realistic. For this reason, the Accounting Principles were established, in order to guarantee the validity of the information provided.

In addition, the information recorded in the accounting period is reviewed by a casting process at the end of the period and the accuracy is checked and the assets in the entity are subject to valuation and they are provided to reflect the real situation.

2.1. Definition of Accounting

- **Definition of Accounting**

Accounting is defined as an art related to the recording, classification, summarizing and presenting of financial transactions; these transactions and events can be expressed in monetary terms.

- **Dictionary Meaning of Accounting**

Accounting is defined as the information about the transactions that are accounted by means of accountability, mutual accountability, dealing with accounting affairs, accounting for the whole account, the place where the account business is carried out, the definition of the accountancy, the assets and resources (capital and liabilities) of the company and the currency transactions; It is an information system that provides reports to related persons and institutions by recording, classifying, summarizing, analysing and interpreting. Accounting is the process of recording and classifying all transactions and values of financial operations of the enterprises engaged in economic activities.

- **What is Accounting?**

Accounting represents the value and amount of a company that occurs in a continuous record, summarizing rises and losses in certain period of times (such as the balance sheet arrangement ...), determining the result (profit-loss statement regulation), reporting and interpreting them to the people and institutions that are interested in providing convenient useful information as a kind of art, science and practice.

- **Purpose and Benefits of Accounting**

The Accounting System aims to ensure that accounting information is delivered to related parties adequately and accurately inside an organization, comparing information of different periods and different businesses within the same enterprise. It provides a standardization of the accounting names assigned in the financial statements with the scope to provide a sense of unity along the enterprise.

The purpose of accounting is to enter, edit, report and transfer the information and documents which are the basis of financial (or economic) activities of the enterprise or organization to the users of information.

Within the many benefits of accounting, the most prominent are that:

- It determinates the value of assets owned by the company;
- It facilitates the understanding of the results obtained at the end of the period and the activities performed during that period;
- It provides knowledge of the economic and social conditions of third parties engaged in business with the enterprise;
- It constitutes a cycle of legal disputes between third parties and the entity;
- It protects company existence against the abuse of personnel working in the enterprise;
- It allows the owner to check and examine the status of the company inside the tax system.

2.2. Development of accounting

- **Birth of Accounting**

Accounting subjects developed following a natural course until the end of the 15th century. According to this, the enterprises have tried to solve the registration problems and organizational needs they encountered during their activities by searching for practical solutions depending on the flow of events. After this time, the natural course of accounting was closed in 1494 with the publication in Italy of the book "Summa Aritmetica" by Luca Pacioli, who was a priest from Toscana with great knowledge of Maths. Under the influence of these new principles from Italy, during the cradle of the Renaissance, the accounting technique begun to spread all over the world.

Thanks to this book, the accounting technique also started to develop in both practical and theoretical terms. With Luca Pacioli, the founder of the double-accounting method, the natural progress of accounting ended, and it rapidly developed in parallel with the development of the commercial life. However, accounting was handled as an organizational tool and was processed in line with the budget implementation and the management objectives towards the end of 19th century. In that period, the accounting literature become rich in both practical and theoretical fields.

Accounting is defined as an art related to the recording, classification, summarizing and presenting of financial transactions, where all the events can be expressed in monetary terms. This definition includes classical and modern functions of accounting.

In the early times, the accounting was used as a practice to record, classify and provide the results related to transactions and event. Afterwards, the accounting procedures become a tool to support managers in decision-making processes. So, it is evolved from simple recording techniques to a control business activity.

Use of accounting records reach B.C. 5.000 years. Accounting records were found in Babylon, Egypt, Ancient Greece, Rome, Old Europe and Middle Ages. However, these records were not based on systematic rules, but just lists related to inventories were payments related to fees, accounts receivable, tax appreciation.

Accounting records in the 12th century were edited in a very simple way. It was just a reminder of trade relations and partnerships (it will be necessary to wait until the end of this century before the realization of the company's records containing also asset ownership).

In the 13th century, the increase in credit transactions and the establishment or use of branches in foreign cities by the enterprises for export products fostered the necessity to utilize a more complex and complete accounting record system.

The accounting in modern sense begun between 13th and 14th centuries with the development of the double-side registration system, introduced by Luca Pacioli. In the case of primitive accounting defined as a simple or unilateral recording system, transactions or events were expressed in a single record; this system was incomplete, more likely to the creation of errors and failure to occur. On the other side, the double-entry registration system leaded to the creation of two aspects for each business activity (one borrower per debtor, one pertaining to each payer, one customer per salesperson, one customer per vendor), allowing the registration of at least two records for each transaction or event. This reduced the likelihood of making a mistake, allowing the records to control each other and the possible errors when occurred.

With the Crusade, the development of trade in the Mediterranean and the commercial vitality in the Italian cities during the Renaissance period made the development of the registration system mandatory.

Del Bene, which deals with the import, production and sale of clothes in Florence, established an effective recording system in 1322, although it did not have a full double-entry system, but in most of the cases, he made a double-entry.

In the 14th century, Italian merchants and manufacturers expanded industrial activities and established branches. They organized trades with the Bank and other financial institutions until Central Asia. Thus, the economic and political effects of Italian merchants spread from Scandinavia to India. In 1340, the double-entry registration system in the city of Genoa was used with a satisfactory account plan. This account plan included separated expense accounts, a city account as a capital account, and expense and income accounts were closed at the end of the year.

The biggest improvement in the double-entry system was provided by the records of a Tuscan merchant and banker, Francesco di Marco Datini. On the Balance Sheet of Datini dated January 31, 1399, there were accounts such as Borrowers, Creditors, Foreign Relations Balance, Branches Balance, Inventories, Doubtful Receivables, Taxes Payable, Amortizations, Reserves, Share Certificates in the Balance Sheet. In the Datini's accounting system, separate columns were used for foreign currencies and profit & loss was calculated due to the difference between domestic and foreign currency values.

The Florence Medici Bank, founded in 1397, represents an important example of application for this new methodology. It established branches, major trade centres and mills in different Italian cities. In the accounting records, each branch and each factory were treated as a separate asset, and the accounts between the branches were controlled. A copy of the balance sheet of each branch was sent to Florence, where accounting control, suspicious or overdue receivables were tracked. However, the bilateral registration system implemented by Medici Bank was insufficient according to the volume of its activities.

According to Western writers, the first book on accounting was the already mentioned "Summa di Aritmetica Geometria Proportioni et Proportionalita" published in 1494 by Luca Pacioli. In the

successive book titled "De Computis et Scriptures", published separately in 1504, the double-entry accounting system was introduced for the first time.

Pacioli did not claim to be the “father” of the double-sided recording system. Indeed, the method described was used in Venice for over 200 years by the merchants, and for this reason, it is known also as the “Venice method”.

In the 15th century, the simple accounting system of Pacioli's work was widely used in Italy.

In the middle of the 15th century, two books were found in the accounting records of Del Bene company. One of these books was allocated to the cost records and the other to commercial transactions. While it is certain that Pacioli's cost analysis forms were used at the time, no related techniques have been mentioned.

In the years following the 1500s, the double registration system spread to Europe. In the 16th century, a large number of books were published in accounting languages.

Among them, there is another Italian, Domenico Manzoni, which book "Quaderno doppio con suo giornale secondo il costume di Venetio" was published in six editions between 1540 and 1574. Manzoni's book has some more examples, but some parts have been taken from Pacioli's vocabulary. The first British work of accounting "Profitable Treatyca", by Hugh Oldcastle, was published in 1543. This work is a very similar to Pacioli’s. John Mellis's "Briefe Instruction" was also re-compiled and collected. The book "Notable and Excellent Woorke" by Ympyn was published in 1543 in France and Germany. Flichard Dafforne's work "The Merchant's Mirrour", published in 1535 by John Waddington with his work "Briefe Instruction", has examples from German commercial applications. Accounting spread to Europe through the development of trade by Italian merchants. Corrections have been made in the system with the use of the application. The first accountants transferred the information to the practitioners. Practitioners have also helped to establish modern recording and reporting methods.

- **Evolution of Professional Accounting**

Modern Accounting is the result of the evolution of different thoughts, actions and conventions that evolved during the centuries. There are two main concepts that gave the "shape" to the current state of the accountant profession:

- The development of the double-entry bookkeeping system, created between the 14th and the 15th century
- The accountancy professionalization between the 19th and the 20th century.

Going more in detail, it is possible to define the "birth" of the modern profession of accountant in the 19th century in Scotland.

In that period, accountants belonged to the same associations of solicitors, and sometimes, even these latter ones offered accounting services to their clients.

It is possible to find some similarities between the early modern accounting and the today's forensic accounting (the practical area which describes engagements that result from actual or anticipated disputes or litigation):

"Like forensic accountants today, accountants then incorporated the duties of expert financial witnesses into their general services rendered. An 1824 circular announcing the accounting practice of one James McClelland of Glasgow promises he will make "statements for laying before arbiters, courts or council."

Queen Victoria, in July 1854, was petitioned for a Royal Charter by the "Institute of Accountants in Glasgow". The petition, which was signed by 49 accountants from Glasgow, claimed that the profession of accountancy was still not recognized as a distinct profession of great respectability, despite it existed for a long time in Scotland. It reported also that the number of practitioners increased rapidly, from the few originals.

In the petition was also highlighted that this profession requires a wide and varied range of skills, such as mathematical skills for calculation, or general knowledge of the legal system, since they were frequently asked to provide evidence of financial matters in court. Subsequently, the Edinburgh Society of accountants decide to be called "Chartered Accountant".

In middle of the 19th century, during the Britain's Industrial Revolution, London become the financial centre of the world. With the growth of the limited liability company and large scale manufacturing and logistics, there was the demand for proficient and technical accountants able to cope with this growing world, with its high speed, global transactions, and increasing complexity. It was required to compute new figures like assets depreciation and inventory valuation, always in line with the latest legislations, like the new "Company law".

As companies proliferated, the demand for reliable accountancy shot up, and the profession rapidly became an integral part of the business and financial system.

In order to improve their status and refuse the criticisms of low standards, the "Institute of Chartered Accountants" in England and Wales was created to combine different local professional bodies under one name. It was established in the 1880 with a royal charted and rapidly increase the number of members, from the original 600. The first point of the Institute was to set up standards and to start examinations for the members than wanted to enter. Once entered, they were authorized to use the professional designation of "FCA" (Fellow Chartered Accountant), for a firm partner and "ACA" (Associate Chartered Accountant) for a qualified member of an accountant's staff. Some years later, in the 1887 the "American Institute of Certified Public Accountants" was established.

2.3. Importance of Accounting in Management Decision Making

In order to manage an organization correctly, it is crucial to have critical data, perform analysis, write reports and records and all the needed information about profits, debts, assets and liabilities. All these functions are performed by Accounting, that therefore cover an important role for business operations,

especially for providing significant information for decision making and for the management of the organization. For the management of an organizations would not be possible to take critical decisions without the support of accurate information that facilitate this process.

In order to be reliable, this information should be based on facts and figures, and not on assumptions or intuitions. Information represent therefore the vital element of the decision making process at every level of an organization. From the data provided by the Accounting, the Management is able to make statistical considerations.

Going more in detail, it is possible to see how Accounting and Management, even if they have different role, are strictly related. Accounting prevents misuse of assets, increases production and profit, controls costs and helps improve overall management efficiency. While the Management functions comprehend planning, organizing, collecting work items, motivating, coordinating, controlling and budgeting etc. The successful achievement of these functions from the Management depends on an effective Accounting system.

The Accounting is a continuous and dynamic system that aims to identify the financial and economic situation of an enterprise, by recording, analysing and presenting the economic events that occur.

2.3.1. Importance of Accounting in different Parts of a Business

Management is necessary at every stage of an organization. Accounting helps Management in planning, organization, motivation, coordination control and budgeting. The Accounting provides the financial and economic information necessary to manage an organization. For this reason, the Management represent the internal stakeholder of Accounting work. In today competitive business world, the Management should be fast and attentive in the decision-making process and the Accounting represents an important management tool accepted as “Business Language.”

- **Importance of Accounting in Planning**

Correct planning represents the key for a successful accomplishment of various management activities. There are different types of planning, such as cash planning, sales planning, procurement planning, stock setting, development planning, target profit determination, and they all directly depend on the data and information gathered by Accounting.

- **Accounting Importance in Organization**

Accounting plays a vital role in the proper execution of the key functions of the management organization. Accounting helps management of an organization by providing information such as percentage of profit, capital investment position, efficiency in control management.

- **Accounting Importance for Motivation**

Employees motivation has always been of the critical activities inside an enterprise. Foster the workers to achieve the expected performance is not an easy task, and therefore the Management usually apply financial reward as motivating factor. In order to take this kind of decisions, the Management should be aware of the financial conditions of the entity before providing financial benefits. Once again, Accounting provides the key information to help the Management to take proper decisions.

- **Accounting Importance for Coordination**

Managing different activities and departments of an organization separately is never a good idea, since it leads to the achievement of local optimum and never to a global one, moreover it does not allow to exploit synergies. For these reasons, the coordination of the various departments of an enterprise is one of the main goals of the Management. The Accounting provides a global view of the

entire organization, helping the Management into make the right choice or adjustment like for sales and purchases, debt realization and similar issues.

- **Accounting Importance in Control**

Once set the plan, it is important to achieve the performance defined. In order to reach this goal, the control function is essential. Also for this task, the Management can lean on the data that the Accounting constantly monitor for the enterprise.

- **Accounting Importance for Communication**

Directly related to the coordination, there is the issue of communication. Breaking down the barriers between different departments and have mangers talk to each other is never easy, especially if they talk "different languages". The Accounting represents the main communication tool inside an organization, directly connecting different departments that can have different goals, sometimes in contrast among them. For instance, the purchase department aims to achieve cost reduction, while the sales department wants to increase the volume sold.

- **Accounting Importance in Budgeting**

In order to decide if a business is performing successfully or not, it is essential to compare the actual results with the budgets that were made previously. The historical information needed in preparing the budgets is provided by the Accounting.

2.4. Accounting Principles and Documents

2.4.1. Introduction to the main Accounting Standards

There are general rules and concepts that govern the field of accounting. These general rules represent the basic accounting principles and guidelines that form the groundwork on which more detailed, complicated, and legalistic accounting rules are based.

If a company distributes its financial statements to the public, it is required to follow the generally accepted accounting principles during the preparation of those statements. Further, if a company's stock is publicly traded, federal law requires the company's financial statements to be audited by independent public accountants (usually this activity is performed by the multinational financial consultant companies like PwC, Deloitte, EY or KPMG). Both the company's management and the independent accountants must certify that the financial statements and the related notes to the financial statements have been prepared in accordance with the main accounting standards.

Because of generally accepted accounting principles, there is the assumption to have consistency from year to year in the methods used to prepare a company's financial statements. And although variations may exist, it is possible to make reasonably confident conclusions when comparing one company to another, or comparing one company's financial statistics to the statistics for its industry. Over the years the generally accepted accounting principles have become more complex because financial transactions have become more complex.

The two main accounting standards present nowadays are GAAP and IFRS:

- GAAP "Generally Accepted Accounting Principles" developed by Financial Accounting Standard Board (FASB).
- IFRS “International Financial Reporting Standards” developed by International Accounting Standard Board (IASB).

In the past few years, IFRS has gained importance since over hundred countries of the world have adopted this standard for accounting.

IFRS implies a principle-based set of standards, while GAAP represents a composition of rules, conventions and procedures that are generally accepted.

- **Definition of GAAP**

GAAP represents a set of accounting standards that defines rules and predefined ways for reporting and recording of the financial data. These data are then used to create the financial statements of a company that are composed by balance sheet, income statement, cash flow statement, etc. This framework is accepted by public traded companies in the US, and also by a certain number of private companies. The principles are periodically updated, in order to meet the new financial requirements. It ensures consistency and transparency in the documents of the financial statement. Moreover, the information provided by financial statement can be useful for a wide range of stakeholders, like creditors, investors and shareholders.

- **Definition of IFRS**

IFRS represents the standard globally adopted for financial statements, and it is also known as IAS, International Accounting Standards. Its main point of strength is the comparability between international businesses. Moreover, it provides to stakeholders and shareholders valuable information about the financial position, the performances obtained, the profitability and the liquidity of the company in the current situation, changes in equity and so on.

Nowadays more than 120 countries have adopted this framework as a standard for the reporting of the financial statements. By adopting IFRS as standard, the presentation and preparation of the financial documents results easier, better and similar to overseas competitors.

- **Key Differences Between GAAP and IFRS**

GAAP represents a set of accounting guidelines and procedures issued by the Financial Accounting Standard Board (FASB) while IFRS, issued is the most used framework followed by companies for the creation of financial statements.

The main differences concern:

- Using of LIFO logic (Last in First out) for registering stock in GAAP while FIFO (First in First out) logic for IFRS.
- Development costs (usually called R&D) are treated as an expense in GAAP, while they are capitalised in IFRS, if the specific conditions are met.
- Inventory reversal is prohibited in GAAP, while IFRS allows inventory reversal subject, if specified conditions are fulfilled.
- IFRS is based on principles, whereas GAAP is based on rules.

- **Similarities**

They are both accounting standards that help enterprises in the preparation and presentation of the financial statements. They are issued by professional accounting body, and for this reason they are widely adopted in many countries around the world. Both the standards provide relevance, reliability, transparency, comparability of the financial statements.

- **Conclusions**

Nowadays, there has been an effort within the main accounting bodies to converge these two standards into one. So, probably the small differences for some peculiar points of the financial statements between the two will disappear, thanks to changes in the next future.

2.4.2. Basic Accounting Principles and Guidelines

1. **Accrual principle**: this principle implies that every accounting transaction should be recorder in the accounting periods when it actually occurs, and not when the related cash flows actually happen. This logic represents the accrual basis on which several accounting documents are built on. This principle is crucial for the construction of financial statements since it show what is actually happening in the accounting periods considered, rather than accelerating or delaying according to the related cash flows. For instance, without accrual logic, a company would register an expense only when it pays for it, and this could include a large delay due to the payments term agreed with the supplier invoice.

2. **Conservatism principle**: this principle implies that an enterprise should register expenses and liabilities as soon as possible, but to record revenues and assets only when it is sure that they will actually occur. This principle introduces a conservative aspect to the financial statements since it may yield to lower reported profits, due to the recognition of assets and revenues could be delayed for some time. On the other hand, with this principle the registration of losses happens earlier and it is encouraged. Anyway, this concept can be spread to much from an enterprise, which could persistently underrate its results, showing a scenario worse than what is actually is.

3. **Consistency principle**: this principle implies that, once chosen an accounting standard or method, the enterprise should keep rely on it, at least until a better method does not come along. If an enterprise does not follow this principle, it could continually change accounting standards making its own financial statements, from different year, not comparable. In particular, the expenses that make its long-term financial results will result extremely difficult to determinate.

4. **Cost principle**: according to this principle, a business enterprise should record its assets, liabilities, and equity investments at their original purchase costs. Anyway, in the recent years, this principle is becoming less valid, since the accounting standards are moving toward the direct of adjusting assets and liabilities according to their fair values.

5. **Economic entity principle**: according to this principle, the transactions of a business should be kept separated from those of its owner and from those of other businesses. This procedure prevents the possible mixture of assets and liabilities among multiple entities, that could create considerable difficulties when the financial statement of a rising business are first audited.

6. **Full disclosure principle**: this principle implies that an enterprise should include, while reporting its financial statements, all the relevant information that could impact a reader's understanding of those financial documents. All the necessary information is specified by the accounting standards, and they have amplified this concept during the years.

7. **Going concern principle**: according to this principle, every business will remain in operation for the foreseeable future. This concept allows an enterprise to justify the deferring on the recognition of some expenses, for instance assets depreciation, instead of recognising all the expenses in one time.

8. **Matching principle**: following this principle, an enterprise, while recording revenue, should record all the related expenses at the same time. For instance, the company charges the inventory to the cost of goods sold at the same time it records the revenue from the sale of those inventory items. This procedure is one of the key concepts of the accrual logic of accounting. On the other side, the cash accounting basis does not follow the matching principle.

9. **Materiality principle**: this principle implies that every transaction should be included and recorded in the financial statements. If a transaction is not reported, it could influence the decision making process of the possible reads of the accounting records. Since this concept is vague and difficult to quantity, it has led to more strictly control so that even the smallest transactions will be recorded.

10. **Monetary unit principle**: according to this principle, and business enterprise should register on its accounting records only the transactions that can be stated in terms of a unit of currency. In this way, it is easy to record the purchase of fixed assets, because it was purchased at a specific price, while at the same tie the value of a quality control system is not registered. Thanks to this principle, an enterprise avoid reaching an excessive level during the estimation of its assets and liabilities.

11. **Reliability principle**: this principle implies that only that the transactions that can be actually proven should be registered into the accounting records. For instance, a supplier invoice represents a valid evidence that an expense has been registered. This principle is fundamental for the work of auditors, who are always in search of documentation that could actually support the evidence of a transaction.

12. **Revenue recognition principle**: following this principle, a business enterprise should recognize revenues only when the earning process has been actually completed. The wrong application of this concept leads to several types of reporting fraud. For this reason, many standard-setting bodies have created a massive amount information regarding how to properly recognize revenue.

13. **Time period principle**: this principle implies that a business enterprise should reports its operating results over a standard period of time. This one should be considered the obvious among the accounting principles, but it means to set up comparable standard periods, which will result useful to perform trend analysis.

2.4.3. Main documents of the Financial Statement

As already mentioned, the Accounting represents a crucial part of an organization. The information provided helps in determining different characteristics on the enterprise, such as:

- The target price in a M&A (merger and acquisition)
- Shares' price and market capitalization of a company in day-by-day trading
- Selling price of shares in an Initial Public Offering (due diligence)
- Credit Stability (Rating Services)

All the data and information collected during the fiscal year are grouped on order to publish different documents that represent a fundamental part of a company evaluation. Some of them are intended only for shareholders and direct stakeholders, while others, in the case in which the company is publicly held, are demanded by the local law entities. So, if a company is company is not publicly traded, it is compulsory to create an annual report, but it is not obliged to publish it.

For every company, there are two main types of financial statement which are differentiated from the time horizon covered:

- Annual reports: published once a year.
- Interim reports: sub-period reports, published every quarter or semester.

The Key documents of an Annual Reports are five:

1. Balance Sheet
2. Income Statement (P&L Account)

3. Cash Flow Statement
4. Statement of Changes in Equity
5. Notes to the Financial Statements

The first three documents are the most important. No-profit organization re focused on balance sheet, while for profit organization, in particular publicly traded ones, the P&L has always been the most crucial. But nowadays, companies seek to put more attention on the Cash Flow Statement, since if a company has high revenues without being able to pay its debt-holders/suppliers, it will fail.

The revenues represent the power of the company or the market capitalization, but it is just "vanity", while the profits are called "sanity" because a company needs to generate value in order to be health. Finally, the cash is the "reality", and it represents the main asset necessary to grow.

In the following paragraphs are provided a deeper insight for these three documents.

1. Balance Sheet

It represents a picture of resources that the company has in given time. The resources of the company are the assets owned, plus those elements that are quantifiable in monetary terms as loyalty or the network. It describes the monetary value of the assets and related rights (equity and liabilities) in a given point in time (usually midnight of 31/12 of each year).So, it is possible to divide the BS is two parts: the Assets and the Equity and Liabilities. The first represents the value of the resources owned while the others the liabilities claimed by the stakeholders on those assets. It is important to pack similar resources together to deliver a clearer template.

The Assets are organized with a crescent liquidity: so first element is more illiquid. Then, the Assets are divided in two main block: Non-Current Assets and Current assets; the different is given by the time frame:

- Current: resources that will be transformed in money within 12 money,
- Non-Current: the company will exploit these resources for more than one year.

2. Income Statement

It's the most important document for the manager, and it focuses on the difference between revenues and costs. The main idea is to understand if the company can cover its cost with is revenues. The balance sheet is a picture taken in one day. The P&L is not a picture, is a flow, that allows to see if a company can generate profits during a year. The company is obliged to produce these documents every quarter, due to the plan and control cycle. This document is drafted the Matching Principle, which helps to decide if costs and revenues should be registered or not. This principle leans on the Accrual logic that differentiate revenues and cost from cash inflows and outflows. According to this logic, the company should register a revenue or a cost only the transactions has actually occurred.

The Income statement can be presented under two forms which are:

- by nature: where costs are aggregated on the basis of their nature.
- by function: where costs are aggregated on the basis of the activity to which they are referred.

3. Cash Flow Statement

It summarises the results (inflows and outflows) of the financial transactions undertaken by the company in a given period (usually one year). It can seem similar to the P&L Account but it is drafted following the Cash Logic.

There are two options for presenting the Cash Flow Statement which are:

- Direct Method: where cash inflows and outflows are classified by nature.
- Indirect Method: where cash flows and outflows are initially derived by adjusting net profit for the effects of non-cash transactions.

3. Company description

Rivoira is an Italian company ex-member of Praxair Europe which has been recently acquired by Nippon Gases Company, part of Taiyo Nippon Sanso, in the beginning of 2019. Taiyo Nippon Sanso Corporation, commonly known as TNSC, is a Japanese multinational industrial gas manufacturer incorporated in the year 1918 as Nippon Sanso Corporation. The company is Japan's largest industrial gas producer and among top five industrial gas suppliers in the world. The company currently operates in more than 15 countries worldwide via its own name and subsidiaries. TNSC is headquartered in Tokyo, with more than 50 subsidiaries and affiliates in other countries. Since May 2014, Taiyo Nippon Sanso has been an affiliate of Mitsubishi Chemical, which is a part of the core Mitsubishi Group.

Figure 1: Map of the Rivoira's sites in Italy

Rivoira is one of the biggest Italian companies in this sector, vaunting a turnover of €287,7 million in 2017. The huge offer of gases allows the company to operate in several sectors, from the automotive to the food and beverage, from the healthcare to the metal or glass production. One of the most important product lines is cryogenic gases that represent the 32% of the total turnover.

Regarding the history of the company, Rivoira was founded in 1920 by Guglielmo Rivoira in Turin and, after 66 years of family ownership, in 1986, Praxair acquired its shares, becoming the largest shareholder of the Italian company.

Rivoira's facilities are present all-around Italy, as it is possible to see in the picture above. In particular, the company has an organisational structure consisting in production facilities and distribution centres, as well as a functional and flexible commercial network. Currently, considering the set of facilities, the company has circa 600 employees.

- 21 Commercial Offices
- 9 Bolting Centres
- 8 Stores
- 5 Air Separation Units
- 2 Special Gas Production Plants
- 6 CO_2 Production Plants
- 2 Pipelines
- 3 HyCo
- 300 Agencies and Retailers

The main type of gases produced are divided in two classes:

- Atmospheric gases that include: Oxygen, Argon, Nitrogen and rare gases. They are obtained by air distillation and are mainly produced in Verres (Ao) plant.
- Process and special gases that include: hydrogen, carbon dioxide, ammonia and many others.

Rivoira deals also with the delivery of gases that can happen in different modalities, based on the entity required by the customer and on the gas typology. These different modalities differ also in terms of the physical state in which the gas is packed.

In 2014, Rivoira established five separated liability companies: Rivoira Gas s.r.l, Rivoira Refrigerants s.r.l, Rivoira Pharma s.r.l, Rivoira Operations s.r.l and Rivoira Sud s.r.l.

4. Why does the company need this project?

This project will focus on the **Key Account Code** and the process that leads to its creation.

This code is the fundamental to manage all the information related to the Order Requests of external clients or internal transactions, and at the same time to draft the Profit & Loss Account of the company. The software and procedure that the company utilize in the Accounting department nowadays are more than 20 years old, and they contain many inefficiencies and ineffectiveness that lead to waste of resources. In this case, the company's resources touched by this project are the time of the employees and the software where all the codes are stored.

Maintaining long lists of codes that are never used only creates an overloading of the company's system and moreover, it makes the Order Request process longer and more complicated to fulfil, since the operators have to pick the codes from a wide range. At the same time, the risk of picking the wrong codes becomes higher and it leads to the creation of errors. Then, it will be necessary to allocate some time of the employees to the correction of these errors, wasting one of the most important and scares resources on which a company can lean on.

The Top management knows that there are these problems but there is a lack of visibility of how they are created. For this reason, the aim of this project is to provide a clear mapping and understanding of the current process followed during the Order Request and creation of the Key Account. Then, the most critical elements will be further analysed until the identification of the root-causes. And finally, some countermeasures will be proposed to speed up the procedure ad reduce the number of errors.

This project is perfectly in line with the willingness of the company to revamp the old structure and consolidate the small improvements done in the last years. Moreover, the results of this analysis will be utilized in synergy with the purchase of a new software, from an external provider, able to cluster different functions into one tool. The idea is to obtain a tool able to quickly transform accounting information into managerial information to help top management in the decision-making process.

The new software, together with a “leaner” code system will facilitate the operators both in the day-by-day activities and in the medium/high level planning activities. To better understand the aim of this project, it can be useful a short description of the general problem noticed by the Accounting and Planning departments of Rivoira.

In the current situation, Rivoira drafts a P&L account for company, that means divided according to the different financial entities in which is split. At the same time, it would like to be able to draft a P&L for Line of Business (the main classes of products present in the company’s portfolio). At the moment, they are able to draft the profits and variable costs for LoB, while they have huge problems for the allocation of the fixed costs when passing from company to Line of Business perspective. The solution currently adopted is to divide the FC proportionately to the profits generated by each LoB, but this leads to a loss of details and sometimes the total amount of costs does not coincide when changing from a metric to another.

At the end of each months, the Accounting department operators spend three working days in gather all the data to fill the accrual part of the report. Then, two more days are necessary to fill the so called “green sheet”, where the fixed costs are reported for each Function Responsible (e.g. IT responsible, HR responsible). The data show only the total amount of the function, with a loss of information when looking at the specific sub-functions.

In these “green sheet” the accrual costs (reported in YTD: year to date) are confronted with the forecasted values. In this way it is only possible to see if the forecast was respected or not, but it is not possible to understand which elements have improved or worsened.

Overall, the information provided by the accounting tools utilized provide weak benefits when they have to support the planning activities for the long run.

Rivoira would like to obtain a new tool that can cover the needs of both the Accounting and the Planning department, in order to keep all the main elements, profits, costs and margin, under control,

without losing details in the information. The software company will provide a small pilot project where all the functions are embraced by only one accounting tool.

This will allow to change easily the metrics of the P&L account without losing details of the data. And moreover, this new software will allow to each single department to enter its own data on the main system, to avoid sending them to the central Accounting department.

This project wants to act in synergy with this pilot, working on the input of the system. By reducing the amount of codes open in the JDE and the number of combinations allowed, it will be possible to speed up the closing activities at the end of each month, and reducing the number of errors.

As the Planning Manager Paolo Ronzi said: “The correction of errors should be the exception and not the daily routine”.

In the following chapter, a clear description of the Key Account creation process will be provided in order to understand which are the main steps and input sources that generate this code.

5. Key Account Creation

The process starts every time there is the need to purchase an item, both physical o a service. The request can come from an external client or from an internal one, that means between two entities of the Rivoira group.

In order to perform the request, the operator in charge must have an active JDE user account. JD Edwards is the software currently used for the purchasing, the planning and the forecasting activities. The Order Request (OR) is performed locally, so each site and division can issue an order.

Then, once the request is filled with the required information, the Purchase Department manage centrally the order and transforms it into an Order Purchase (OP). The OP is sent to the different suppliers and a negotiation phase begin. Once the OP is approved, the Supplier will receive the final OP and it will deliver the service. Each site will issue locally a receipt to confirm that they received the correct items/services. And finally, the Supplier will issue a supplier-invoice that is managed centrally.

It is possible to divide the overall process in four main steps:

- Order Request: managed locally
- Order Purchase: managed centrally
- Receipt emission: managed locally
- Supplier Invoice: managed centrally

The Project is going to focus on the first step since it is the point where all the relevant information are accounted and the main errors are generated. This is the phase in which the Key Account code is created. A mistake made in this phase will affect all the other steps.

5.1. Order Request

The OR process starts with the issuing of the request, of a physical item or a service, by an operator with an active JDE user account. After the creation of a new OR, it must be filled with the following information:

- Business Unit (BU)
- Supplier Code
- Dates
- Quantity
- Value of the item/service
- Unit price
- Item code
- Subledger (if requested)

Each one of this information contribute to the creation of the Key Account. As is possible to see in the picture below, this code is made by three main components: the **BU**, the **Object** and the **Subsidiary**. A detailed description of each element is provided in the following paragraphs.

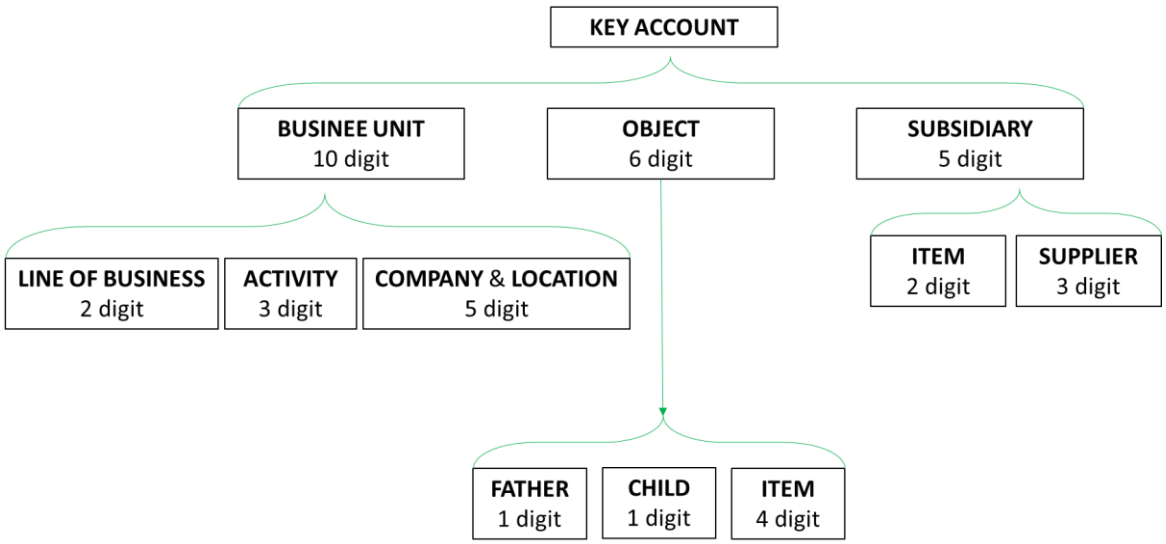


Figure 2: Key Account Structure

5.1.1. Business Unit

The first part of the Key Account is composed by the **Business Unit** (or Cost Centre) that give information about the site issuing the order, for what kind of activity and business.

The number of digits varies according to where the code is going to be registered: Balance Sheet or P&L account.

In the first case, the BU is used to report the working budget requests of different departments. These cost centres represent the generic investments done to cover the expenses of the supporting generic activities, like technical assistance, IT assistance and so on. Or they can be used for the purchasing in advance of large quantities of materials, in order to then satisfy customer requirements in a short time lap. For instance, the purchase of tanks is accounted as investment in the Balance Sheet and so can be capitalized and amortized.

The code for Working Budget has only 7 digits: the first two represent the generic activity for which they are issued, while the last five digits represent the site and company that will benefit from these activities.

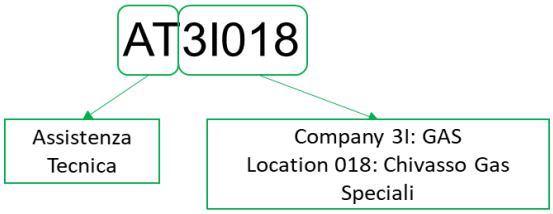


Figure 3: example of Balance Sheet BU

In case of Cost Centre for P&L account, the BU contains more detailed information and for this reason it has 10 digits and it is composed by four different elements.

The first two digits are dedicated to the **Line of Business** (**LoB**): they represent the main businesses managed by the company and they can differ according to the molecule sold or application field in which the product will be used (e.g. refrigerants, medical & healthcare).

LoB	JDE code
Other	**00**
Merchant	**01**
On-site	**02**
Carbon Dioxide	03
HYCO	04
Liquid Hydrogen	05
Helium	**06**
Packaged Gases	**07**
Hard goods	**08**
Specialty/Rare Gases	**09**
Other	**10**
HealthCare Equipment	11
Polishing	12
Advanced Components	13
Targets	14
Liquefied Natural Gas	15
CNG/Cylinders & Kits	16
Coatings	17
Aviation	18
Powder	19
Healthcare Homecare	**20**
Eliminations	21
Refrigerants	**22**
Porous Mass	23

Table 1: Line of Business

At the moment, there are 24 different line of business available on JDE, but only 9 have been actually used in the last two years (those ones highlighted in the above table). The company is evaluating to open another LoB (Helium 06) starting from the next year.

The code 00 does not represent any Line of Business. It is used to represents the central office in Milan, where the general administration expenses are reported.

The next three digits are for the **Activity** linked to the Order Request. The related code is decided by the JDE user according to the department issuing the order. Currently there are 91 different activity codes open on JDE, while only few are actually used during the year. It is possible to cluster the different activities in few categories that are reported in the following table:

Activity Category	JDE code
Other (sales, wip, model bu, etc.)	000-099
Reserved for future use	100-199
VMC - Production range	201-249
PMC & PDC - Service range	251-299
VDC - Distribution range	301-399
R&D - R&D range	401-499
Engineering - Engineering range	501-599
Selling - Selling & Marketing range	601-649
G&A - Human Resources range	651-699
G&A - Finance & Accounting range	701-749
G&A - IT range	751-799
G&A - Legal range	801-849
G&A - Procurement & Materials Mgt	851-875
G&A - Safety & Environment range	881-899
G&A - General Management range	901-949
Reserved for future use	950-999

Table 2: Activities

The last five digits are dedicated to the **Company** and **Location**. As already mentioned, the Rivoira Group is divided in 5 different entities, separated from a financial point of view. Each Company can manage orders from all the Line of Business.

Company	JDE code
Gas	3I
Pharma	3M
Refrigerant	3R
Operation	3P
Rivoira SUD	3N

Table 3: Companies

The location can represent both a plant owned by Rivoira Group or a customer site.

All the possible combinations of these codes generate the Business Units. At the moment in company's system more than 15.000 codes are available but only a small percentage has been used in the last two years.

5.1.2. Object

The **Object** is that part of the Key Account that gives information about in which line of P&L Account the order request should be recorded.

The first digit, called "**Father**" describe the main class of the OR, for instance profits is represented by number 4 while costs by number 6.

Then, the second digit, called "**Child**", gives information about the related P&L account line, and it goes from 0 to 6. This digit is generated according to the activity registered in the Business Unit, so it is important that these two components are always aligned.

Father	Child	Activity
6	0	VMC (variable manufacturing costs)
6	1	VDC (variable distribution costs)
6	2	FMC (fixed manufacturing costs)
6	3	FDC (fixed distribution costs)
6	4	R&D
6	5	FC Selling
6	6	G&A (general administration))

Table 4: Correlation Object-BU's Activity

Then, the last four digits, further specify the nature of the costs. They come from the combination of the **Item Code** and the **Business Unit**, denominated **Classe Coge**. The process that generates this code will be analysed in detail in the following paragraph.

5.1.3. Subsidiary

The last component is called **Subsidiary** and it is not present in case of profit items. The first two digits represents the **Item**, generated by the link between the Item Code and the Business Unit. While the last three digits come from the **Supplier code**. This last part is used to differentiate between external and internal suppliers. This separation is fundamental because during the drafting of the consolidated P&L Account of all the companies of the Rivoira group, all the transactions that involved internal entities (so, with internal suppliers) must be eliminated.

5.1.4. Classe Coge

Each **Item Code** must be linked to a **Business Unit**. This combination can be wrong, and in this case the system blocks the Order Request process (sometimes the operators can force the system to complete the OR, leading to the creation of wrong Key Account Code). The system control that the combination Item Code-BU is present in an **Address Book**, that contains all the possible combinations allowed. If the match is correct, the system generates two codes:

- 2 digits code that represent the first two digits of the Subsidiary (Item)
- 4 digits code, the so called **Classe Coge** that generates the last four digits of the Object. It is important to underline that Classe Coge does not represents exactly the last four digits of the Object, but there is a univocal correlation between these two codes.

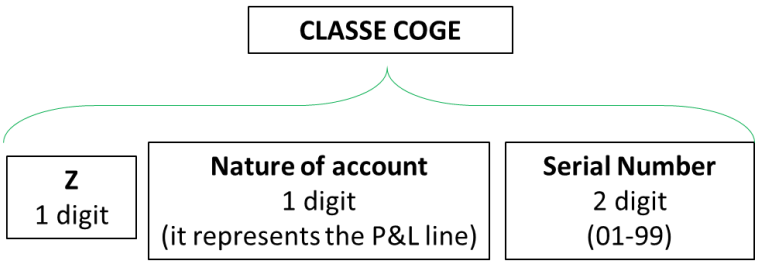


Figure 4: Classe Coge structure

In the following image, extracted from the company software, it is possible to see how the Object code is univocally associated to the Classe Coge.

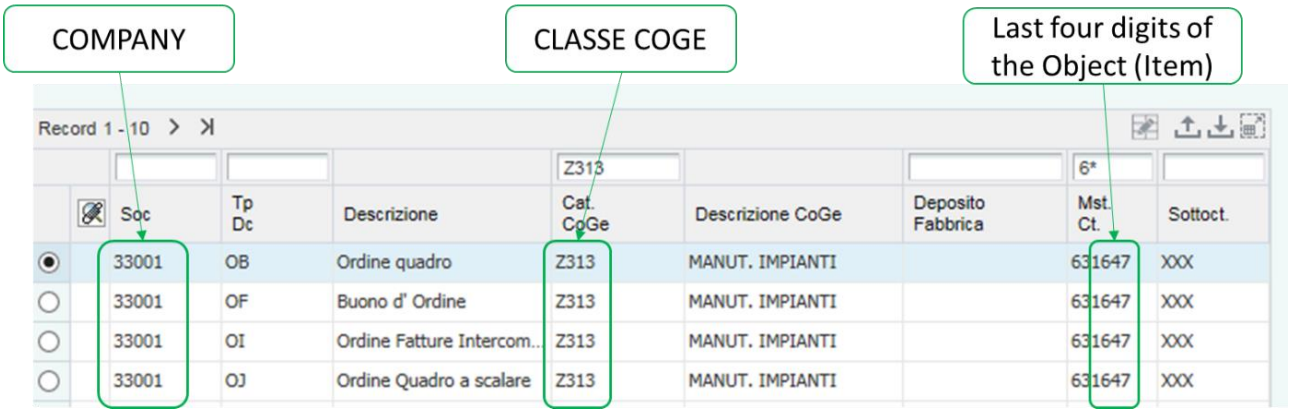


Figure 5: Correlation Classe Coge and Object

While, in the following image, it is possible to see how the system associate the Classe Coge code and the two digits code of the Subsidiary for each combination of Item Code-Business Units.

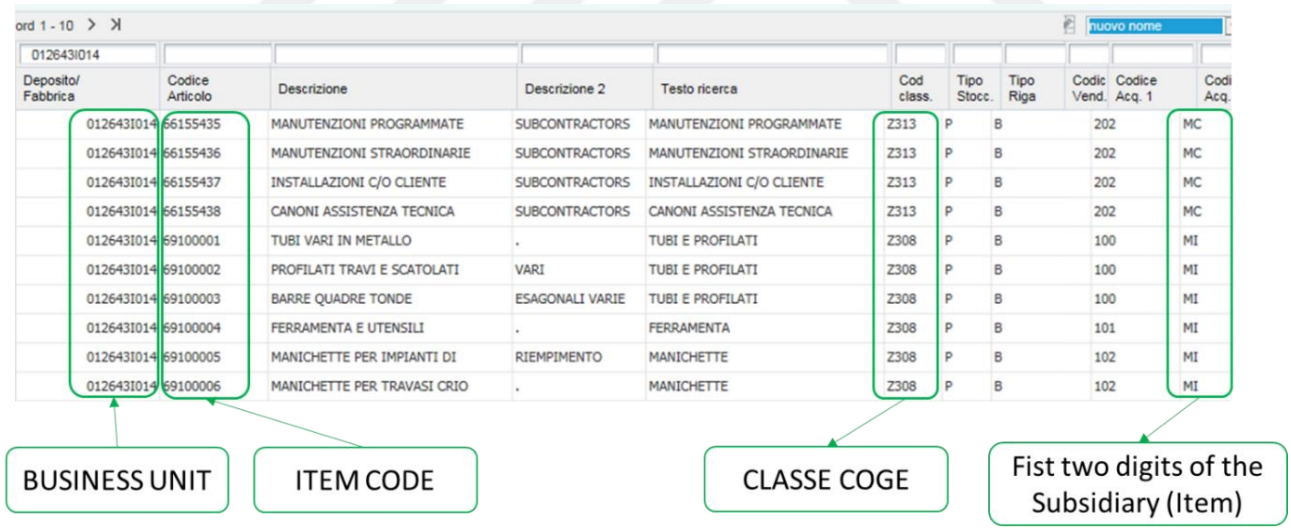


Figure 7: Correlation Classe Coge-Subsidiary

Here is reported a complete example of a Key Account (in case of P&L Account BU), containing all the three parts.

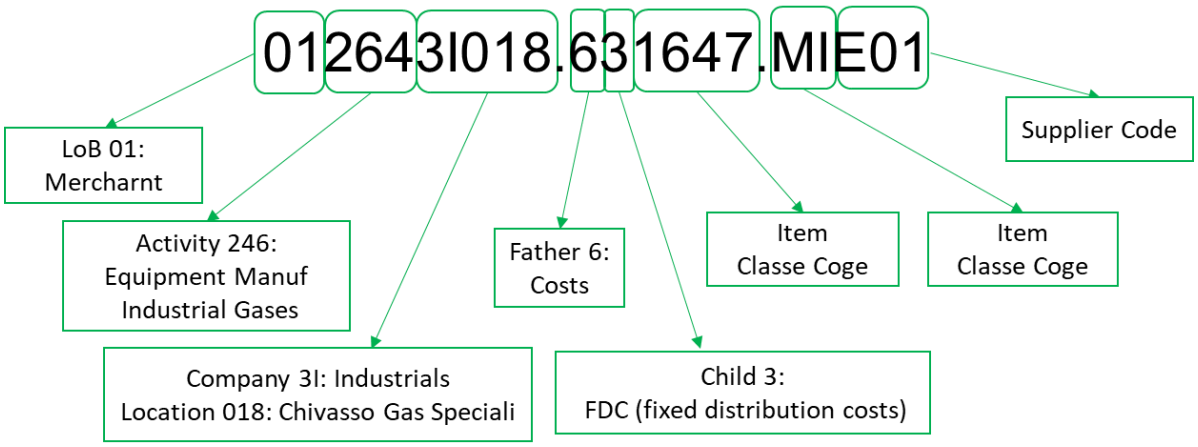


Figure 8: Example of Key Account Code

At the end of the process, the system checks if the Key Account generated is present in another **Address Book** where are reported all the possible combinations of Key Account allowed. In the case in which the code is not present on the list, the system will block the registration of the Order Request.

As it is possible to see from this description, the Key Account is a combination of different codes. The number of combinations allowed is very high, but only a small percentage is used frequently during the year. Moreover, it is important to remember that some inputs, like the ones for the BU, are chosen by the JDE user, who can pick the wrong code among the ones present. Usually, this kind of mistake is given by the long list from which he/she can chose, and by the absence of a pre-defined path to follow during the Order Request compilation.

5.1.5. Subledger

The **Subledger** (**SBL**) is an additional code that can be required by the system during the Order Request process. It is a seven digits code formed by two parts: the first three digits identify the specific activity performed and nature of the subledger, while the last four digits are just serial numbers that are used to account the same activity when it is performed more times during the year in different sites, or in the same site more times. There are different types of subledgers and they can be

distinguished according to the first digit. The main ones are the “working budget” subledgers (1) and the “sales (3) and costs (5)” subledgers. Subledgers type 1, 3 and 5, accounts more or less for the 80% of the total subledgers opened every year. For this reason, it makes sense to focus the attention only on these ones.

The different types of subledgers follow different paths:

- **Sales (3) and Costs (5) Subledgers**

  The Order Request is inserted on EasyFace, a software used by Rivoira to collect and check all the different customers’ requests.

  After that, an inspection and a cost analysis are carried out. Once completed the cost analysis, a business agent makes a proposal to the client and if it is accepted, a conformity check between business and technical aspect is performed. The conformity is aimed at guarantee that the margin of the company is respected (e.g. if the costs forecasted are not respected, it could be possible to raise the price asked to the client).

  Then, the subledger is opened from TSO. After many controls of documents and various approvals, the specific order of the technician is issued to the purchase department, that will generate the order.

  In the end, there is another control of the marginality of the specific subledger.

- **Working Budget (1) Subledgers**

  Subledgers type 1 follow a different path compared to subledgers type 3 and 5. They are based on customers analysis, so the company is anticipating them purchasing in advance equipment to then serve quickly the customers.

  E.g. when Rivoira issue the order of a tank to its supplier, it can be required to wait till 15 weeks. It is not possible to ask to the client to wait such long time.

So, the company makes some investments plans to purchase tanks and related equipment in advance. They order is issue internally, and it requires different steps of approval. The number of steps and people involved vary according to the size of the investment. E.g. for investments under 50.000$ is not necessary to require the approval of the European Coordinator, based in Madrid. After the approval, a specific Subledger is opened in Airwaves, a different software compared to EasyFace.

The two different processes have only a step in common, that is the attachment of the Subledger to the specific cost centre.

Usually, the Working Budget Subledgers, since they are more general, create more problems in the allocation, compared to the costs and sales subledgers.

When the JDE user select the BU, during the Order Request fulfilment, the system says if the SBL is mandatory or not. In the case in which is mandatory, the user account should insert a SBL code and then the system will check if the code is correct or not. If the combination BU-SBL is wrong, the system blocks the Order Request.

The main issues in this process are that usually the JDE user account do not have a deep knowledge of the SBL structure and it can happen that at OR level is inserted a generic SBL and then at the Receipt level a specific one is inserted, generating possible errors.

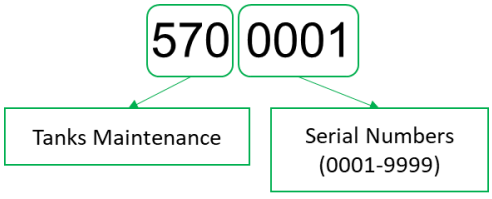


Figure 9: Example of Subledger

The main reason why the Subledgers are not always requested is because they were used only in Italy and they were not present in JDE. The company tried to integrate the old system with the new one

imposed many years ago by the American Company Praxair. Still nowadays, the match between these codes is incomplete.

5.1.6. Item code

The Item Code specifies what the user needs, it can be a physical item or a service. Then, in the ERP of the company, the Item Code will build the object account of the cost generated.

As previously stated, the object account represents one of the three main parts of the Key Account generated in Rivoira, and its function is to create the P&L of the company. The Item Code helps to specify the OR related costs, and not the related sales.

The JDE authorized user is the one that inserts the Item Code into the OR. Generally, the user knows what is required even if he/she is not the final beneficiary. In reality, the technicians are those that need a material or a service but they do not have an open account on JDE, so they have to ask to someone else to generate the OR for them. This process can lead to some mistakes since the JDE user are not familiar with all types of Item Codes present in the system, and moreover, they have to create the right combination of Business Unit and Item Code in order to complete the Order Request process. For this reason, it is not possible to blame only the JDE users for the possible errors generated, since the wrong information could be given from the technicians.

The reason why not every employee has access on JDE is because this software service is not for free. Every new account requires the purchase of a license that has an annual cost, and for operators that make just few orders per months or even per year, this kind of investment for the company is not justified.

The same Item Code can be used for Capex or for P&L costs, the discriminatory factors are the Subledgers (starting with 1, 3 or 5) and the Business Units associated.

Capex (Capital expenditure), also called Working Budget, refers to the purchase of assets which useful life extend over one year. For instance, the purchase of new cylinders which useful life is estimated around 30 years. It is possible also to capitalize services that will be used to realize an asset.

In case of Item Code for Working Budget, the BU correlated is a seven digits code, starting with two letters that state the function for which the investment is done. For instance:

- FS: filling station
- BD: business development (e.g. the purchase of the new software will be allocated with this code)
- DB: distribution bulk (purchase of a new trailed designated for the distribution of bulk gases.)

While, in case the Item Code refers to P&L cost object, the related BU is the ten digits codes, where LoB, Activity, Location and Company are specified.

Going more in details, the Item Code is composed by eight digits:

- The first one is always a 6;
- The second digit specifies what is requested, e.g. physical item that will be sited in the company's inventory for future uses (represented by 0) or a service (9);
- Then, the 3rd, the 4th and the 5th digits indicates the main group of items of services that the user is asking;
- Finally, the 6th, the 7th and the 8th digits are the serial numbers that further specify the item/service purchased.

Here are reported two examples of Item Codes for materials that will be put at stock, where the last digits specify what component is required, and an example of Item Code used for services.

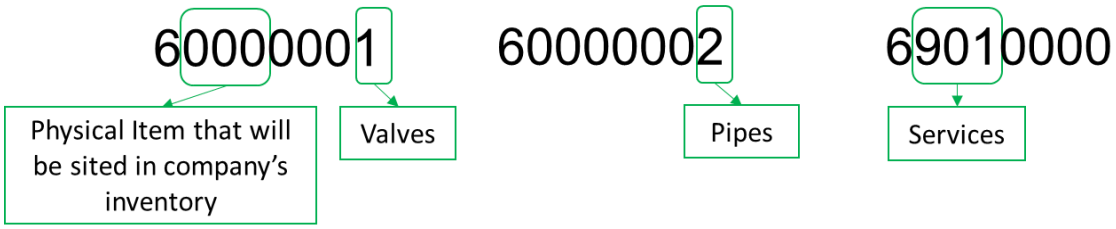


Figure 10: Examples of Item Codes

6. Target

Before setting the targets, it is fundamental to understand the elements on which to focus the attention. As previously stated, the aim of this project is to decrease the number of codes present in the company's system, to reduce the number of errors generated during the Key Account generation and consequently to shorten the time required for the closure and checking activities at the end of each month.

From the previous breakdown analysis and according to the company itself, two main components resulted to be the most critical ones in the creation of the Key Account: the **Business Units** (or Cost Centre) and the **Item Codes**. These codes represent not only a part of the Key Account, but from their combinations, other parts are created as well. Let's see more in detail how much they influence they final code.

The Business Units represents the first 10 digits of the overall 21 of the Key Account, while the combination between the BU and the Item Code generates the Classe Coge, that in the company's system creates the last four digits of the **Object** and the first two of the **Subsidiary**.

Overall, these two components account for 16 of the 21 digits of the Key Account, this means that they influence more than 76% of the process. For this reason, it has been decided to focus the attention on these two, and set the targets accordingly to their analysis.

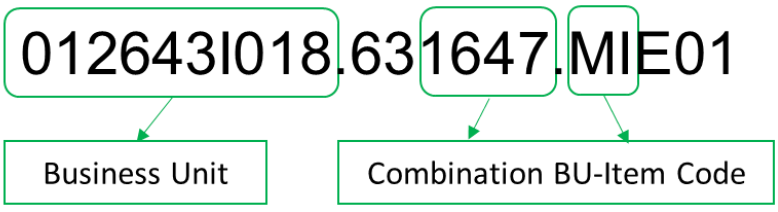


Figure 11: Digits generated by BU and Item Code

Moreover, the Object and Subsidiary code system have been recently improved in the last two years and according to the company, a further upgrade will be only time consuming at the moment.

In order to improve the process, it is possible to compute different of KPIs and set the related targets:

- KPI for the Business Unit codes, to measure which percentage is used;
- KPI for the Item codes, to measure which percentage is used;
- KPI for the errors, to quantify how much does it cost to the company to correct the errors, both in terms of time and money.

In order to quantify the number of codes not used, both for BU and Item codes, two similar analysis will be carried out, consisting in the comparison between the codes that have been actually used (AS IS situation) with the list of nominal codes open in the company's system.

Moreover, in the case of BU, the company has already in mind a possible TO BE scenario, that shows which codes it wants to keep and those that are going to be closed.

The results from these two analyses will help to understand which kind of BU and Item Codes are the most frequently used and which ones have never been picked in the past two-years period. Moreover, comparing the codes used with the nominal list of codes available in the system allows to make a quick check and to spot possible "visible" errors. These latter ones represent codes that have been actually used or generated by the JDE users during the OR process, but they are not present in the company's system. Therefore, they will create delays later in the process because the operators will waste time to correct them.

There are also other types of errors to take into consideration. To make a differentiation with the previous class, these ones are going to be called "hidden" errors and they can be found only having a deeper knowledge of the various codes: for instance, a BU code that contains the Location code of a site that has been closed, or the allocation of production cost the administrative centre in Milan.

Due to the lack of deep knowledge and time, this project will analyse only the "visible" errors, since they can be found more easily, comparing available codes with the ones actually used.

To quantity the impact generated by the errors, it is possible to set a KPI with two different unit of measure. First one, in minutes spend by an operator to fix the errors, divided by the number of errors

generated per year. Then, multiplying the value obtained, minutes/error with the average hourly wage of an employee, it is possible to quantify how much does it cost to the company to fix every error. Finally, the total costs sustained by the company are obtained by multiplying the €/error for the average number of errors per year. The value obtained does not correspond to a real cost but it represents the waste of resources, time of the employees, that could be used to improve the process instead of correcting the same errors.

More detailed about the computation of the average hourly wage are reported in the sub-chapter "*6.3 Errors generation*"

6.1. Business Unit

In the actual situation, the number of Business Unit code open is equal to 15.449, composed by:

- 145 generic codes linked to the different sites
- 619 working budget business unit codes
- 14.685 P&L business unit codes

From the previous classification, it results that the last class of Business Units accounts for more than the 96% of the total amount. For this reason, the following analysis is going to be focused on the P&L BU codes.

Analysing the data of the 2017 and 2018, extracted from JDE, is possible to notice that only a small percentage of the Business Unit codes open have been actually utilized.

In the following table are reported the overall amount of rows of Key Account registered in the past two years, for four different classes of data, divided according to the specific P&L Account Line (4, 6, 7 and 8), and next to them the number of univocal[1]codes used.

[1] Univocal codes are computed counting the codes used at least one time among those actually used, without making repetitions.

	Key Account codes		Business Units	
	Total amount	Univocal codes	Total amount	Univocal codes
2017_4xxxxx	538.722	1.887	1.887	367
2017_6xxxxx	144.886	8.543	8.543	1.533
2017_7xxxxx	45.656	588	588	246
2017_8xxxxx	123	53	53	15
Total 2017	729.387	11.071	11.071	2.161
Overall univocal codes 2017				1.795
2018_4xxxxx	439.736	1.738	1.738	369
2018_6xxxxx	87.805	5.746	5.746	1.300
2018_7xxxxx	40.535	526	526	230
2018_8xxxxx	37	19	19	11
Total 2018	568.113	8.029	8.029	1.910
Overall univocal codes 2018				1.572

Table 5: Key Accounts and Business Units utilised in the last two years

As is possible to see from the data reported[2], once eliminated the duplications, the number of univocal codes used on yearly basis is really small compared to the complete list available in the system, respectively the 11,6% in 2017 and the 10,2% in 2018 (percentage computed considering the total amount of 15.449 codes). Moreover, comparing the codes used in these two years, it has been found that only 1.965 (12,7%) univocal codes have been actually used.

In order to understand which types[3] create the highest inefficiency, it is fundamental to analyse in detail the AS IS situation of the codes, to spot which ones have been utilized by the company in the last two years. A certain BU code could not be used, for instance, because the Location to which it refers is now closed and consequently, all codes that contain that location will not be used anymore. Or a certain activity is not performed in a certain Location or is not monitored for a certain LoB. For instance, it should not be possible to allocate a general administration cost to a productive plant, but only to the administrative centre in Milan.

[2] Data obtained from an extraction of the total number of Key Accounts registered in JDE in the 2017 and 2108
[3] In this case, types of codes refer to the components of the BU: LoB, Activities, Location&Company.

To give a clear example of what has been done, two table different tables are reported. In the first row there are the various LoB present in the company's system, while in the first column are reported the Activity codes, in this case only the ones from 000 to 249. The number present in the different cells indicate how many codes are available for each Activity-LoB combination.

The first table represents the codes available in the system, the nominal list of BU codes that could be generated and accepted by the system.

While the second table represents the number of combinations that have been actually used during the time period monitored.

Nominal List of BU

Activity	Other (00)	Bulk (01)	On Site (02)	Pag (07)	Hard Goods (08)	Specialty (09)	Other (10)	Medical (20)	Refrigerant (22)
000	158	294	324	294	52	284	110	216	259
201		319							
202			264						
205			166	1					
206				230		185			155
208									10
220								130	
229						14			
243								168	
245							3		
249	125	103		214				130	127

Table 6: Nominal List of BU available in the system

The two table must be red at the same time, in order to maximize the number of information that they can provide.

In the first table, the cells with numbers in red represents the number of codes that have not been used in the last two years; this means that the correspondent cell is blank in the AS IS scenario table.

AS IS scenario table

Activity	Other (00)	Bulk (01)	On Site (02)	Pag (07)	Hard Goods (08)	Specialty (09)	Other (10)	Medical (20)	Refrigerant (22)
000	18	99	117	235		183	6	94	128
201		10							
202			4						
205			14						
206			1	25		7			5
208									1
220								4	
229						1			
243								23	
245									
249	9	21		165				55	57

Table 7: AS IS scenario table

At the same time it is possible to notice a cell marked in red in the AS IS scenario table. This cell highlights an Activity-LoB combination that has been used but that is not present in the nominal list. Therefore, it represents a wrong code generated during a OR process. This error can be classified as "visible" since it was found during this visual check.

Anyway, before closing definitely a BU in the company's system, it is important that Accounting and Planning managers check carefully the codes.

The "closure" of these codes in the actual system (making them not available for future use) can represent a quick-win easily achievable by the company thanks to the collaboration between the Accounting and the IT department.

At the same time, the list obtained will be used as input for the new software that the company is going to purchase in the following months.

It is important also to match the AS IS situation (what the company is currently using) with the TO BE situation provided by the company itself, that represents what the company would like to keep. In the table reported below, it is possible to notice some differences with the current situation.

TO BE scenario

Activity	Other (00)	Bulk (01)	On Site (02)	Helium (06)	Pag (07)	Hard Goods (08)	Specialy (09)	Other (10)	Medical (20)	Refrigerant (22)
000	Y	Y	Y	Y	Y		Y	Y	Y	Y
201		Y			Y		Y		Y	
202			Y							
205			Y							
206					Y		Y			Y
208										
220				Y						
229										
243									Y	
245										
249		Y	Y	Y	Y		Y		Y	Y

Table 8: TO BE scenario table

In particular, there is the introduction of the new Line of Business, Helium (06), that will be monitored separately, starting from the next year.

The introduction of this new LoB will not necessary lead to a higher number of codes, since the value of this product are currently monitored with other BU codes. Once the new codes containing LoB 06 will be available in the system, it will be possible to "close" the ones previously used for the registration the Helium. The company is confident of the value that the new data monitored will bring.

The results obtained matching the AS IS and the TO BE situations with the nominal list of codes present in the system, show that 740 codes were never used in the past two years, while 3.100 codes are not considered necessary by the company be kept for future operations

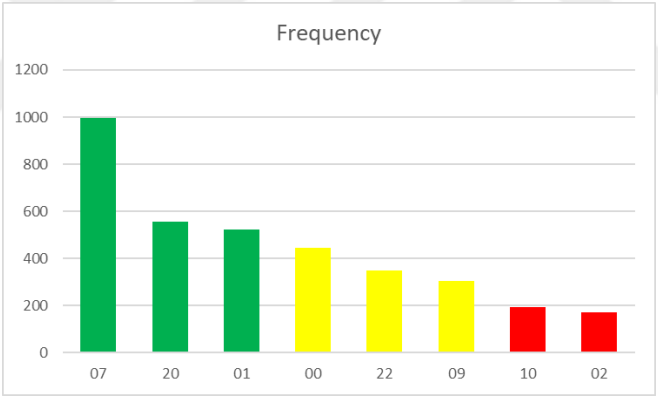
So, filtering the overall 15.449 codes open with the results obtained from the TO BE scenario, in the end the result shows 11.309 codes open, used or considered necessary by the company. This second comparison, among the three tables, allows to increase the percentage of codes used from 12,7% to 17,4%.

In order to further increase this percentage, it is possible to analyse more in detail the codes. In particular, performing a Pareto Analysis for each main component of the Business Unit, it will be

possible to prioritize the codes of the different components, according to the frequency with which they are used. This means to create a ranking of the different Line of Business codes, Location codes and Activity codes and in the end, the BU that are composed by the codes with the lowest frequency for each component, are those ones that will be investigate first, since are more likely to be "closed".

Starting from the **LoB** code, since the codes used do not respect the 80-20 rule of the Pareto Analysis, it was necessary to use an ABC Analysis. The result is reported below, where the green represents class A, yellow class B and red class C.

07 (Packaged Gases), 20 (Healthcare and Homecare) and 01 (Merchant) are the ones used more frequently. While it is possible to notice that the LoB 08 (Hard Goods), present on the nominal list of the company's system has never been used.



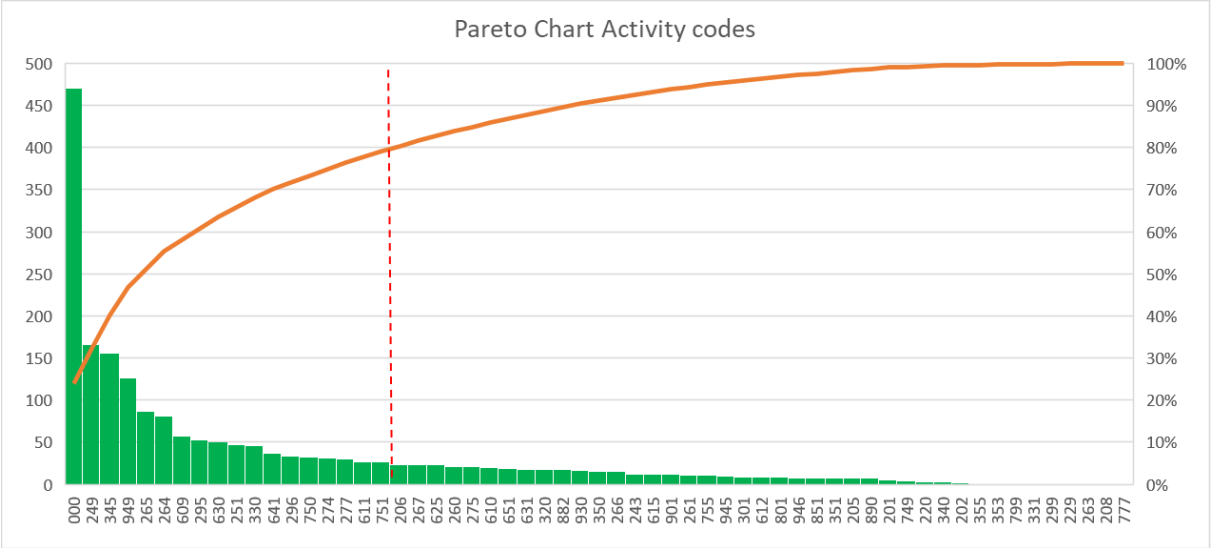
Graph 1: ABC Analysis of LoBs

Looking at the **Activity** codes, the result of the Pareto Analysis shows that the most the frequently used is the 000, related to generic administrative costs, while there are many codes that used just one time per year.

From the 91 activity codes available on the system, only 59 have been used in the last two years (64%), but looking more in detail, there are just 19 among these 59 that accounts for more than the 80% of the codes frequently used (only 20% of the overall 91). In particular, as above mentioned, the code 000 is the most used one, and it accounts alone for more than the 24%. The repeated use of a

generic code for the allocation of different types of costs generates, later in accounting process, many inefficiencies. This lack of details leads to a loss of information once the totals are generated.

As already mentioned in the introduction, the company has found difficulties in changing metric for the P&L Account, going from companies to LoBs. This issue is indeed led by the inability, from the system and the operators, to reallocate the variable costs and in particular the fixed costs for each LoB, due to the assiduous use of this generic activity codes.

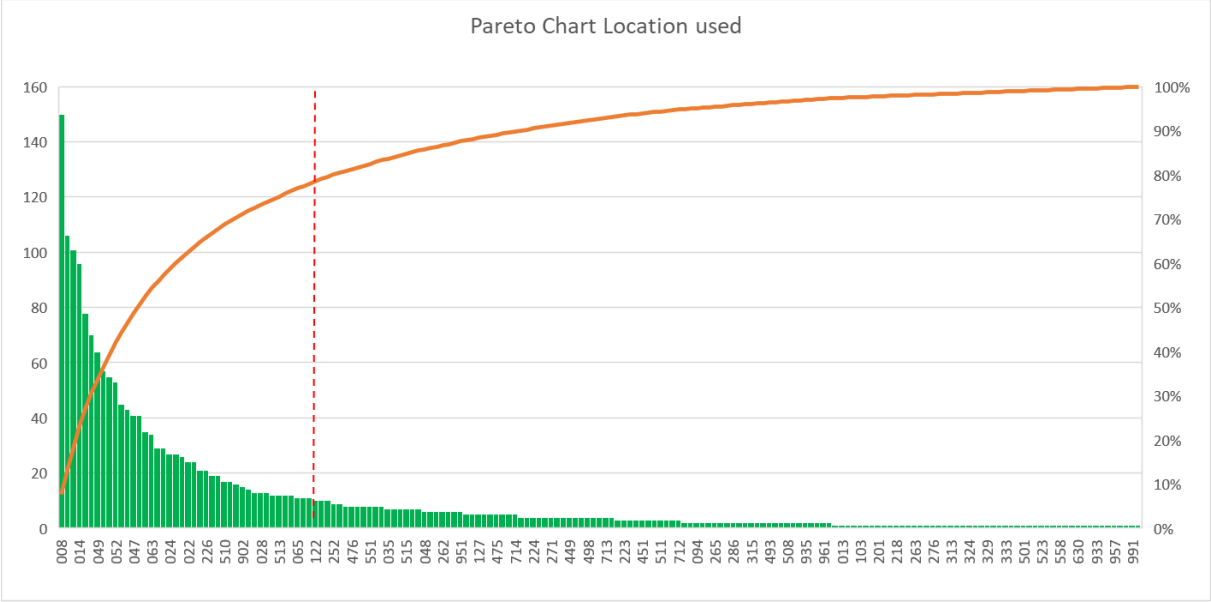


Graph 2: Pareto Chart Activity codes

The same observations can be done also for the codes of the **Locations**. Only a small number was used with a high frequency, while the others were utilized just few times during the year.

More in detail, from the 339 codes available in the system, only 179 have been used (52%), but from these latter ones, just 45 are frequently utilized (25% out of 179, 13% out of 339).

Moreover, as it is possible to see from the graph reported below, there are many locations whose code is used only once or twice, and this happen because in the locations there are not only the production sites directly owned by Rivoira, but also the plants partially owned and all its clients. So, it can happen that some clients acquire only a specific product and not too frequently. This situation makes even harder reducing the complexity of codes, since the low frequency can be just a sporadic event of the last years.



Graph 3: Pareto Chart Location codes

A possible target for the KPI of BU codes can be to increase the percentage of codes used from a 17,4% to a more efficient 30%. Since this percentage is computed as number of codes used over available ones, in order to increase the value, assuming constant the number of BUs used, it is necessary to shorten the list of available BUs. The value of this KPI can be improved every year by monitoring and separating the codes used from the ones not necessary.

6.2. Item Code

In this case, the number of codes available in the system is even higher. There are 161.802 Item Codes divided as follow:

- 60: 57.886 (35,78%) physical items to be put in company's inventory
- 61: 19.102 (11,81%)
- 62: 8.376 (5,18%)
- 63: 6.589 (4,07%)
- 64: 4821 (2,98%)
- 65: 9.245 (5,71%)
- 66: 10.840 (6,70%)
- 69: 44.943 (27,78%) services

The same values are reported in the above Pareto Chart to make clearer the distribution of the different types of Item Codes.

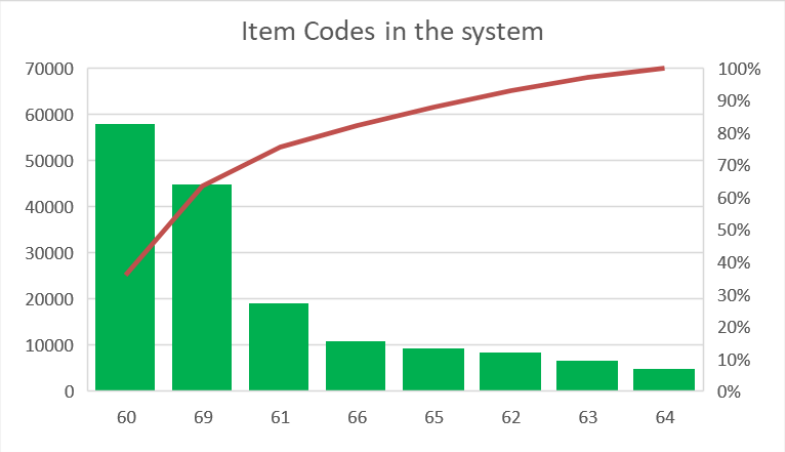


Figure 12: Item Codes present in the company's system

Also for the Item Code, the same type of analysis done for the BU was carried out. The aim was to understand which percentage of codes has been actually used among the nominal list present in the system.

The data provided from the company, where are registered the orders requested between the years 2017 and 2018, show that a very small percentage of univocal Item Codes have been used in the last two years. Only 2.669 codes from a total of 161.802 (1,65%) have been used at least one time in the orders issued in the past two-year period.

It seems evident that there is a serious case of inefficient use of the company's resources, since thousands of codes are stored in the system even if they are never picked. Moreover, the larger the range of codes from which an operator can choose, the higher the probability that he/she will pick the wrong one.

In the following Pareto graph, a more detailed view of the data obtained is provided, in order to understand which kind of Item Codes has been picked more frequently and which not.

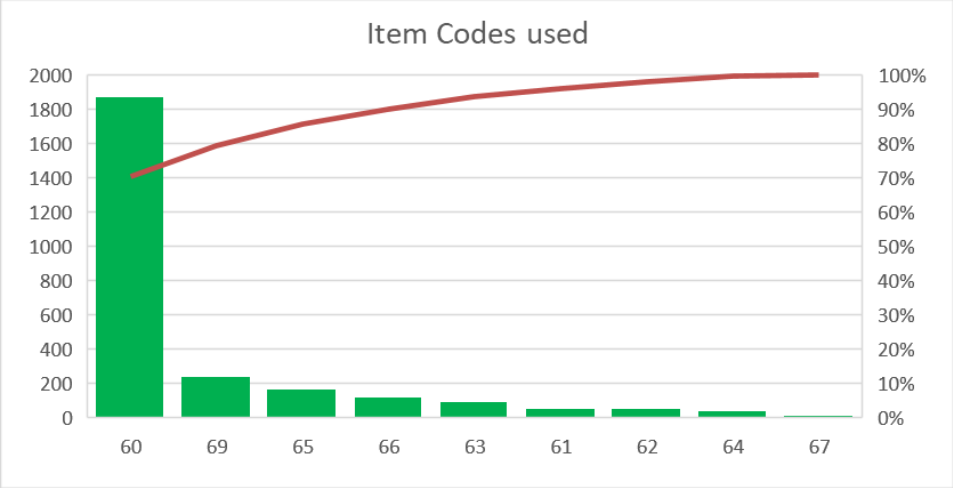


Figure 13: Frequency of Item Codes Used

Making a comparison between the two graphs, the one of the nominal lists and the one of the codes actually used, it is possible to notice that the most used types are still 60 (physical items to be stored in the company's inventory) and 69 (to purchase services). At the same time, the 67 class appears among the ones used while it is not present in the nominal list of the codes stored in the system. Therefore, it is possible to consider all the Item Codes associated to this class as errors. In particular, there are 14 univocal codes generated in this class, and they have been used in total 17 times in the

last two years. This type of error can be considered similar to the ones found during the analysis of the Business Units, and can be labelled as “visible” errors as well.

In the end, the errors generated by the codes 67 represents a very small percentage, almost negligible. The real problem is represented by the codes stored for the classes 60 and 69, for which have been used respectively only 1.875 out of 57.886 (3,24%) and 241 out of 44.943 (0,53%).

As previously done for the Bus, it is necessary to set a target value for the KPI of the Item Code. Also in this case the percentage is obtained as codes used over codes available. Therefore, making the assumption that the number of Item Codes used will remain the same, the only way to increase this percentage is to shorten the list of the available Item Codes stored into the system.

A possible value could be around 15% for the first year, and then, following improvements in the next years will for sure increase the percentage. In this case, it is necessary to be more careful since the lack of use for an Item Code does not mean that the physical item or the service will never be ordered again by the clients. To increase the accuracy of this “cleaning” activity, the sales forecasting can be used as supporting tool to decide which codes “close” in the system.

6.3. Errors generation

As previously stated, this chapter will focus only the so-called “visible” errors, those that can be found thanks to a visual check between the available and the used codes. The remaining errors, called “hidden” requires a deeper knowledge of the single components that create the BU code, of the Item Codes. For this reason, they will not be considered in this analysis.

To compute the errors’ KPI and to set the related target to achieve, it is necessary to follow four steps:

- 1st: quantify the average number of errors generated per year.
- 2nd: quantify the average time, in minutes, required to identify and to fix an error.
- 3rd: quantify the average hourly wage, €/hour, that the company pays to each operator.
- 4th: compute the total yearly costs related to the errors.

The average number of visible errors is obtained from the analysis previously done for the BU codes and the Items Codes.

- Errors from Item Codes: 17
- Errors from BU codes: 543

It is better to notice that the number of wrong codes generated among the business units is not negligible as the one for the Item Codes.

To make the average, the sum of the two types of errors is divided by number of years monitored:

(543 + 17) / 2 = 280 errors/year.

Now, it is necessary to estimate the time required to fix an error. Since, the errors are not too frequent, and the time spend inside the company was not too long, it was not possible to make observations of the errors correction. Therefore, the time is suggested from the operators, that thanks to their experience, were able to estimate around 15 minutes/errors. This value is the sum of the time needed to find the errors, understand its nature, identify the correct code to insert in the invoice. Usually this check activity is done at the end of the month from the planning manager and from two operators of the accounting department. This means that the 15 minutes for error should be multiplied for three, that represents the number of employees involved.

To compute the average hourly wage of an operator, it was necessary to use external source of data, starting from an estimation of the average annual gross salary.

From the on-line site of the Average Salary Survey, the average annual gross salary of an employee in Italy is equal to 51.828 €/year[4]. This value was determined according to a survey that involved 995 individual salary profiles. In this survey, most frequent education is master's degree and the most

[4] https://www.averagesalarysurvey.com/italy

frequent experience are 8-12 years, that perfectly represents the employees that compose the Accounting and Planning department in Rivoira.

In the following table are reported the annual wages of different profiles that participated to the survey.

Career	Avg. gross salary	(in USD)	Profiles
Engineer	EUR 44,566	US$ 56,222	34
IT Project Manager	EUR 53,189	US$ 65,598	31
Mechanical Engineer	EUR 43,116	US$ 51,275	26
IT Manager	EUR 58,283	US$ 73,787	25
Project Manager	EUR 53,808	US$ 65,393	25
Human Resources Manager	EUR 71,054	US$ 85,030	24
Software Developer	EUR 30,915	US$ 39,794	24
Director	EUR 113,739	US$ 144,621	23
Manager	EUR 84,050	US$ 102,513	20
Sales Manager	EUR 77,064	US$ 98,407	17

Table 9: Average annual gross salary

Dividing the annual value for the 12 months, the result is equal to 4.319 €/month.

Then, in order to compute the hourly value, it is necessary to set the following assumption:

- In a month the number of working days is 22.
- In Italy the working day is composed by 8 hours

Multiplying the two value, it was found the number of working hours per month equal to 176.

Now, it is possible to compute the average hourly wage as:

(4.319 €/month) / (176 hours/month) = 24,6 €/hour; that can be approximated to 25 €/hour.

Now, it is possible to compute time required every year to correct the errors. This value obtained represents the resource wasted, time of the employees, that could be used for other activities.

Then, the resource wasted can be quantified in monetary terms, by multiplying the hours/year dedicated to errors resolution with the average hourly wage of an operator (€/hour).

280 errors/year * 15 minutes/error * 3 operators = 12.600 minutes/year → 210 hours/year

210 hours/year * 25 €/year = 5.250 €/year.

According to how it was computed this KPI, it is not possible to associate to a reduction of the number of errors a cost saving for the company. The benefit will not correspond to a real cost avoided by the company, since it already pays the annual gross salary of the employees, but it will allow to achieve a better allocation of the operators' time, that in this case represents a scarce resource.

The total amount resulting from the previous computation can seems very low, but it is important to keep in mind that it represents only a small part of the errors that can be found.

Moreover, the waste of employees' time is caused also by the complexity of the costs allocation that slow down the operations when trying to change P&L account metric, but in this case there are too many factors that influence the process and so it was not possible to achieve a quantitative estimation.

7. Root Cause Analysis

As previously stated in the introduction, the general problem faced by Rivoira is an inefficient use of the company's resources.

In this chapter, the main problem will be split in two sub-problems, accordingly to the type of resources wasted:

- **Overloading of the company's system**
- **Waste of the employees' time**

Each sub-problem will be then analysed in detail in order to understand what are the causes that generates it. At the end of this process, it will be possible to define the so-called root-causes that generate the whole inefficiency.

This step is probably the most critical one because its results will influence the overall efficiency of the project's output. It allows to focus on the root-causes of the problem, so the initiating causes from which the errors generate, and not on the general symptoms.

The root-cause analysis allows to have an overview of the main problem, the one saw from the management, and the various sub-problems that generate it. Moreover, it establishes the chain of cause-effect the links the various causes to the main one.

Using the results of this analysis, it will be easier to develop specific countermeasures aimed at solving the single root-cause, increasing their efficiency and allowing to monitor more easily the impact of each corrective action impact.

7.1. Overloading of the company's system

In the Target chapter, it has been highlighted the high inefficiency in the company's system due to the huge number of codes available. To make a quick recap:

- 15.449 Business Unit codes open, but less than 12% are used;

- 161.802 Item Codes open, but only 1,65% are used.

The main reason is that the company system is more than twenty years old, and during these years it has never been updated. In this time period, there have been many changes, like the acquisitions of small companies or the closure of old production sites, the introduction of new products to increase the company's portfolio. Every time that one of these changes happened, the system was not updated. Moreover, it is important to mention that the company shares some of nominal codes' lists (e.g. Item Codes) with the other companies of Nippon Gases (Praxair until the 2018) in Europe. So, many of these codes are used only in one nation, but still an operator could insert the one valid in another country.

Now, a deeper view of the BU and Item Codes will provide more information.

7.1.1. Business Units

As previously stated, the Business Unit code is composed by four different components: Line of Business, Activity, Company & Location. The combination of these different elements generates the BU code specific for each Order Request.

The system that manage all these codes is more than 20 years old, and during its lifecycle it has been never updated. This leads to have codes of the different components of the BU that are redundant or unnecessary. For instance, some sites have been closed during the years, but their codes are still present and available in the company database. So, it can happen that the JDE user allocates to a closed site the costs generated for a certain activity while filling the Order Request. Anyway, even if the operator know that the specific site has been closed, he/she could keep using the old codes, because the instructions about the reallocation of personnel and functions in the other sites have not been provided. This happen because the closure of a productive site does not mean necessary that also the amount of work have been shut down definitely or that the employees have been all fired.

Usually, the activities and the personnel are reallocated to the closest sites. So, in order to avoid future mistakes during the input of data, it is necessary not only to “close” the codes of the closed sites in the system, making them not available for future use, but also to reallocate the various functions into the other sites, and provide the new codes to utilize to the JDE users.

Since the Order Request fulfilment is performed locally (from each main site) and there is the absence of any kind of restriction, or predefined path or steps to follow, each operator with a JDE user account open can issue orders of any nature. For example, an administrative request for a productive site, or a tank maintenance activity in a central administrative site. The absence of pre-defined paths and guidelines to follow for the operators increases the liability of the process, and consequently the spread of errors.

Below, an Ishikawa Diagram for the inefficient use of BU codes is reported to cluster the main causes.

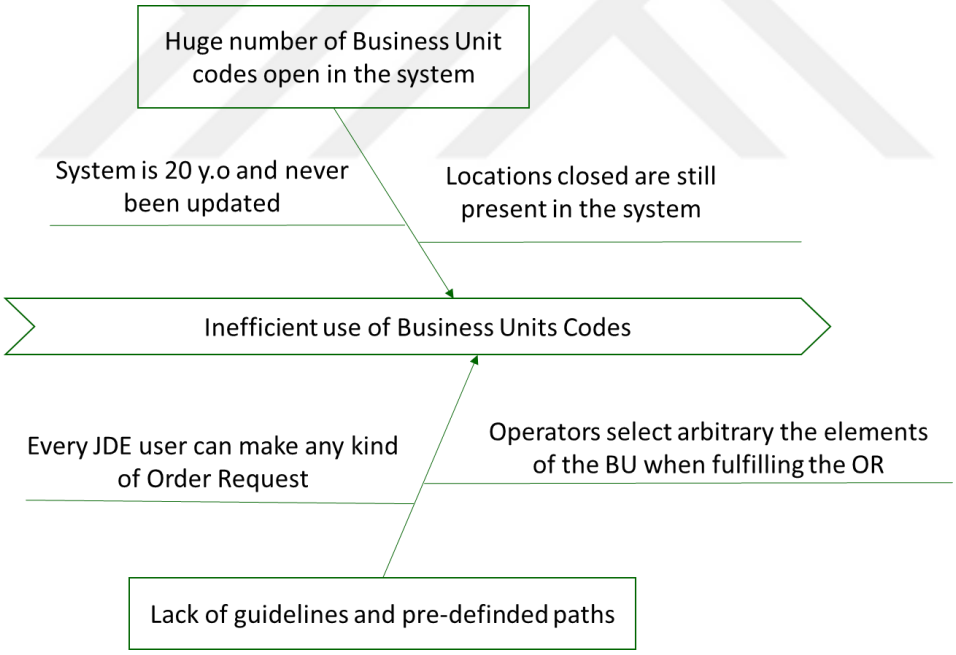


Figure 14: BU's Ishikawa Diagram

From this diagram it is possible to see that the inefficiency is generated from four different causes. In order to establish a ranking, to decide which ones have a higher impact on the main problem and so need to be tackle first, a simple quantitative approach was used. During a brainstorming session, and a following check with the

management of the company, it was possible to assign a score, from 1 (not critical-low impact) to 5 (critical-high impact), to each cause.

Root cause	Impact
System is 20 y.o. and never been updated	5
Locations closed are still present in the company's system	3
Every JDE user can make any kind of order	4
Operators select arbitrary the elements of the BU when fulfilling the OR	3

The first root-cause has the highest value since is the one that basically generates all the other issues. Then, the third one has also a high score since it increases the liability of the process and the likelihood to make errors.

7.1.2. Item Codes

The Item Codes share some of the causes of the BUs, such as the lack of guidelines or pre-defined paths for the operators when generating the Order Request.

In this case, the process became even more complex since the list of available codes from which a Rivoira operator can choose does not contain only the code for Italy, but all the ones used for the European division of Nippon.

Moreover, contrary to Business Unit, the Item Codes do not vary in case of Capex or operating costs, and the differentiation is made only with the association to the specific BU.

Another problem is related to the fact that who is filling the Order Request, is not who is going to actually use the item or service purchased. To make it clearer, the JDE user is not usually the technician issuing the order, and for this reason he/she can have a lack of detailed knowledge about that specific material or service. This is why it can easily happen that the operator inserts the wrong digits, in particular the last one, that specify an item different from the one actually required.

Below it is reported the Ishikawa Diagram for the Inefficient use of the Item Codes to summarize the causes found.

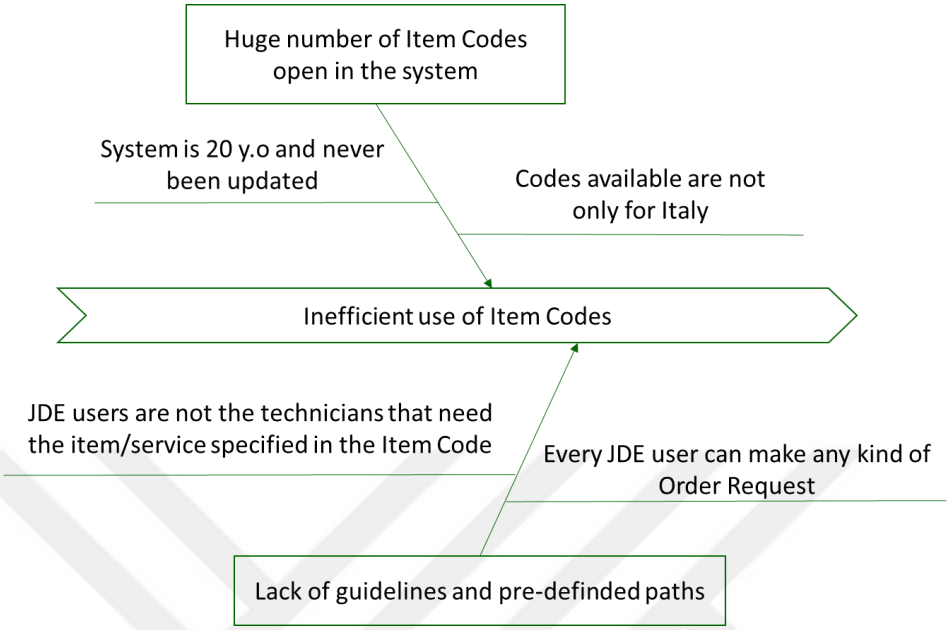


Figure 15: Item Codes' Ishikawa Diagram

As done previously for the BU, it is now necessary to rank these root-causes.

Root-causes	**Impact**
System is 20 y.o. and never been updated	5
Codes available are not only for Italy	3
JDE users are not the technicians that need the item/service specified in the Item Code	3
Every JDE can make any kind of OR	4

Also in this case, the missed updating of the system through the years has led to the major inefficiency. And again, the possibility for every operator with a JDE open account to generate any kind of order increases the liability of the process.

7.2. Waste of employees' time

The employees represent one of the main resources on which a company can lean on to perform as efficiently as possible. Moreover, they are also one of the major components of fixed costs that a

company has to pay every year. This is why the allocation of the employees' time becomes critical for the performances of a company. The **complexity of processes** that slow down the operations and the necessity **to correct errors** are two clear examples of wrong utilization of the scarce resource represented by the time of employees inside an organization. Unfortunately, both these kinds of inefficiencies are present in Rivoira, and they will be analysed separately, in order to spot the causes that generate them.

7.2.1. Difficulties in changing P&L account metrics

Changing the metrics of the P&L account can be useful for the planning activities of the company, giving a clear understanding of which company is performing well, achieving the forecasted values and respecting the budget. But at the same time, it is fundamental to know how the different line of business are performing. Moreover, this kind of swap can be asked from the European control centre in Madrid, and for this reason the managers should be able to perform it rapidly.

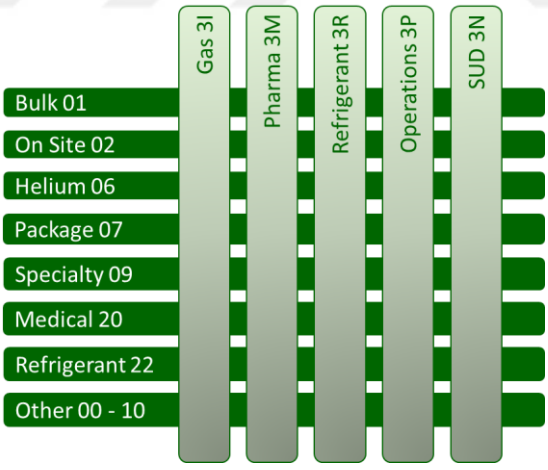


Figure 16: Swap of P&L account metric

In reality, the company is not able to perform this change easily, in particular when it comes to allocate the fixed costs from Companies to LoBs. The profits and the related variable costs are easier to reallocate, while the fixed costs need a sort of "driver" to be split among the various LoBs. Right now, the company is using the percentage of profits of the LoB compared to the total profits as weight

for the fixed costs allocation. This method allows to have only a gross estimation of the real values and sometimes it leads to a loss of information and accuracy. In fact, it can happen that the totals obtained summarizing the values of the Companies can be different from the total coming from the sum of the LoBs.

This issue can be linked to a frequent use of generic codes for the allocation of operating costs. As reported in the chapter "*6.1. Business Unit*", the result of the analysis of the different components of the BU codes showed that the most frequently used activity code is the generic one, 000, that accounts alone for the 24% of the codes used in the last two years. The repeated practise of allocating expenses to a generic code has the side effect to lead to a loss of information. Therefore, the reallocation of these costs to the different LoBs is not immediate, because it is not clear to what they refer to.

The overall problem is generated by different factors that acts simultaneously, but due to the short time period of the project and also the reduced knowledge of the entire company's environment, it was possible to identify only the root-cause above mentioned.

Anyway, the frequent use of generic code covers a critical role in the creation of complexity, and for this reason its score is equal to 4.

7.2.2. Correction of errors

It is fundamental to divide the different types of errors in two classes in order to better address the causes that generate them.

As before mentioned, the two main types of errors are:

- **"Visible" errors**
- **"Hidden" errors**

In the following paragraphs, the two classes of errors and their causes are briefly descripted and analysed.

- **“Visible” errors**

The visible errors are those errors that can be identified thanks to a simple visual check. The check is done confronting the codes generated/used with the list of nominal codes present in the system. These types of codes, both for BU and Item Codes should not exist, but it can happen that an operator force the system in order to finish the OR, instead of repeating the operation from scratch.

The introduction of a codes that is not present in the system creates a bottleneck in the final part of the process, when there is the allocation of profits or costs to a specific request. The system will not be able to identify the BU or Item Code specified in the invoice and the operators of the accounting departments will have to determine which is the real code to attach.

At the same time, it is fundamental that the combination of the BU and Item Code select is correct, and that it makes sense. To be clearer, if the Item Code specify the purchase of an IT service (69xxxxxx), and the BU register a working budget for the IT department, the combination is correct. This type of error is more difficult to find, compared to the previous one, because it requires familiarity with the main classes of codes, but it is still feasible with a visual check.

The main cause attributable to this class of errors is the lack of pre-defined steps to fulfil the OR and also detailed guidelines to follow in case of error.

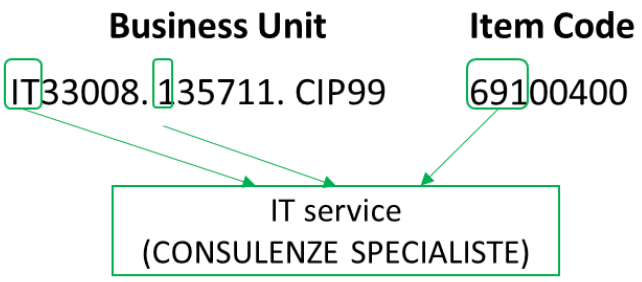


Figure 17: Example of correct BU-Item Code combination

- **“Hidden” errors**

In this case, the errors can be noticed only if the operator has a deep knowledge of the different elements that compose the BU and the Item Codes. The code reported in the invoice is present on the nominal list, so it is a code that can be actually generated, but the information that it provides are totally correct. The errors can be more or less severe: for instance, if the activity code specifies “tanks maintenance” while the location code specifies “Milano”, this represent a big mistake since in Milano there should be only the general administration activities, and not the operational and productive ones. In this case, it is possible to notice that the causes reported for the BU and Item Codes inefficient use, are the same that can lead to the errors generation. For instance:

- Location closed but their codes are still open and available in the system;
- Lack of guideline or pre-defined paths for the operators;
- Every JDE user can order any kind of item/service;
- JDE users are not the ones that will directly use the item/service demanded in the OR.

Usually the demand starts from the technicians that requires a specific material of service. The problem is that they have no access to JDE, since they are not provided with an open user account. The reason is that this service is not for free, and the company pays a fee for every license (open account). Therefore, it is not convenient for the company to have thousands of accounts open on JDE.

In the following table are reported the different root-causes with the related scores.

Root-causes (visible errors)	Impact
Operators can force the system to complete the OR	2
Lack of guidelines or pre-defined path	4

The low score assigned to the first root-cause is related the fact that this issue is not too frequent.

Root-causes (hidden errors)	Impact
Location closed but their codes are still open and available in the system	3
Lack of guideline or pre-defined paths for the operators	4
Every JDE user can order any kind of item/service	4
JDE users are not the ones that will directly use the item/service demanded in the OR	3

8. Countermeasures

8.1. Possible Countermeasures

Now that the different causes have been identified, it is necessary to found specific corrective actions in order to eliminate them.

As it is possible to see from the previous chapter, the most frequent root-causes are for sure the **lack of pre-defined paths** to follow when fulfilling an OR and the **absence of general guidelines**. Moreover, the **possibility for the operators with a JDE account to generate any kind of order** increase the process liability. These issues generate errors in both BUs and Item codes.

In this case, the corrective action should help the operators into the OR filling process, guiding him/her step by step, in order to reduce the liability of the process and to speed up the procedure.

There are three main countermeasures that could be introduced:

- Training courses for the operators that have a JDE user account
- Setting main guidelines to follow
- Introduction of an auxiliary software that reduce the options of codes that can be used according to the physical item or service specified in the OR.

The final aim of the training courses is not only to increase the knowledge of the operators about the functionalities of the software, but also to update them on the new codes to use.

Focusing the attention of the BU codes, it is necessary to identify all the codes of the Location that have been closed and also understand which activities of these Locations have been reassigned to other sites. This information should then be send to all the JDE user accounts, indicating which are the new codes to use for the corresponding activities.

Since Rivoira has several sites spread all over Italy, it will be necessary to carry out theses training sessions remotely, thanks to the use of skype sessions, for face-to-face lessons, or video tutorials

updated on a specific web-site. At the end of every session, the operator will perform a small test, with multiple choice questions, in order to assess its improvements.

Moreover, the training session can be used as a tool to spread the main guidelines decided from the head centre. These guidelines that are going to be spread in all sites, should define not only the main steps to follow when inserting the different codes in the OR, but it should also to provide the corrective action to perform in case an error should come along. Moreover, it will be necessary to deliver a customized set of guidelines for each site, describing more detailed procedures and codes to utilize accordingly with the operations carried out in that location.

Training and guidelines can be implemented easily with very low investments from the company, while the last solution, auxiliary software, requires more time to be implemented and a medium-high investment. However, once implemented, the OR process will become faster and the errors less likely to happen. Once introduced the Item Code in the OR, the auxiliary software will block all the codes of the BU's elements that are not compatible with the Item Code itself. For instance, in case of purchase of tanks for CO_2, a code for IT assistance service will be not available. Then, the process will be repeated for each BU's element, starting in order from the Line of Business, then the Activity and finally Company and Location. In this way, at every step, the list of codes available for the operators will become shorter and shorter, leaving only the combinations pre-approved.

This new system will guide the operator in the OR filling process in a different way according from where the request is being made. To be clearer, if the operator is issuing a OR from a production site, he/she will not be able to insert the code for a general administration expense, or vice versa, it will not be possible to issue a tank maintenance service from the Administrative centre in Milan.

In this way, the operators with a JDE user account open will not be able anymore to make all types of orders, and more important, they will not choose arbitrarily the codes to use, but they will be helped by the system which will lead them though a pre-defined path of mutually-exclusions.

Furthermore, the auxiliary software will block all the Item Codes present in the nominal list that refers to products/services of other countries.

This kind of solutions are easily available on the market, for instance it could be possible to purchase one of the solutions already proposed from SAP and then to configure the system internally with the help of the IT department, creating the mutually-exclusion alternatives.

There are also some quick wins can be easily applied to the current situation with no investments. For instance, taking all the codes from both BUs and Item Codes that have not been used in the past two years and "close" them, that means making them not available for future OR operations.

Then, to overcome the **difficulties in changing the P&L account metrics**, there are two possible countermeasure that can be applied, with different impacts and implementation costs:

- Less frequent use of the generic code 000 for operating costs
- Purchase of the new accounting tool from the external software company

With a more moderate use of the generic code 000, it will be possible to better allocate the costs to the different Line of Businesses and to the activities to which they refer. This process will generate more accurate information, that will help the accounting department in reallocating the fixed costs when changing the P&L account framework. In order to be implemented, it is necessary review all the expenses registered in the last two years under the code 000. The procedure can result time consuming but it does not require any type of monetary investments, and the impact will be medium-high. Then, in order to avoid that this problem could reappear, it will be necessary again to spread detailed guidelines to all the operators with a table of the codes to utilize instead of the 000. Also in this case, the information can be spread during the training sessions introduced above.

On the other hand, the new accounting tool that Rivoira is going to purchase in the following months will partially solve the overall problem, since all the different accounting information will be collected

in only one tool. Even if this seems to be the most efficient solution, it is the most expensive one, and also the longest to be implemented.

8.2. Prioritization of the Countermeasures

The resources, in terms of money and time, that a company can use for improvement projects are always constrained. For this reason, it is fundamental to prioritize the possible corrective actions accordingly to the impact that they will have on the final target and the effort needed to implement them.

Crossing these two dimensions, it is possible to create an investment-benefit matrix that allows to carefully prioritize the countermeasures proposed.

In this case, since it was not possible to actually implement the solutions, it was necessary to make a qualitative estimation of the impact that the solutions will have on the targets. It was decided to divide the impact in three level, low, medium and high, in order to better allocate the various countermeasures in the investment-benefit matrix.

While, for the effort dimension, it was decided to measure it in terms of money instead of time needed, since it can be easier to quantify. The monetary effort is intended as the additional investment needed, as the delta with respect to the actual expense.

It was decided to prioritize the countermeasure favouring those ones requiring lower monetary effort, because they require less approval steps and can be implement sooner. It was also possible to check the information regarding similar solutions applied from other companies, in order to make more accurate estimations. For this reason, the dimension of monetary effort can be divided in four main levels:

- Nil: 0<€<50
- Low effort: 50<€<1.000
- Medium effort: 1.000<€<5.000

- High effort: €<5.000

The 5.000€ is taken as maximum value because for higher investments the company has to ask the permission from the European centre in Madrid.

In the scheme below is reported the investment-benefit matrix obtained, where the various countermeasures are allocated.

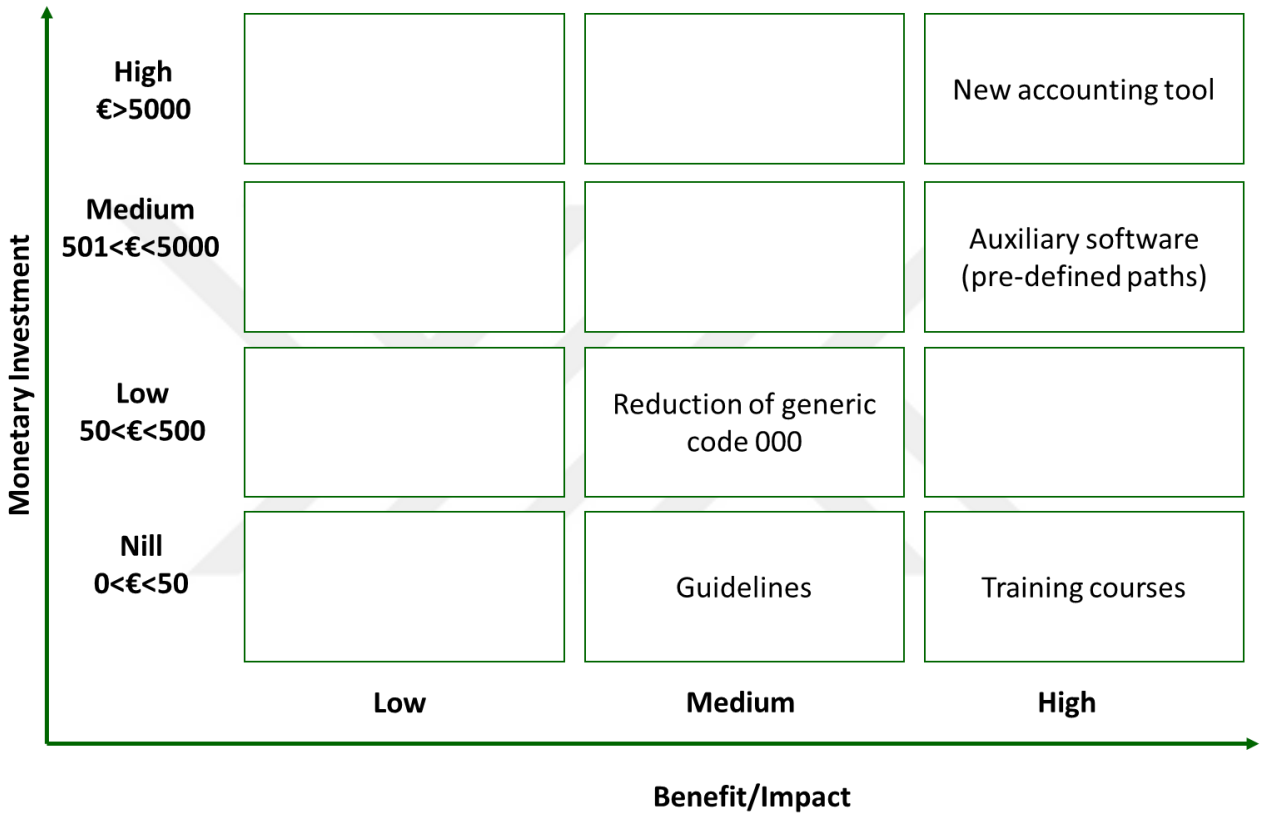


Figure 18: Investment-Benefit Matrix

All the countermeasures suggest seems to have a positive investment-benefit trade-off, in particular for the training courses, that will have the highest impact on the errors' target, and moreover, they will be used also as a tool to spread the new guidelines.

To set up the pre-defined paths for the operators, the auxiliary software is the perfect solution, that with a medium effort will allow to achieve high impact on the errors related target.

The purchase of the new tool will for sure reduce the time of the employees wasted at the end of each months to change the P&L metric, but this service will not be cheap and for sure not available in the short time. For this reason, it should be implemented as the last corrective action, in order to consolidate the improvements of all the other countermeasures.

To make a final prioritization, it is possible to divide the cells of the investment-benefit matrix in three groups. All the solutions that are below the diagonal of the matrix are those that have higher priority (green cells) and should be implemented first. Then, the ones on the diagonal (yellow cells) with lower priority, and finally the solutions which require an investment higher compared to the benefits that can bring (red cells).

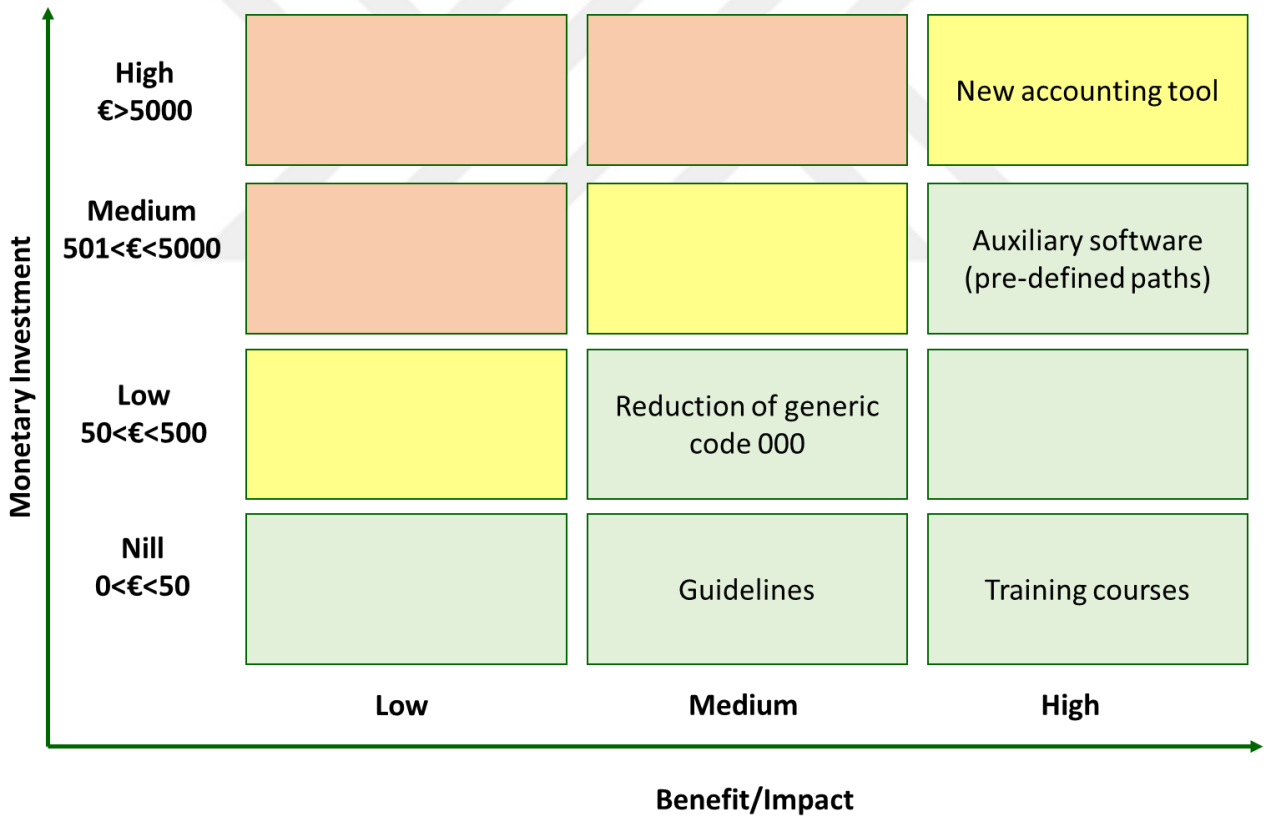


Figure 19: Countermeasures Prioritization

9. Conclusions

In the 21st century, which is called the information age and where there is a very high competition, the most important way to survive for companies is always to continue to operate in the most efficient way. For this reason, it is essential for companies to reach the a high level of accuracy with the least margin of error, in the shortest time possible, making decisions accordingly.

The aim of the project was to map the current processes, to spot the inefficiencies and to suggest corrective actions in order to improve the operations inside the accounting department of the project partner.

The project was developed following the A3 methodology, a structured approach used for problem solving. The peculiarity of this project is that it helps to breakdown the main problem in sub-problems, where is possible to perform more accurate analysis, and found the root-cause of the problem, instead of the symptoms. Finally, specific countermeasures aimed at solving the related root-causes were developed.

The main issue of this kind of project, where the time spend inside the company is not long, is that is not possible to actually implement the solutions suggested and to measure the related benefit that they can bring. In this case, it was only possible to make various proposal plans with an approximation of the impact on the specific target and the monetary effort required to implement. Moreover, it was deliver also a tool, the investment-benefit matrix, to prioritize the different solutions and to make an order of implementation.

The project partner is satisfied of this collaboration with the Politecnico of Milan, and it is also optimist that the targets will be achieved, following the directions set, step by step. The possible improvements are still many, and maybe the output of this work can be used as starting point for future projects.

10. Managing relationships

- **Cognitive and Learning Style (Kolb model)**

In order to understand the company tutor Lorenzo Davoli's profile, the Cognitive & Learning Style model was used. The result showed the profile of an analytical person with reference to this model.

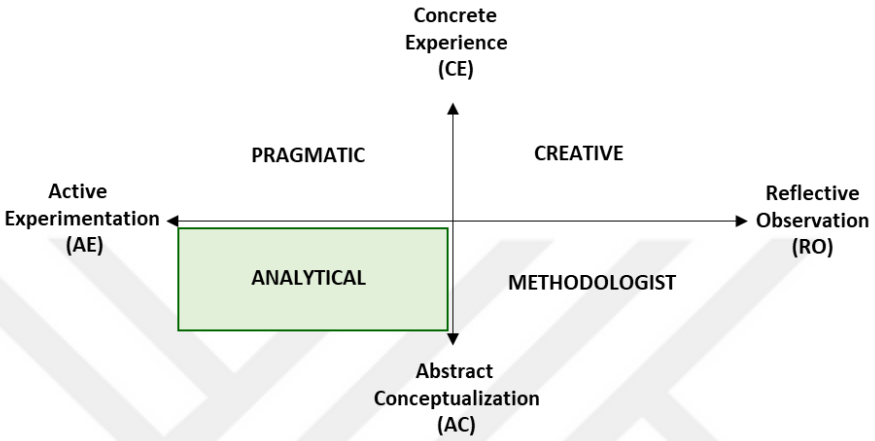


Figure 20: Kolb Model

According to this model an analytical person is described as a person who is able to find solution to problems. Moreover, an analytical person is capable of solving practical issues by using experiences. These kinds of people are open to new ideas, and they like to simulate and work with practical applications. During the working period with Lorenzo Davoli, it was possible to clearly see that he takes care of the practical implementations and he was always welcome to new ideas. Furthermore, he showed new ways that allowed to convert the theoretical knowledge into practical.

All these skills exist in his personality. For all these reasons he can be identified as an analytical person.

- **Style of Conflicts**

Conflict is a part of a working system. In other words, there are conflicts in the nature of working life. Therefore, it is crucial for a manager to overcome these conflicts. Thanks to Assertiveness Model,

it is possible to classify a manager's preferred style of conflict management. Assertiveness Model consists of 30 questions and each question has two options. The most suitable way can be designated to deal with disagreements among a manager and others by answering these questions. According to answers, behaviours can be described in five different categories which are:

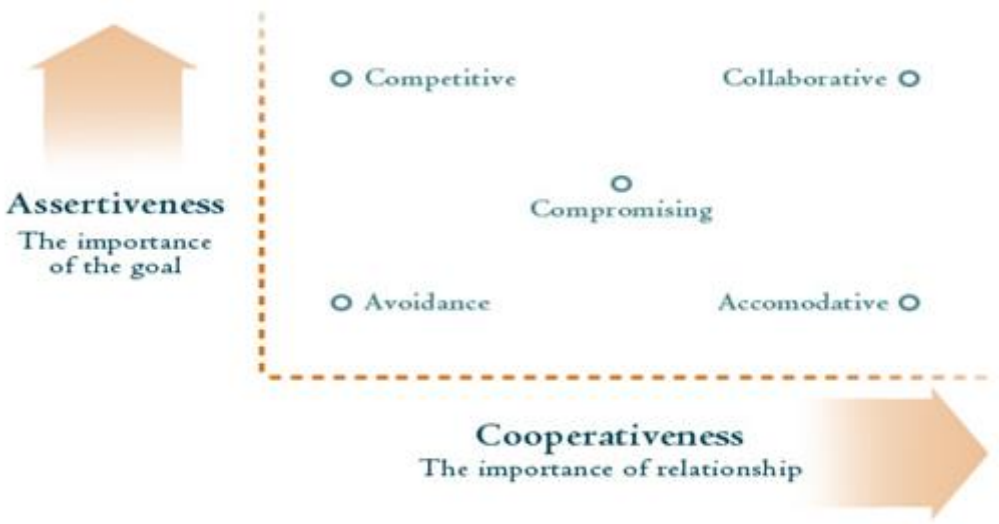


Figure 21: Assertive Model

According to the categories written in the graph, it is possible to classify personal behaviour of a person in a conflict situation.

The outcomes of Assertiveness Model Test for Lorenzo Davoli are visible in the chart below. Results are shown as a graph in order to make it more understandable. These numbers that are written in the graph point out quantity of answers about every type of conflict resolution.

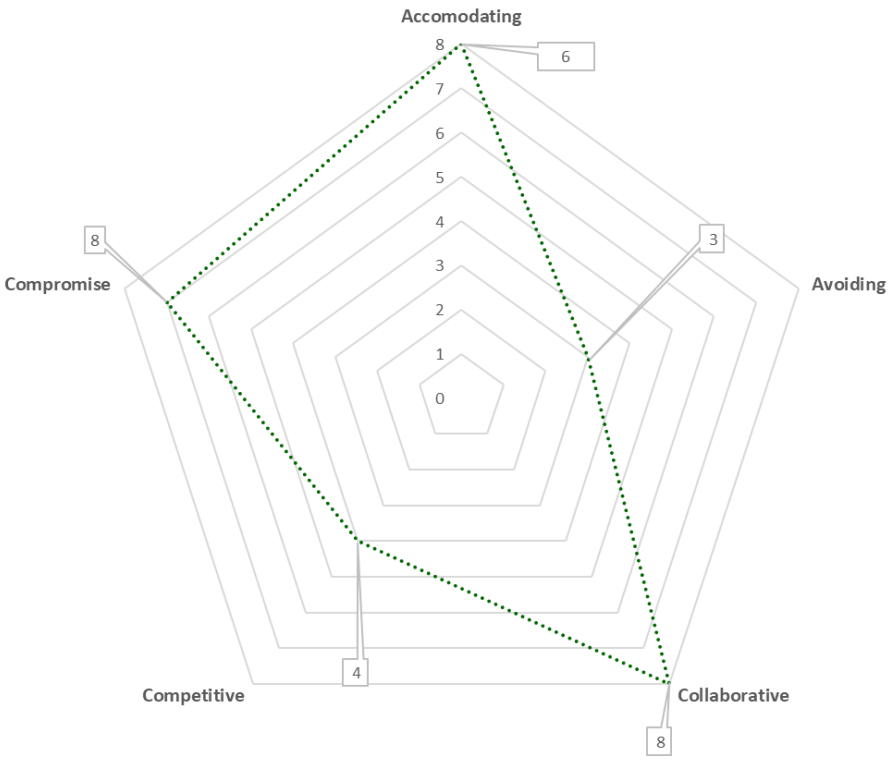


Figure 22: Types of confict resolution

It is possible to observe from the table above that Lorenzo Davoli identified himself as an accommodating and collaborative person according to Assertiveness Model.

As it is mentioned before Rivoira Group was acquired by Nippon Gases during the project period. During this acquisition, some problems were revealed. It became harder to get data and information to continue the project. Moreover, due to the acquisition, Nippon Gases had different perspective and expectations for this project. Lorenzo Davoli followed an accommodating stance and collaborated with the project every time in order to overcome these conflicts and provide the adequate information and data.

In the matrix reported below it is highlighted the position of Davoli's profile inside the Assertive Model Test.

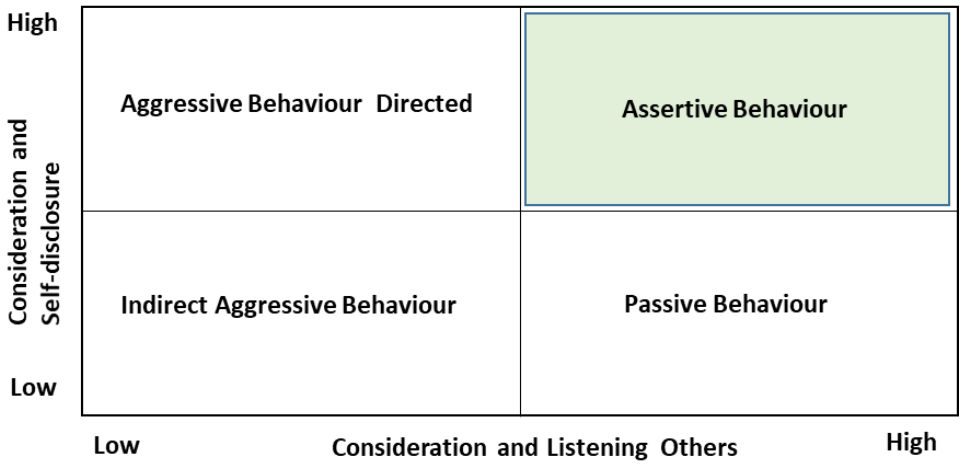


Figure 23: Assertive Model Matrix

Lorenzo Davoli can be identified as a person with an Assertive Behaviour. During the working period, he always clearly expressed his requests for this project. Moreover, he did not hesitate to share is thoughts and ideas.

He was always calm and transparent, and he never showed any aggressive reactions during the project period.

- **Meetings**

Meetings are one of the most important parts of a project work. Therefore, a lot of meetings were held during the project in order to proceed much stronger. First meeting occurred in Milano, in the centre of Rivoira Group, where the financial department is placed. The issues, goals and schedule regarding the project were explained during this kick-off meeting. For these reasons, this meeting can be identified as Briefing Sessions and then it turned into Brainstorming.

In the second meeting with Lorenzo Davoli, together with Paolo Ronzi and Laura Cervi, several financial documents were analysed, and they represented the starting point for the overall project. The managers also explained their coding system, in particular how to enrol costs and register an

order request. They took into consideration the ideas proposed and they explained their point of view. Therefore, they can be defined as “Enablers”.

During the last meeting, some solutions to the problems regarding the coding system were proposed and for this reason, this meeting can be classified as “Problem Solving.”

It is also important to mention the additional meeting done in the first part of the project together with Lorenzo Ottolina and Marco Seregni. Lorenzo Ottolina worked in finance department approximately 10 years before passing to manufacturing department in Rivoira Group. Talk with him was a crucial part, since he is one of the few persons that has a clear and global view of the overall process of the key account generation.

In addition, it was possible to receive some feedbacks from him about doubts and opinions, and to set the following steps to conclude the project. Consequently, Lorenzo Ottolina can also be identified as “Enabler Participant” and the meeting can be described as “Brainstorming.”

In the last period there was a fourth meeting with accounting department and an external software company which are going to develop a new software program for Rivoira Group. This software program is going t to be able to cluster different functions, transforming the accounting information into managerial tools. During the meeting the process was analysed and some criticalities were discussed regarding the accounting functions in the company. Therefore, the meeting can be classified as “Problem Solving” and Software company engineers are “Enabler Participant” because they were offering their views about this process.

- **Linear Culture to Structured Culture**

Rivoira was part of Praxair Group which is an American Company, but in the beginning of January, Rivoira was acquired by Nippon Gases which is a Japanese Company as it is mentioned before. Therefore, two different cultures exist. America is an example of Linear Culture where targets are identified clearly, and meetings are organized in order to reach these targets directly. Moreover,

meetings take short time and purposes of the meetings are to decrease time wasting as much as possible and reach the targets quickly which means there is a pragmatic system. On the other hand, there is a task-oriented system which means that people relationships and emotions are not important; capture the target in one way.

Rivoira Group operates in Italy which is an example of Structured Culture. In this culture, targets are not settled clearly, and meetings take much more time than required. In addition, there is no obvious schema to reach the target and too much information regardless the target. Another aspect is that people who would work together are not well informed about the target and they spend significant amount of time to understand each other. On the other hand, there is a people-oriented system means human is the most significant resource and human values are above everything.

- **Non-Verbal Communication**

People do not always express their ideas, feelings and emotions directly. In other words, people sometimes interact with someone by using non-verbal communication. This is also true for Lorenzo Davoli. He communicates with in non-verbal ways occasionally. He sometimes rubs his hands during the explanation of the work done until that moment, and this means he did not always agree with the ideas proposed, and he wanted to opt for a better solution.

Most likely these non-verbal signals come from his analytical style which always looks for a better way and understanding the foundation of a problem in order to find the best solution.

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