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**ANALYSIS AND OPTIMIZATION OF
HUMAN RESOURCES PROCESSES
UNDER A LEAN APPROACH**

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INTRODUCTION

This thesis aims to analyse and optimize the Human Resources (HR) process in a consultancy company. The urge for this optimization comes from the importance of this process for the business of companies in general, but especially for consultancy ones. Indeed, in such a firm, where no products are manufactured and the business is based on the competences of its Human Resources, all the processes related to them became of a vital importance. This work presents also an application of the lean approach to the processes specific of the Human Resource Management (HRM), that has not yet been deeply explored in the scientific literature.

The first chapter is dedicated to a brief discussion of the theory standing behind the HRM and Strategic Human Resource Management (SHRM), followed by the presentation of the traditional process carried out by the HR functions. This work has had an extensive focus on the recruiting and selection processes, due to their major monitorability. In fact, the outcomes of each phases of the previously mentioned processes are measurable and allow to have a control over the processes. To accomplish this need of measurements, further in Chapter 3 a set of KPIs is defined.

The second chapter develops a description of TurinTech Srl., the company where the thesis has been deployed, and its goal is to provide the reader with a framework enabling the understanding of the general context where the work has been carried out.

The third chapter represents the core of the thesis. The processes of Recruitment and Selection of TurinTech have been analysed thanks to Business Model Process and Notation (BPMN) and have been represented thanks to *Signavio*. The processes have been detailed and decomposed into subprocess, until the task depicted were maintaining relevance for the analysis. The representations have enabled a deep comprehension of the workflow and the parties involved in the process leading to the construction of a Value Stream Map (VSM). The VSM is a tool typically employed in a lean framework, aimed at the identification of the Value-Added Activities (VA) and Non-Value-Added Activities (NVA), in order to eliminate the NVA or at least to reduce them. Once the value's flow has been depicted, the criticalities encountered has been analysed with the support of another lean technique: the 5 Whys. This technique has favoured the individuation of the root cause related with each criticality, allowing its resolution or at least its highlighting.

Since the beginning it has been clear that the processes needed to be controlled more carefully, for this reason some Key Performance Indicators (KPI) have been identified. Their purpose has been dual: to assess the state of the art of the processes and then to keep under control the trend of the same processes and infer predictive analysis.

The last paragraph of the third chapter has been dedicated to the application of another lean tool, the 5S, that provides the five pillars of the lean management: Sort, Set in Order, Shine, Standardize and Sustain. This analysis has stressed some problems related to the information flows and to the incomplete reliability of the recruitment and selection processes, due to the halo effect and the influences of subjective opinion on decisions.

The lean analysis conducted in the third Chapter has highlighted, thanks to the VSM, that it exists an urge for a tool able to reduce the NVAs. To accomplish this need, in the fourth chapter has been conducted an analysis of some frameworks employed in Personnel Selection that relies on Multi Criteria Decision Methods

(MCDM). These frameworks allow to reduce the subjectivities in the decisional processes. Then, a specific model has been tailored on the needs of TurinTech, aimed at reducing the NVAs.

Finally, chapter 5 describes the benefits and limitations related with this work and suggests the future steps for TurinTech.

CHAPTER 1

HUMAN RESOURCE MANAGEMENT

This chapter aims to review the theory and the scientific literature standing behind the Human Resource Management.

1.1 Human Resource Management definition

Human Resource Management (HRM) is a bundle of activities related to the management of people and their work in an organization: from recruiting and selection to compensation, from training to assessment, from retention to management of industrial relations. Defined as *“a strategic and coherent approach to the management of an organization’s most valued assets – the people working there who individually and collectively contribute to the achievement of its objectives”* by Armstrong (Armstrong , 2006).

The importance of HRM has grown progressively in the years, becoming one of the most important functions of management, in small companies but also in great organizations. Its history could be traced back to the birth of the modern industry in the late 1800s, with the personnel management, but the term HRM emerged only in 1965 (Miles, 1965).

Armstrong (Armstrong , 2008) points out the key characteristics of HRM:

-
- *Diversity*: difficulties in identifying universal characteristics of HRM. Many models exist, and practice are diverse in every organization
 - *Strategic nature*: HR planning should be integrated with the strategic planning. The strategic nature represents one of the common themes in the typical definition of HRM (Legge, 1989)
 - *Commitment-oriented nature*: all employees should perceive themselves to be engaged with the organisation, achieving a higher performance level. Walton states that: “The new HRM model is composed of policies that promote mutuality – mutual goals, mutual influence, mutual respect, mutual rewards, mutual responsibility. The theory is that policies of mutuality will elicit commitment which in turn will yield both better economic performance and greater human development.” (Walton, 1985)
 - *People as “human capital”*: employees, their abilities and experiences should be regarded as valuable asset and source of competitive advantage, rather than a cost
 - *Unitarist philosophy*: employees share the same interests as employers. Organizations are considered harmonious and integrated, where employees share the same organizational goals and work as a team (Gennard & Judge, 1997)
 - *HRM as a management-driven activity*: it could be considered as a central activity, owned, developed and delivered by management, pursuing the interest of the organization
 - *Focus on business goals and values*: HRM drives business values and is modified every time the business objectives and conditions change

1.2 Strategic Human Resource Management

The strategic role of the HRM has been considered since the same function was acquiring space in the manager's agenda. The development of the studies among this direction has been influenced mainly by two frameworks: the Matching Model, also known as Michigan Model, and the Harvard Model.

1.2.1 Matching Model

Developed by the Michigan School, the model states that the organizational structure should be congruent with the organizational strategy (Fombrun, Tichy, & Devanna, 1984). In this model is observed that the different business strategies influence the styles adopted in the human resource cycle. This cycle is deployed by *selection* of people that are best performing in the jobs defined by the structure, *appraisal* of their performance in order to allow the distribution of rewards and the *development* of the employees. The promoters of this model evaluate the human resources, and therefore the way they are managed, as source of competitive advantage, in order to maximize the economical results, of primary interest of the organization's shareholders.

1.2.2 Harvard Model

In this framework is stated that nowadays is demanded a broader, more comprehensive and more strategic perspective for what concern the organization of human resources (Beer, Spector, Lawrence, Mills, & Walton, 1984). There are five significant components, i.e. situational factors, stakeholder interests, HRM policies, HRM outcomes, long-term consequences, that should be considered by the organizations.

The model analyses the organization as an open system that interacts with external factors and a plurality of stakeholders.

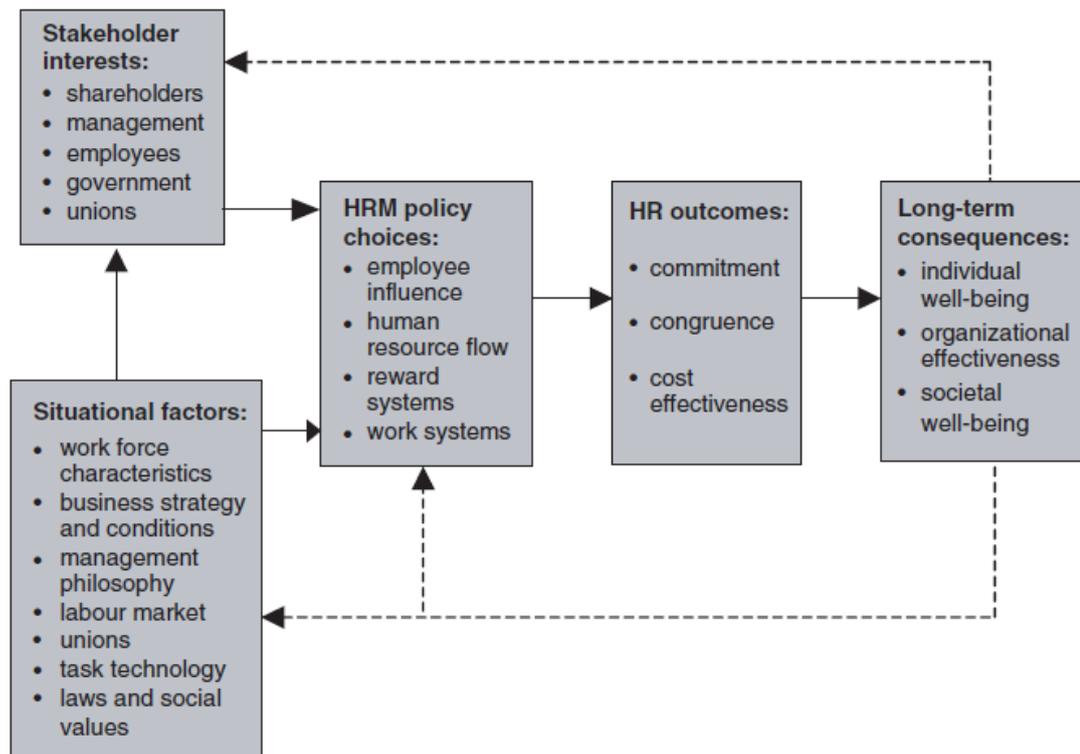


Figure 1-1 Harvard Model

1.3 The Theory behind the Strategic Human Resource Management

In the following paragraphs will be presented some of the theories that have influenced the SHRM, constituting the theoretical basis for its development. These theories are: Human Capital Theory, Resource Based View, Resource Dependence Approach, Transaction Cost Theory and Socio-Technical Systems.

The *Human Capital Theory*, a framework developed in 1964 by Becker, considers as human capital the productive capacity of people (Becker, 1964). Their skills, experiences and knowledges have an economic value for the organization because they ensure it to be productive and unique. The human capital to be deployed, need the cooperation between people, and that determines costs (to motivate, control and retain people) that could be viewed as anticipated

investments. This theory is aligned with the SHRM since it sustains the investment on the human resources as an enabler of organizational results.

The *Resource Based View's* approach, formulated by Barney, is focused on the analysis of the internal resources and the relationship standing between them and the profitability and competitiveness of a company (Barney, 1991). This model is highlighting that an organization reach the highest level of competitiveness having resources that are distinctive, i.e. valuable, rare and difficult to be imitated.

Basing on this model, the employees are considered as resources, being scarce, unique and difficult to be imitate. The value of this resource could guarantee a competitive advantage when the competitors could not possess the same resources. For example, the culture and the history are considered to have an important role in the insurance of uniqueness, because they influence a behaviour difficult to be repeated.

The *Resource Dependence Approach*, developed by Pfeffer and Salancik, asserts that some behaviours of a company could be determined by external resources (Pfeffer & Salancik, 1978). This is based on the thought that all organizations depend on external resources that are detained by another organization. This explains why it is important to have some resources: the power of company A over company B is proportional to the extent in which company A has vital resources for company B. This approach is at the basis of some recruiting dynamics, where company A tries to hire company B's employees to have a lower dependence on it.

The *Transaction Cost Theory*, introduced by Commons, J.R. in 1931 and subsequently studied by Coase, R. and Williamson O.E., is aimed at defining how a company is structured, and it is concerned with the duality between hierarchy and market. The costs are divided into two categories: the production costs, related to the realization of an activity and the transaction costs, pertaining to the organization of an activity. The latter are split into ex-ante and ex-post, with reference to the happening of an action. In the specific context of SHRM, it is

enhanced how to prevent opportunistic behaviour understanding the transaction costs in the relationship between company and employees.

The *Socio-Technical System* proposes to pass the model proposed by Ford and its concept of “one best way”. The authors that adopted this theory focused on the following assumptions:

- The technical and social system should be managed together
- More than a single organizational choice could be met for the same technological solution adopted
- The employees should be engaged in the design of the adopted solution
- The implementation of the solution should be tested

1.4 Basic function of HR

The basic functions of HRM are: *Strategic HR and HR Planning, Job Analysis, Recruitment, Selection and On-Boarding, Training, Career Development and Planning, Evaluation and Management of Performances, Remunerations Policies and Reward Management, Internal Communication, Industrial Relations and Health and Safety at Work.*

Initially, top management is engaged in the *Strategic HR and HR Planning* with the aim of determining the targets of the company and the modalities in which reach them. With an environmental assessment the strengths and weaknesses of the company are evaluated, as well as the opportunities and threats arising from the external. Then the objectives are set, determining what the company expects from each activity. Then, considering the general strategy of the company, the HR strategy is pointed out, aiming at promoting the points of force and minimizing the debilities. The strategy implementation is concerned with the actuation of the strategy, during this phase, the organization could undergo to modification in order to be addressed to the expected results.

The *Job Analysis* is a structured process aimed at the acquisition of information regarding the company's roles and the relationship standing among them.

The outputs are the job description and the job specification. In the job description are stated the goals, the responsibilities, the duties, the time needed for them, the required standard of performances, the work's condition, the organisational positioning and the informal relationship maintained, the tools employed. The job specification, instead, is a document declaring the requirements that a person should have to assume that role. These requirements concern knowledges, abilities, experiences and educational level.

The job analysis activity could be considered as preliminary to the activities related to the management of human resources. The awareness of the organizational roles allows the identification of the prerequisites needed for the potential new employees, to define performance appraisal process that are really tied to the work done by the employees and to design specific training courses. Moreover, it enables the evaluation of the value of each specific role and the connected rewards

The *Recruitment, Selection and On-Boarding* is the process that ensures to the organization to have the appropriate number of employees with the adequate competencies enabling the achievement of the targets.

The Recruitment is the medium through which the organization express its request of work. It is an activity focused on the long-term plans with the aim of acquiring the best resources. Personnel recruitment and selection directly affect the quality of employees (Chien & Chen, 2008). The recruitment could take place internally through interpersonal contact or communication or job posting; or externally aiming at recruiting new professional from the labour market.

The selection represents the activity to identify the workers that better meets the needed requirements, with the aim of maximising his works results and his stay in the organization. This process, therefore, should ensure that the selected people are satisfying the organizational requests, both in terms of knowledges and abilities,

and that there is congruence between the personality of the employer to be and the culture of the company.

Finally, the on boarding is a process aimed at giving information and assistance to the newly hired in the first period of activity, it should promote the sharing of the company's values and the acquisition of a specific professionalism.

The *Training, Career Development and Planning* is a process that should sustain the target of development of the organization. First of all, the training is carried out in order to enhance the knowledge of people working in the company. The process starts with a study of the required training in order to organize activities that correspond to the organizational needs. Then follows the design and implementation of the defined activities. At the end, critical reflection should be done, as a basis for the future intervention.

The development is related with the activities that sustain and promote the professional growth of the resources, they are not based only on training but also on working on special projects or in overseas offices.

Finally, through the career planning, the organization awards the individual behaviour that are more aligned with the expectations, but especially it designs the professional growth of the employees to ensure the future development of the company.

The *Evaluation and Management of Performances* has the aim of address the behaviour of the individual resource toward the goals of the company. The evaluation is the leverage that mostly influences people. This process enables the measurements and evaluations of the targets' achievements with particular reference to a specific job and a particular timeframe. The evaluation is a necessity of the company, that should monitor the productivity of its resources, but also a right of the same employee that becomes aware of what the company is asking him and how it evaluates his contribution.

The activity focused on the *Remunerations Policies and Reward Management* should ensure the internal equity and the external competitiveness, encourage the

reaching of predefined target, retain and motivate the human resources and optimize the company's cost to employee's benefit ratio.

The remunerations policies could be divided in two main categories: the company's policies and the individual policies. The first regards the decision of the organization that impacts on all the workforce, the second concerns just the specific competencies and performances of individuals.

The total remuneration is divided into direct and indirect. The former comprehends the fixed remuneration, the variable and the deferred ones, while the latter regards the shareholding, the direct and indirect benefits.

The process of *Internal Communication*, is defined as a coordinated ensemble of information flows, aimed at maximizing the employees' engagement. The information exchange could be of a vertical or horizontal nature. The vertical is divided into top-down, when the flow starts from the management and bottom-up, where the flow finishes to the management. This second kind of flow is particularly employed in companies based on the quality that find their competitive advantages in the competence of their human resources.

The horizontal flows on the other hand, includes the exchange between employees working at the same organizational level. These flows are fundamental where the coordination of the different company's function is essential.

An internal communicational plan should answer to two needs. First to facilitate the transmission of information regarding the production of goods or services and the obtained results, second it regards the necessity of the communication of the culture and identity of the of the company.

The activities tied to the management of the *Industrial Relations* are about the relationship among the institutional entities of an industrial context, i.e. the workers and their trade unions, the entrepreneurs and their trade unions and the institutions. The aim is to solve the conflict among interest of the opposing interest between trade unions and entrepreneurs.

In the end, the process aimed at ensuring Health and Safety at Work includes all the individual protection system and the processes that should prevent the physical or mental illness caused, even indirectly, by the working environment.

1.5 Recruiting

Recruiting is the process of generating a pool of qualified applicants for organizational jobs (Mathis & Jackson, 2008). HR planning enables the alignment of HR strategies with the goals and plans of the organization, and it is concerned not only on determining how many applicants are needed, but also on the recruiting methods that will be employed.

The organization should ensure themselves to obtain and retain the needed people and employ them in an efficient way. The aim of resourcing is “to obtain the right basic material in the form of a workforce endowed with the appropriate qualities, skills, knowledge and potential for future training. The selection and recruitment of workers best suited to meeting the needs of the organization ought to form a core activity upon which most other HRM policies geared towards development and motivation could be built” (Keep, 1989).

The company, therefore, should achieve the competitive advantage hiring more capable people than its rivals. This could be done ensuring better opportunities and rewards, developing a positive psychological contract that increases commitment and mutual trust.

One of the first steps concerns the decision of where to recruit, this step is critical to the success of the overall recruitment strategy (Noe, Hollenbeck, Gerhard, & Wright, 2003). The sources of recruiting are various and range from Campus Recruiting to Website, going through Referrals and Professional Organizations and Associations. All these sources have their specific advantages, disadvantages and are focused on a specific target of employees (Human Resource Management). A brief description of these sources will follow.

Campus Recruiting is focused on hiring new talent that have specialized training in specific field. It is required to establish relationship with the universities and their career services, and it needs time to attend campus events.

Professional associations are organization that are aimed at promoting a particular profession, such as nurses, women engineers, accountants and so on.

Websites allows to make a contact between potential candidates and companies. Indeed, lot of websites have the option to place an ad, without any payment. The downside is the fact that it produces a vast number of applications that may not be aligned with the job position and therefore needs to be screened by the recruiter.

The Referrals represents a powerful source due to the fact that current employees would recommend just people they think would be capable of doing a certain job. Referrals are encouraged via emailing job opening to the actual workers, and it is a quick way of recruiting. The disadvantage of this source is that it leads to a lack of diversity in the workplace and that it favours the nepotism.

1.6 The Selection Process

The selection process could be viewed as the steps involved in choosing people presenting the required qualification to fill a job opening. Usually the process consists in 5 steps: *Criteria Development, Application and Resume Review, Interviewing, Test Administration and Selection.*

The Criteria are developed maintaining a strict relation between the job analysis and job specification, moreover they should be aligned with the organization's strategic direction and culture (Stone, 1998). In this phase are outlined which information will be used and how that information will help in scoring the candidates. Additional criteria such as the attitude, the ability to take initiative or other characteristics that are not demonstrated by the CV, could enter in the criteria. The media through which assess these criteria should be determined in this phase.

The Application and Resume Review consist in a screening of them, different methods could be applied, in order to select who meets the minimum criteria. This process should be run avoiding disparate treatment against candidate's age, race or gender.

The Interviewing could be categorized into two main type: unstructured, where the questions change according to the candidate's background and structured, where the list of questions to be asked is decided a priori. The interviews could be run through several methodologies that are:

- Traditional Interview, conducted in the office where several questions are asked and answered
- Telephone Interview, usually conducted to narrow the number of people that will access to the traditional one
- Panel Interview, several people ask question to the candidate at the same time. It allows for a more effective use of time
- Information Interview, it is not connected with a specific job opening but allows to find good quality candidate ahead of the occurring of a job opening
- Group Interview, more candidates are assessed at the same time. This is useful when it is important to assess how the candidates behave in a team context
- Video Interviews, same as the traditional interview, but they are conducted in thanks to video technology

The Test Administration could be of various type, i.e. cognitive ability, personality, physical ability or job knowledge test, and are aimed at assessing skills and capabilities. The cognitive ability test measures numerical ability and reasoning, the aptitude test measures the aptitude toward a specific kind of job. The Personality test is aimed at comparing the results of the test with successful employee scores while the physical ability should ensure a minimum standard but a

correlation with the job duties should be demonstrate. Last, the job knowledge test is aimed at measuring the candidate's level of understanding about a particular job.

The Selection is biased by the perception of the decision makers, the major problems include (Mathis & Jackson, 2008):

- Snap Judgements, decision about an applicant is taken between the first two to five minutes of interview, then the time is spent to find evidence supporting the judgement
- Negative emphasis, bad information is emphasized over than good ones
- Halo Effect, a positive characteristic overshadows other evidences
- Biases and Stereotyping, favouring people that are similar to themselves

To limit the interviewer's perceptions and stereotype it is possible to use a statistical method, assigning weights to specific factors, according to the specificity of the job.

1.7 Research gap

The thesis deals with the analysis of recruiting and selection processes, for this reason, has been done an analysis of the theory standing behind HR. This has enabled the critical analysis developed in Chapter 3. The knowledge of the various, historically applied methodologies in such processes, has enabled a deep understanding of the choices carried out in the company object of the research, TurinTech. The literature review has enlightened the bias introduced by personal judgements and the study conducted in the company has confirmed that this problem has a great influence over the results of the output, i.e. the hiring of a new employee. In chapter 4 has been deployed a review of frameworks employed in Personnel Selection that are expected to solve, or at least to reduce the subjectivity that is intrinsic of these processes. The current literature doesn't cover what is concerned with recruitment and selection in consultancy company, as is TurinTech. The peculiarity tied with this kind of companies is that the recruitment and

selection processes should undergo through a phase where the interaction with the final client is needed. This phase has not been considered in no one of the study reviewed for the scope of this thesis. Hence, this work aims to deepen this aspect.

Another aspect that represents a novelty, is the appliance of lean methodologies to HRM. Indeed, while the scientific literature has not given adequate emphasis to this theme, in the deployment of this work it turned out to be of great importance for the individuation and analysis of the criticalities.

CHAPTER 2

TURINTECH'S PRESENTATION

This chapter aims to give a description of TurinTech Srl, the company where the thesis has been deployed, in order to favour a deeper comprehension of the topics covered in the same thesis.

2.1 Introduction of the Company



TurinTech (TT) is an automotive engineering company, born in 2000 in Turin. The company boasts some of the most prestigious clients in the automotive area, such as FCA and its tier-one. Since its early start, it

has developed innovation projects, as the electric mini car, and it has focused on specific division, such as the lighting area.

The years between 2003 and 2005 has been characterized by diversification. The company has developed activities in the aerospace, naval and nuclear sector, establishing working relationship with clients including Augusta Westland, Microtecnica, Azimut, Intermarine and Ansaldo Nucleare.

In 2005 started a reinforcement period regarding the automotive sector. TT gets a Fiat Group supplier code and acquired shares of automotive companies. It continued developing innovative project such as the Stop & Start.

In 2012 the company experienced a period of great development; it reinforced its presence in the automotive sector and in the electronic one and opened a new 500mq's office in Modena. It also become a shareholder of a human resource consulting agency.

Since 2015 it started to reinforce its agreements in the automotive sector and to develop new markets.

In the last months of 2019 TT has experienced a period of massive growth, that is still lasting. The employees have growth of about 20% in just 6 months (June 2019- November 2019), and the hiring pace is increasing.

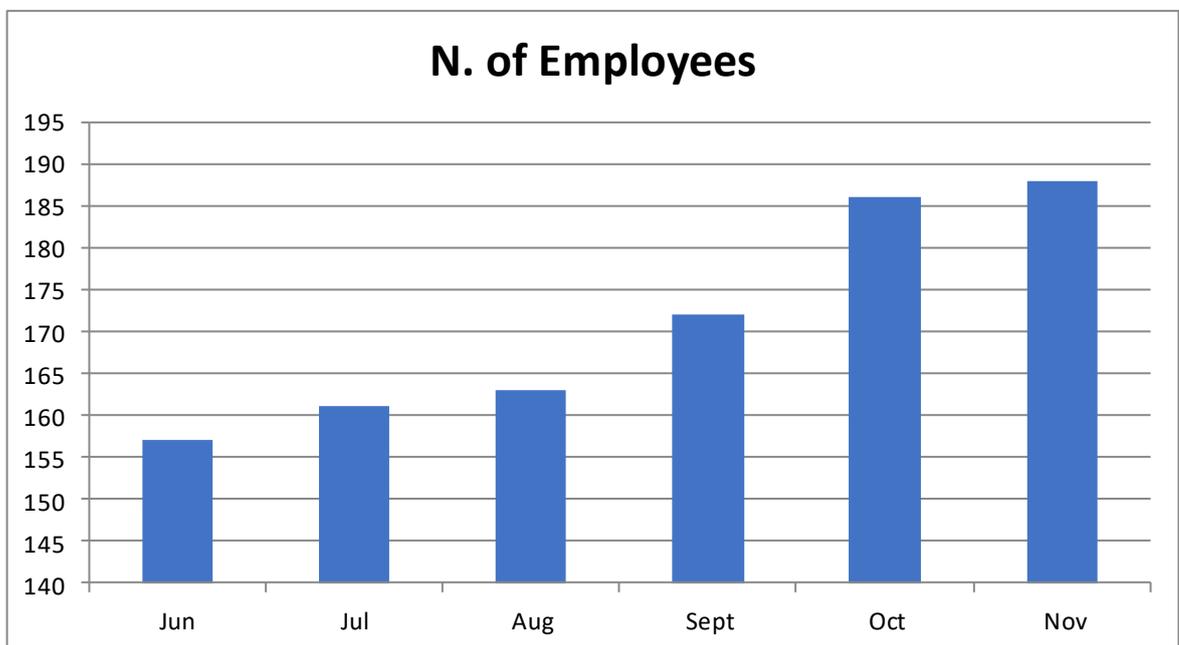


Figure 2-1 Hiring Trend

2.2 TurinTech Structure

The purpose of the structure is to react in the best possible way to market request, staying aligned with the company philosophy. This aim is reached thanks to independent technical divisions that maintain a direct contact with the client, to the support provided by the management structure to the single division and to the continuous pursue of the R&D department of new technological solutions that can be applied in the short and long term.

The R&D department represents one of the strengths of the company: it operates independently on strategic projects, then the innovative solution become expertise for all the technical divisions. This ensures a continuous evolution of the services and the highest quality level.

TT provides engineering support to the main global companies in:

- Technological and process innovation
- Strategy and management of projects

TT offers Consulting services and Turnkey Projects, for the most specific phases relative to the development of products and services. Its ability to react quickly and its flexibility, make TT a strategic partner. To achieve these goals, the company is focused on recruiting people having:

- Competence. The technical staff is composed of professionals with an extreme expertise, with passion for the results and a full commitment toward the clients.
- Experience. Working for different organizations in several sectors, the TT's staff acquire experiences that are strategic for the development and innovation by the client

TT is focused on the continuous growth of its employees; indeed, it invests 3% of its revenues in training each year. The training includes all levels of the company and it is developed via classroom's session and innovative projects.

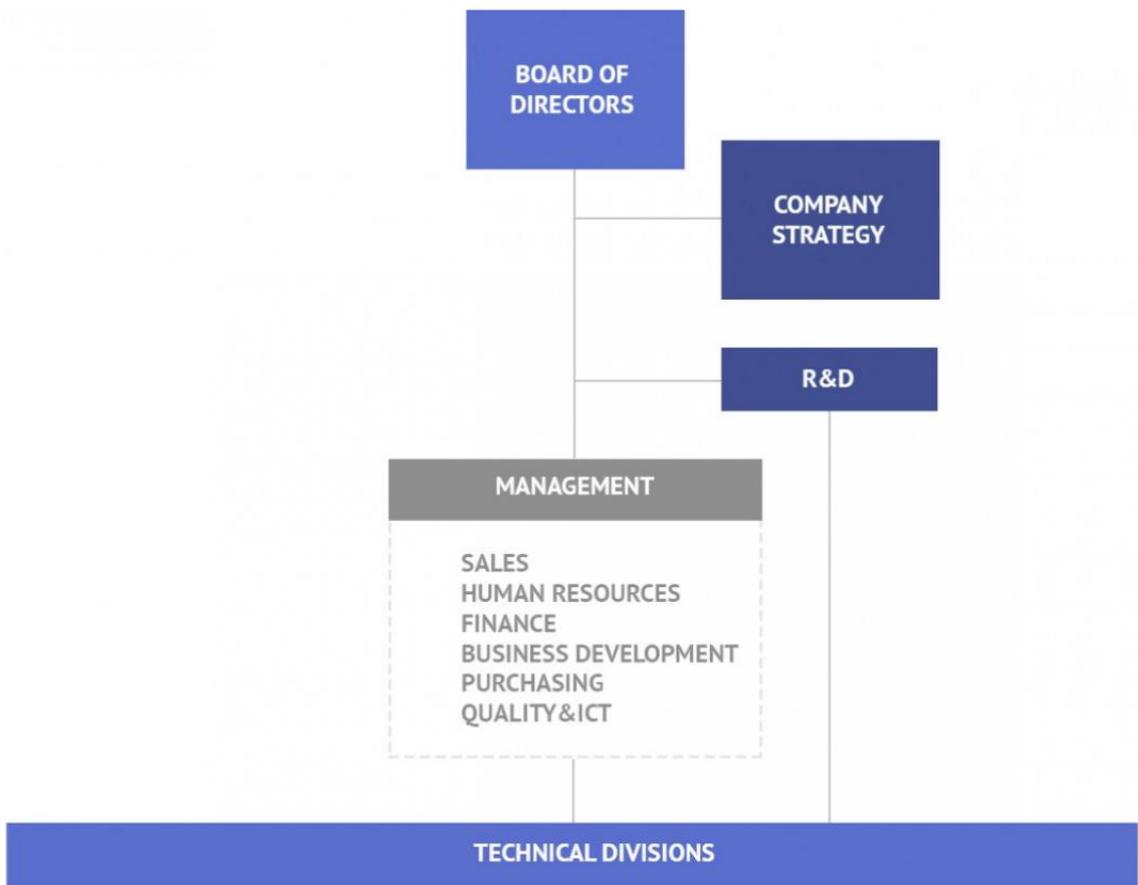


Figure 2-2 TurinTech Structure (<http://www.turintech.it/it/>)

2.2.1 Consulting

The area of consultancy is divided into NAAR and EMI, as showed in Figure 2-3:

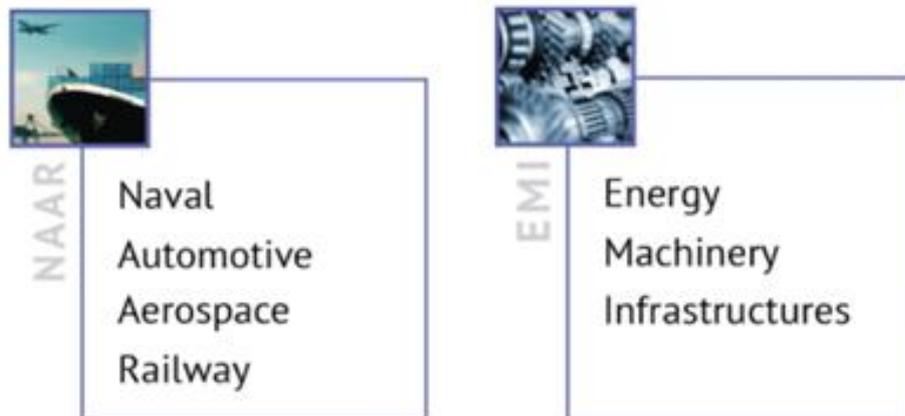


Figure 2-3 Consultancy's areas (<http://www.turintech.it/it/>)

It offers its services focusing on 4 different domains:

- Engineering
- Project Management
- Manufacturing & Technical Support
- Embedded Electronics

In the framework of Engineering Consultancy, TT supports its clients in the most specific phases of product's and service's development, adopting their specific procedures. The main activities carried out are feasibility, development, concept and virtual validation.

In the Project Management's field, thanks to its team, having expertise in organization, management of projects and industrial contract, TT combines its consulting's activities placing itself across all the involved areas.

For the Manufacturing's field, TT is involved in all stages of the product industrialization, starting with the concept, going through the commissioning to the overseeing of the construction and start-up phases of the industrial plans. The TT's consultant offers their services ensuring optimization of costs, quality and time.

The Embedded Electronics consultancy department, created in 2014, offers its support in Software design, development, integration and validation.

2.2.2 Turnkey projects

TT gained experience in the Automotive, Lighting, Machinery and Railway areas. It offers its competencies in design and development, from the individual component or part of a product to the whole project.

OUR APPROACH



Figure 2-4 TurinTech Approach (<http://www.turintech.it/>)

Figure 2-4 depicts the approach adopted by TT, the Phase and Gate process, ensuring to deal with the increasing complexity.

Concerning the automotive area, TT has focused on four further areas of expertise: Exterior, Interior, Chassis & Vehicle Dynamics and Powertrain.



Figure 2-5 Expertise Areas of Automotive (<http://www.turintech.it/>)

TT is able to independently manage each stage of the process up to the production start-up, as for example the style support, program management, benchmarking and target setting support.

In the Lighting sector TT is able to identify, formulate and solve complex problems, thanks to original solution and innovative technical contents. It is able to provide feasibility studies for the industrialization, 3D modelling and 2D project. It

also defines materials, processes and sizing according to the stress, relying on specific software.



Figure 2-6 3 Expertise Areas of Lighting (<http://www.turintech.it/it/>)

In automation and industrial production's areas, TT supports the client in each phase, from analysis to realization of the machinery or system, and also identification of the productive cycle.



Figure 2-7 Expertise Areas of Machinery (<http://www.turintech.it/it/>)

The field of Railway is divided into three areas of expertise: Exterior, Interior and Equipment/System.

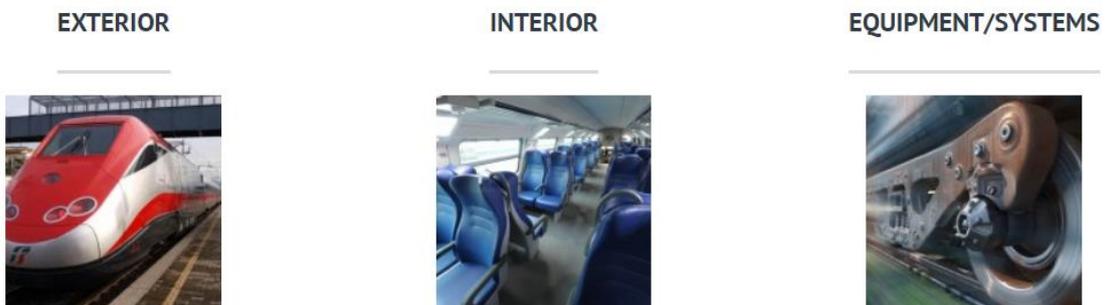


Figure 2-8 5 Expertise Areas of Railway (<http://www.turintech.it/it/>)

2.3 Lean Thinking in TurinTech

In the current status of the human resources' process, it is possible to see some influences of the lean thinking. These influences are the result of the initiative of the singular person and are not pursued by the top management, as Camuffo states in his book that it should be (Camuffo, 2014). Indeed, the Lean Thinking should be a clear aim, defined by leadership and should become part of the cultural organization of the company. There should be someone that at once has the knowledge of what is considered value, and how this value flows in the company.

Lean management consists in achieving more with less. Applied to Human Resources represents “an attempt to efficiently bring together quantitative and qualitative manpower resources, and to further optimise personnel related processes to the benefit of the organisation” (https://www.cornerstoneondemand.it/sites/multisite/files/whitepaper/IT_WP_LEAN_HR_WEB_0.pdf).

2.3.1 Visual Management

The Visual Management is a lean tool that “uses instinctive visual cues to make succinct, accurate information within a workplace available at all times to those who need to know it” (<https://www.clarityvisualmanagement.com/technique/vm-visual-management/>). In TT's context, this has been widely applied in the HR's office. Here the recruiter has to tackle everyday with multiple Job Openings, and in consequence with dozens of curricula. Indeed, when a candidate should be interviewed by a BM, his curriculum associated with an Interview's Sheet is printed. These curricula should be stored in a way that allows to identify promptly to which position they are related. To cope with that, the curricula are maintained in binders, one for each BM, and within the binder, they are divided into folder, each one corresponding to a job opening. The binders as well as the folders are identified with tags, to make crystal clear to which position or which manager it is referred.

The folders' tag also have a reference to the status of the research, to remind the recruiter if it has been closed, if new profiles are still needed or if it is in waiting for feedback.

One more binder is intended for the recruiting events that take place at the universities, because the curricula are nor linked with a specific BM nor with a specific position. This situation should be carefully managed indeed, the curricula gathered at the university represent great importance for the company, but if not properly stored it could be difficult to employ them. The problem was that all of the curricula should been stored in the database, but since for each event were collected the curricula of around 60 people, the time needed to do it was long. Initially the curricula were stored in 2 different folders: the first for the ones already stored in the database and the second one for the ones that already needed to be registered. Before this storing operation was completed, it happened many times that the managers have wanted to see the curriculum of a specific student, in order to contact him. So, the curriculum was taken from the stack and when the BM was ready with it, he gave it back to the HR. But in that moment, it was not easy to remember whether it has already been registered or not. So, the HR should check on the database, wasting time. The solution was to sign directly the curricula when registered, in this way the knowledge of being registered or not was associated directly with the curriculum and stops relying on the splitting among the folders.

Beginned with a sign on the curricula, now it is utilized to mark the Interview's Sheet and identifies if the profile has been stored in the database, if the database has been updated after each interview and so on.

CHAPTER 3

THE CASE STUDY

This chapter is focused on the analysis of how the Recruitment and Selection processes are developed in TurinTech. First of all, these processes have been modelled, then it has been studied how the value flows through the different tasks, later on have been identified KPIs able to define the status of the process and finally the criticalities encountered have been studied.

3.1 The Recruitment Process

In order to have an insight about how the recruitment and selection process runs, the Recruitment Funnel comes into our help. It is a framework for the entire recruiting process to create a never-ending pipeline of candidates, allowing to find the right people for the right jobs in a company (https://www.jobvite.com/wp-content/uploads/2015/10/jobvite_the_recruiting_funnel.pdf). It can be used by the company to determine total application needed to get a single hire, and by the applicant to reveals the chances of success at each step of the hiring process (Mohapatra & Sahu, 2017). The recruitment processes conducted by TurinTech could be split up into two main classes: one aimed at hiring people who will work for the client, and another to hire people who will work for TT itself. The process carrying the major relevance is the first one, due to the interaction with the client

that reserves himself the opportunity to decide if a candidate should be hired or not. Moreover, the process for internal position could be considered as a subset of the first one, just excluding all the interaction with the client.

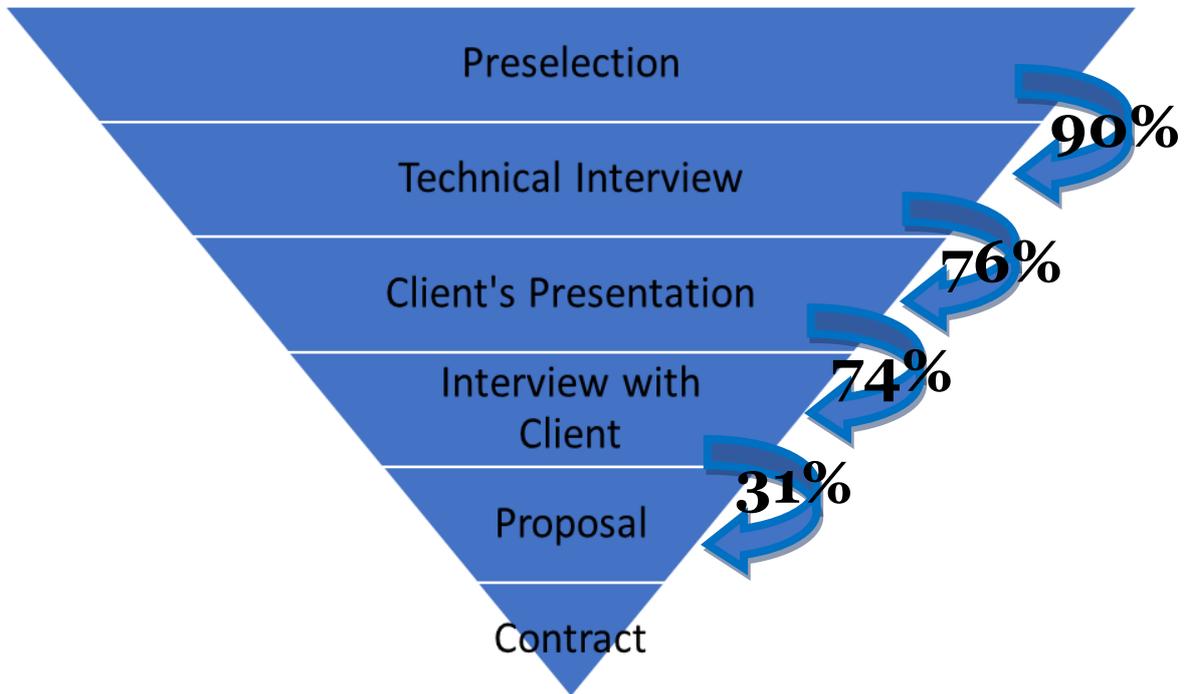


Figure 3-1 The Recruitment Funnel

The recruitment funnel, as shown in Figure 3-1, **Errore. L'origine riferimento non è stata trovata.** *Errore. L'origine riferimento non è stata trovata.* defines the process through which the company will identify and eventually hire a selected few out of a large number of applicants. The process is composed of 6 main stages, that could be broken down into smaller tasks, that will be detailed later on.

In the *Preselection* phase the first collection of profiles takes place, gathered from multiple sources. With an exploratory phone interview, the profiles are assessed whether they are qualified for the position or not. Thus, the output of this first stage is a list of candidates that will be presented to the Business Manager (BM). The latter, with a *Technical Interview* he will skim more profiles, that are not considered suitable for the position, due to hard skills or soft ones. For those a TT Sheet is prepared and *Presented to the Client*, to let him decide who will attend the

Customer Interview. This stage shall be intended to assess if the applicant is suitable for the client’s environment and represents the last test that the candidates have to pass to get a *Proposal*.

The importance of the Recruitment Funnel lies in the fact that allows to understand if, with the recruitment process, the company is attracting the right talents, where the bottlenecks of the process are, how many candidates are needed to fill the position and other information. The percentages, represented in Table 3-1, are intended for this purpose, and they represent the Qualified Candidates. Each of them has been calculated with reference to the previous stadium and thanks to data gathered for eight job openings.

	N° Exploratory Interviews	N° Technical Interviews	N° Presentations to Customer	N° Customer Interviews	N° Proposals
Job Opening 1	7,3	7,3	7,3	5,3	1
Job Opening 2	4	4	3	-	1
Job Opening 3	9	7	3	3	1
Job Opening 4	10	9	6	3	1
Job Opening 5	7	6	3	4	1
Job Opening 6	3	2	2	1	1
Job Opening 7	7	7	7	3	1
Job Opening 8	3	3	3	3	1
Mean	6,3	5,7	4,3	3,2	1,0
Variance	6,3	5,1	3,9	1,5	0,0
%		90%	76%	74%	31%

Table 3-1 Data of 8 Job Opening

In “Job Opening 1” the N° of vacancy to be filled was 3, for this reason the total number of candidates present in each phase was divided by 3, in order to make them comparable with the other openings. As underlined by the variance, the data have great differences between them, due to the particularities of each job opening, making the percentages not completely reliable.

On one hand, the percentages have the scope to give an image of the recruitment model’s state, assessing how many qualified candidates exist in each phase of the process. On the other hand, these percentages could be predictive of

how many candidates are needed to ensure the filling of a vacancy, i.e. the *Candidates to Fill a Job Opening*. Table 3-2, explains these numbers.

N°Exploratory Interviews	N°Technical Interviews	N°Presentations To Customer	N°Customer Interviews	N°Proposals
7	6	4	3	1

Table 3-2 Candidates to Fill the Vacancy

They have been obtained as follows:

$$CtF_x = \frac{N^{\circ}_{x+1}}{\%_{x+1}}$$

To have a proposal are needed 6 CVs at the first step, 6 at the second one, 4 at the third and 3 at the fourth.

To have a better understanding of the whole process, some diagrams have been deployed thanks to the modelling technique of Business Process Modelling and Notation (BPMN), making possible to analyse each stage presented in the recruitment funnel. An investigation about the timing has been conducted and Key Performance Indicators has been identified.

3.1.1 Business Process Modelling and Notation

The BPMN is a notation developed by “Business Process Management Initiative” and the “Object Management Group”. The aim is to provide a standardized graphical notation for business process in a Business Process Diagram, in order to support the Business Process Modelling being comprehensible to business users and represents complex semantics process for technical users (<https://www.omg.org/bpmn/>). It enhances the integration between modelling, development and informatization of the process. This modelling technique has been employed because it is easier to understand a diagram rather than narrative text, thus will enhance the understanding of the process by different levels in the company, regardless their background.

The notation provides 4 basic categories of graphical elements, that allow the modelling of numerous business process.

The four categories are:

- Flow object
- Connecting object
- Swimlane
- Artifact.

The Flow objects comprehend Events, Activities and Gateways.

The Events are elements that trigger the start, the modification or the completion of a process. They are divided into Start, Intermediate or End event, and could include message, timer, error signal and other type, depending on their function.



Figure 3-2 Events

Figure 3-2 shows, in order, a Start Event, an End Event and an Intermediate Signal Event.

The Activities represent tasks performed by person or system; the graphical representation is showed in Figure 3-3. The activity could be detailed thanks to sub-processes and loops.



Figure 3-3 Activity

The Gateways are decisional points, depending on conditions or events, the path of the process will change. There are different types of gateways: inclusive, exclusive, parallel, complex or based on data or events, as represented in Figure 3-4.



Figure 3-4 Gateways

The inclusive gateway defines one or more choices that should be taken in the process, more paths could be followed, the exclusive one defines a single choice, that excludes the others. The parallel gateway defines the execution of more activities at the same time, the complex one is concerning with the union of more than a simple gateway and finally the event based relies on signal coming from the extern.

The Connecting Objects include Sequence Flow, that depicts the order in which the activities should be performed, the Message Flow, showing messages that goes across “pools” and organizational boundaries, and the Association, that associate artifact or text to event, activity or gateway. Their graphical representation is inFigure 3-5.



Figure 3-5 Connecting Objects

Pool represents a participant in the process, or it is employed as a container for an ensemble of activities that should be separated from other pools, as shown in Figure 3-6. Lanes are a sub-part of pool; their extension takes the whole length of the pool. They are employed to organize and categorize activities.

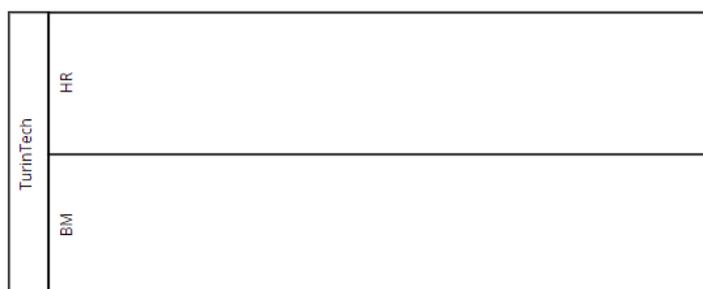


Figure 3-6 Pool and Swimlanes

The artifacts are the additional information added by developers to detail the diagram. They are Data Object, showing which data are needed to carry out an activity, the Group, grouping logically activities without interacting with the process flow, and Annotation that provides further information to the diagram. The graphical representation in Figure 3-7.



Figure 3-7 Artifacts

The tool that has been employed for the modelling is Signavio, a web-based modelling tool. It provides a free academic suite, accessible on the web, where it is possible to model processes with BPMN 2.0. It also allows for simulation.

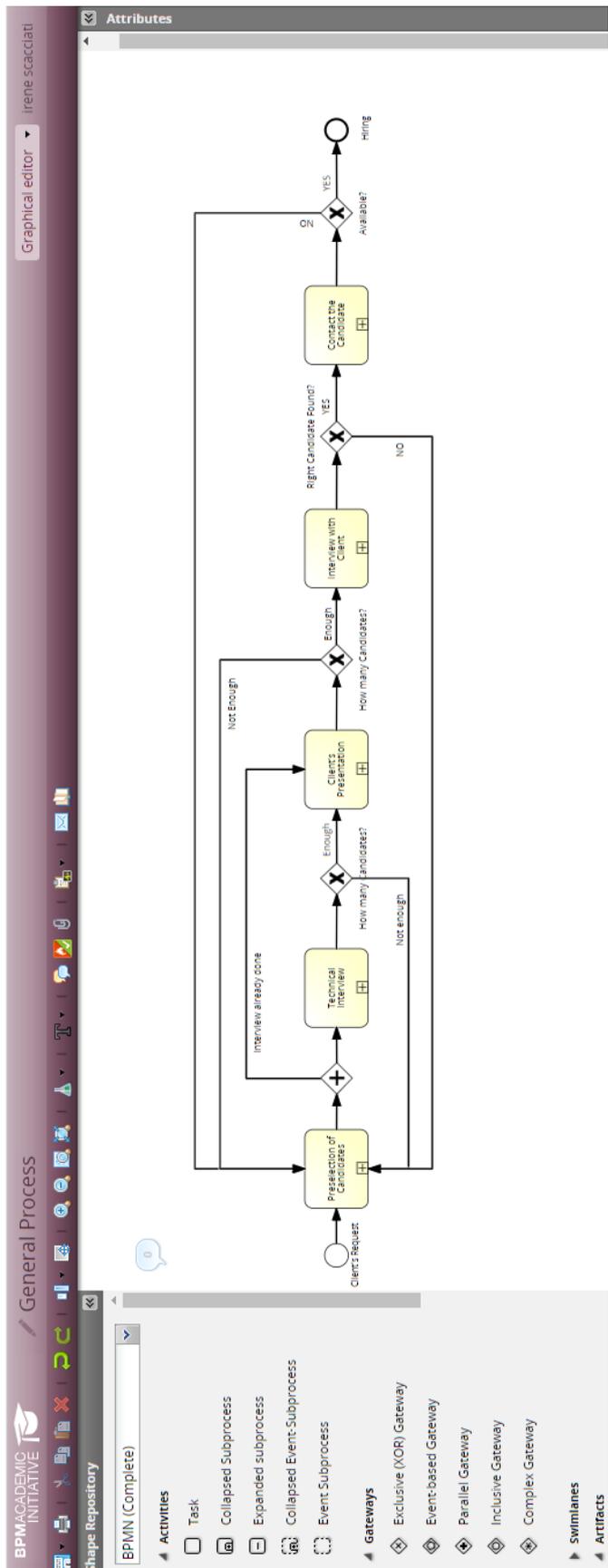


Figure 3-8 Signavio

3.1.2 General Process AS-IS

Firstly, the process has been studied from the Company point of view: the process is triggered by a *request* of a client and it will have as an output a *hiring*.

Once the request has been received, the Human Resources Function will start the Preselection of the Candidates. That is an iterative task the recruiters will run until a satisfying pool of candidates has been selected. Then, these profiles will be presented to the BM of reference, who will proceed with a *Technical Interview* aimed at assessing their knowledge. The number of candidates keeps decreasing and those who were regarded as meeting the needs will be *Presented to the Client*, that will select who is going to move forward and have an *Interview with the Client* itself. The client notifies the company who is the selected profile, and the HR *Contact the Candidate* to proceed with the hiring. Such description represents the best case, when the sufficient number of applicants to ensure a hire is reached at each stage and no candidates “ghost” during the progress. Anyway, there may be the need to go backward at the Preselection stage to add new profiles, graphically represented through the exclusive gateways.

Each task represented in the general diagram, Figure 3-9, could be decomposed into simpler tasks and consists in iterative processes aimed at reaching the number of needed candidates.

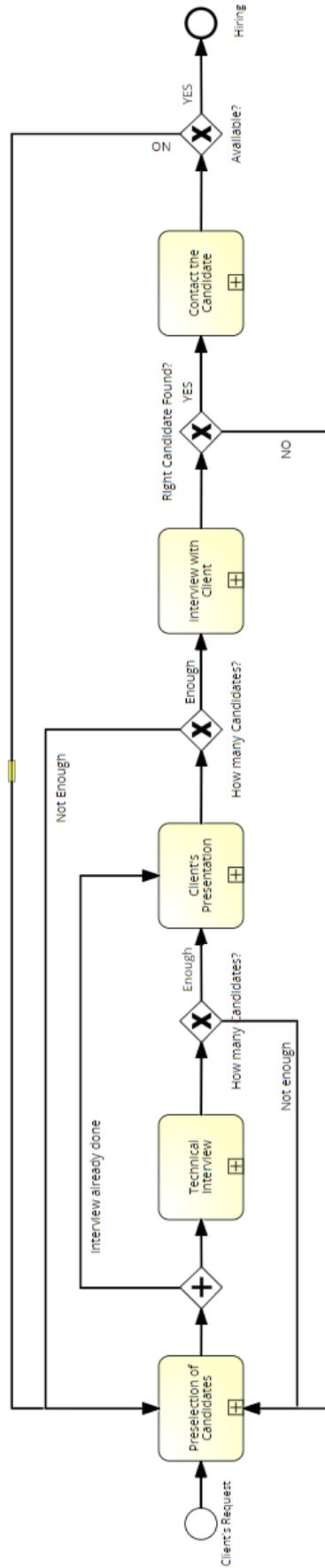


Figure 3-9 General Process AS IS

3.1.3 Preselection of the Candidates

The reception of a Job Description is the trigger of this collapsed process, the HR will start an iterative procedure to preselect the candidates in order to find on average 7 profiles. This quantity, deriving from the analysis and quantification made thanks to the recruitment funnel, represents the number of applications needed at the Preselection Stage to ensure the filling of the position. The first step is *Searching in the Database (DB)* for a profile, if it has been found, the process ends with the presentation to the BM. If not, the process keeps going on with the *Search for a New Profile* through different media. This new profile will face an *Exploratory Interview* and, if considered qualified, it will be presented to the BM, otherwise the process will go backward to the Search for a New Profile until a sound one has been detected. The HR will assess, in this first interview, the present condition of the candidate. Information about the current job, the economic condition of the contract or about the academic path if the candidates is a newly graduated are collected.

The exploratory interview will be conducted after the printing of the applicant's Curriculum Vitae, where the HR will take some relevant note. Then, if the candidate is available and judged suitable to go on with the process, the HR will prepare a personal "Interview's Sheet" that will be delivered to the BM when the Technical Interview takes place.

During the execution of this process, the HR employs a powerful instrument, the Database. Here are contained information about all the people that already have had a contact with TurinTech. These information concerns the education, the availability, the previous work experiences and notes from the BM or HR. Its utility lies in the opportunity to keep a track of who is going through the funnel, at which stage his journey stops and for what reason. From the company point of view, the first advantage of maintaining such data is the opportunity to measure the

performance of the recruitment process while the second advantage is the chance to contact already known candidates, having a shorter duration of this sub-process.

The Interview's Sheet is a tool aimed at easing and standardizing the collection of the data during the Technical Interview. Moreover, it contains the information gathered by the HR during the Exploratory Interview. A more detailed description will be made further.

3.1.4 Search for a New Profile

The Search for a New Profile relies on two different techniques:

- Searching for Active Candidates;
- Searching for Passive Candidates.

Active candidates are those who are looking for a new job position. They currently may or may not have a job and are those who send their applications and resumes to the company. These are attracted by the company through advertisement on different platforms such as LinkedIn, Bakeka, or the company's website.

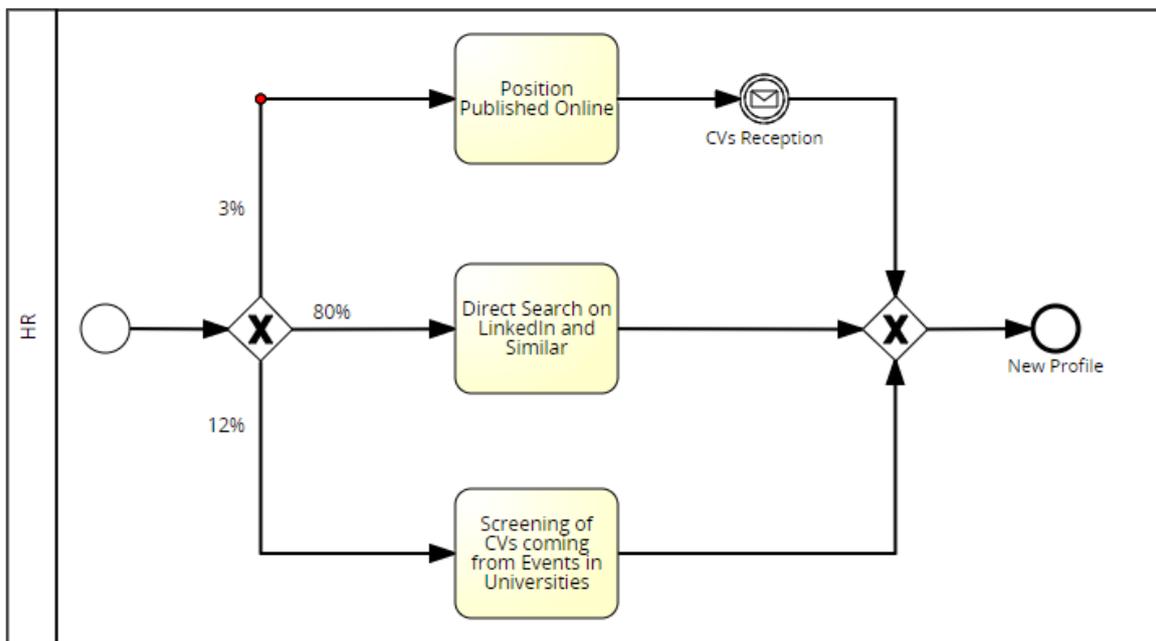


Figure 3-11 Search for New Profile

On the other hand, there are the passive candidates, that are not actively looking for a job. It is the company itself that has to do the first move, contacting them. This kind of recruitment is useful when the Job Opening needs to be filled with a highly skilled employee that is not easy to find on the job market. To carry out this kind of recruitment, the HR make use of LinkedIn, actively looking for the needed characteristics and directly calling the identified profiles. While searching

for active candidates doesn't need a lot of time, the passive ones does. Figure 3-11 shows the 3 most relevant sources where the HR search for possible applicants, each branch leading to the task is associated with a percentage that represent the probability with which the specific path is taken. These percentages have been calculated thanks to the data stored in the DB. Indeed, it associates each CV with its sources, making possible to calculate the composition of the DB itself and understand how the research are split.

The time needed for searching active candidates is related to the writing and publication of the position online and it is estimated to be 30 mins, but producing lot of applications, the time per applicant tends to 0 min. The time per passive applicant is 4 hours. Even if there is such a big difference, the search for passive candidates is the most utilized in TT because it produces candidates meeting closely the needed characteristics. The Screening of CVs coming from Events in Universities take is another time-consuming activity, taking up to 3h.

Before performing the exploratory interview, an "interview's sheet" is prepared where the HR and, later on, the BM are supposed to take notes about each candidate. After this first contact, usually by phone, the first knowledges about the applicant are registered in the database.

3.1.5 Technical Interview

When, on average, 7 profiles have been detected in the previous phase, the HR transmit them to the BM that will proceed with the *Technical Interview*. The aim of this second interview is to assess technical and soft skills written in the CV of each candidate before presenting him to the client. The knowledges about specific software needed in the job are verified, as well as the linguistic proficiency, if relevant. The previous working experiences are investigated and also the academic background. Usually it takes place in TurinTech but could also be executed via Skype.

The BM of reference should update the interview's sheet and return it to the HR, that will update the database with the new information. The BMs decide if the candidate should go through the next step of the process or if he is not suitable for the proposed position.

3.1.6 Presentation to the Client

At this stage the BM should present to the client a resume of each valuable candidate. In that way the client has the chance to evaluate, before an eventual interview, if the candidate fulfils the requirements, at least from a theoretical point of view. In order to prevent the disclosure of the identity of the candidates, each one of them is associated with a TT sheet, a document written by the HR, that is a curriculum vitae on condition of anonymity. Once this document has been written, the HR transmit it to the BM, that is in charge of sending it to the client. The waiting time for the feedback represents one of the critical points of the process indeed, it could take up to 7 working days.

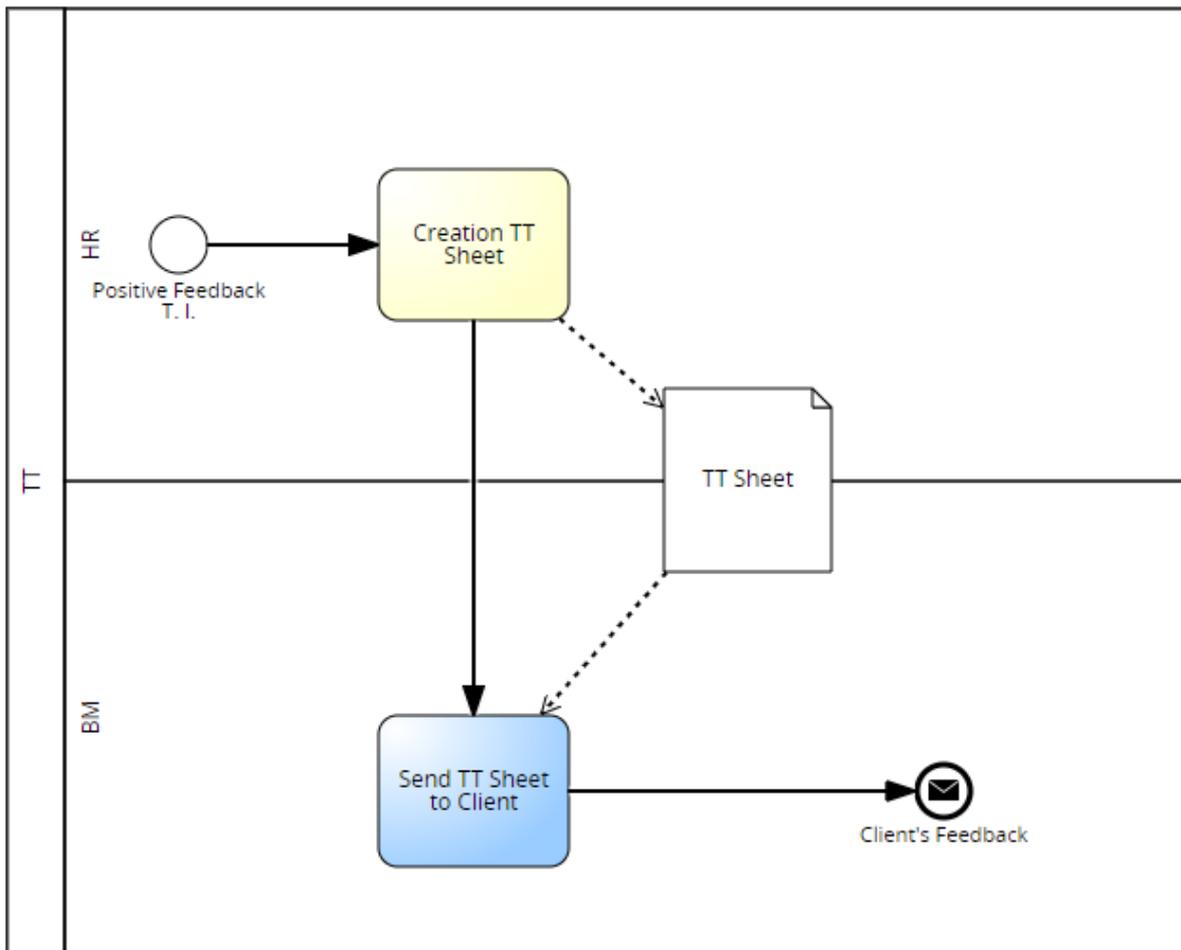


Figure 3-12 Presentation to the Client

3.1.7 Interview with the Client

The feedback on the TT sheets is the input of the sub-process “Interview with the Client” that unfolds into several tasks. When the process has been triggered the HR has the responsibility to *Fix the Interview with the Client* for each of the chosen applicants, then the BM will take part, with the applicant, at the *Interview with the Client*.

The client cares to describe in detail the Job Position and to assess specific knowledge needed. In this moment it is possible for the client to assess if the profile of the candidate matches the one searched, and for the candidate to clarify any work-related doubt. As long as 7 working days could be needed to receive a feedback from the client, then the HR Updates the Database.

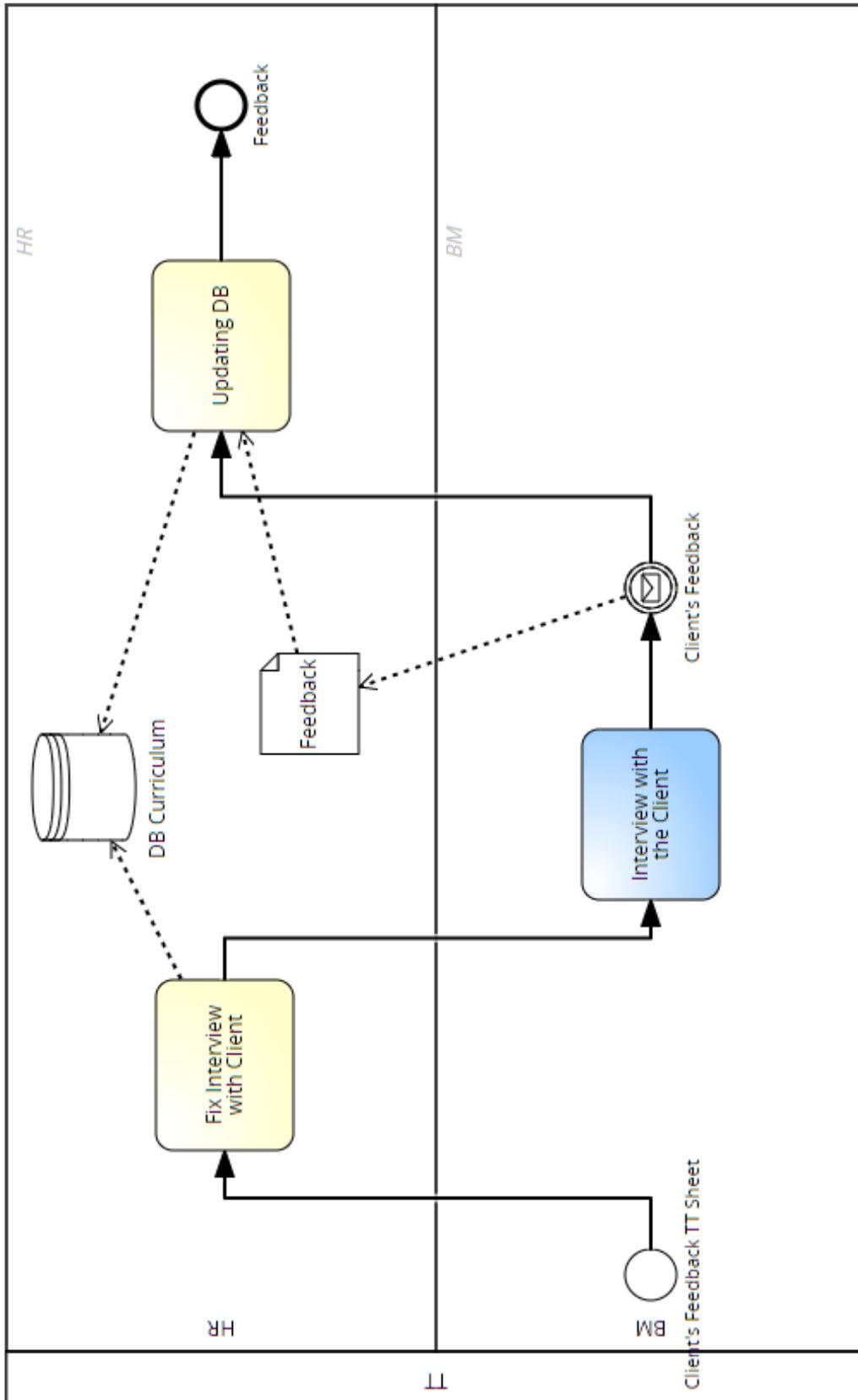


Figure 3-13 Interview with the Client

3.1.8 Hiring Process

When the recruitment and selection process end, another one is triggered: the Hiring Process. It consists in all the steps, administrative and not, needed to make effective the hiring. First of all, the BM is in charge of *Sending the Information* requested to the HR department to elaborate a *Binding Agreement*, then the HR draw and transmit it to the BM. The BM presents the agreement, where the information about the condition of work are specified, to the candidate. In the case that the applicant doesn't accept the offer, there will be a *Negotiation* upon the terms of the contract. If an agreement will be found, the *Binding Agreement is Modified* and the applicant hired, otherwise the process ends with a negative outcome.

3.1.9 Post-Hiring Processes

After the hiring is concretized, a new delicate process starts in which the Information and Communication Technology professional (ICT), the BM and the HR are involved. The most critical part is related to the acquisition and production of documents: Entrance Permits, Client's order and documentation produced by the Job Center. The first are the documents needed to enter in the client's facilities, each client has its own timescale, way of delivering it and inputs required to produce it. The second is the actual and effective order from the client and the last one is the document stating that the employee has been effectively hired, and he is covered by the insurance. To start smoothly the on-boarding of the new employee, the *Entrance Permits* in the client's infrastructure should be ready before the starting day. To achieve this goal, the ICT should *Ensure the Availability of the Hardware and Software Material*, the BM should receive the client's order and the HR should receive the CPI, then the request for the permits could be emitted. Of great importance is to take into consideration the fact that, once the request has been made, are needed approximately 10 days to receive it. As a consequence of not ready permits, the new employee doesn't have the opportunity to start working, becoming a source of money's waste for the company. The same is happening in case of not available Workstation.

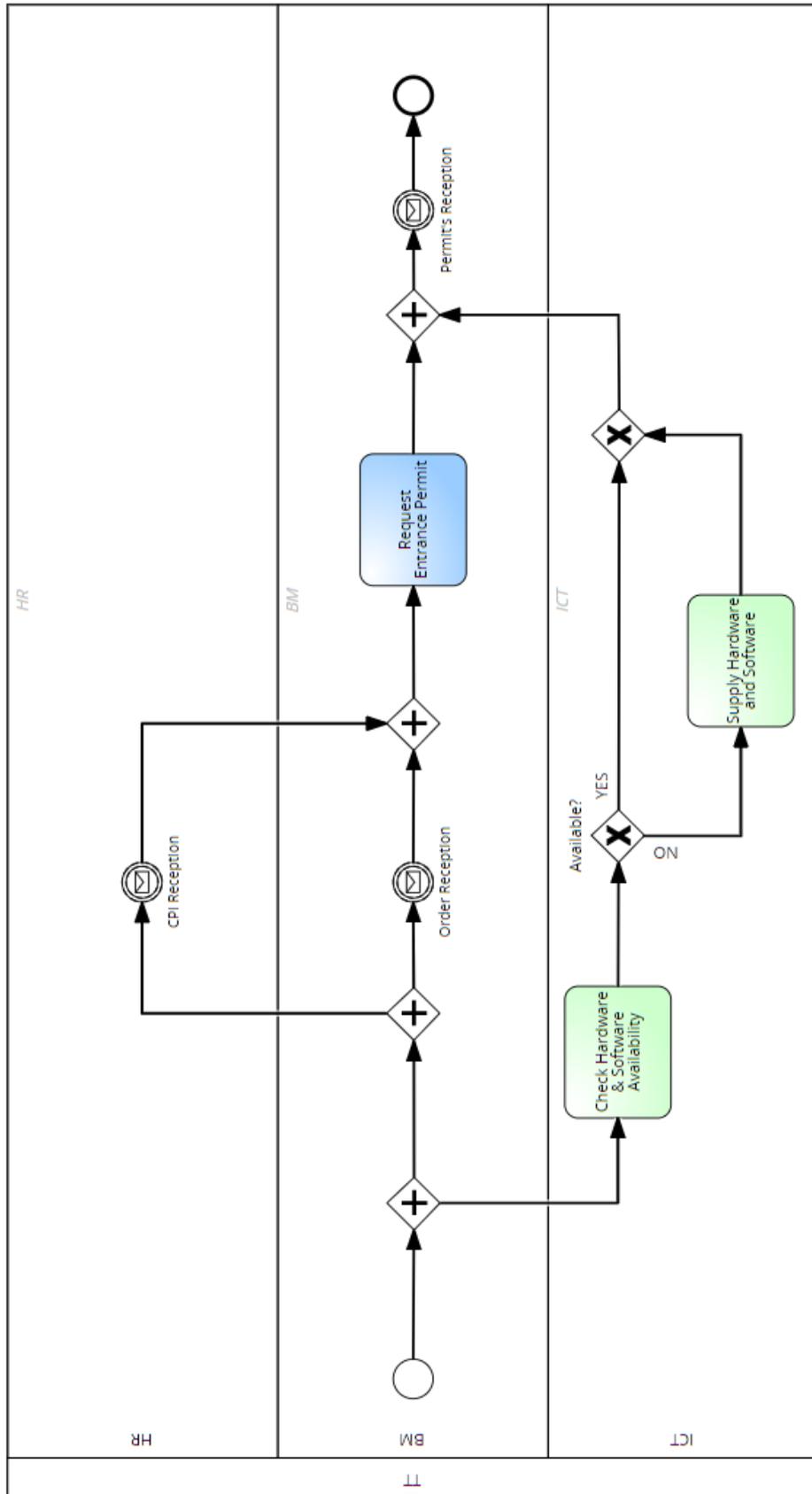


Figure 3-15 Post Hiring Process

3.1.10 Applicant's Point of View

The process has been studied also from the applicant's point of view. From this perspective, the process is triggered by the first contact between TurinTech and the applicant and ends or with a hiring or with a rejection. The rejection could happen early, at the end of the process, for intent of the company, of the client or of the applicant. The phases that the applicant should go through are four. In each of them, except the Presentation to the Client, is needed the interaction of the candidate. While, in the mentioned former, the candidate does not have to actively participate, but he just waits to have a feedback.

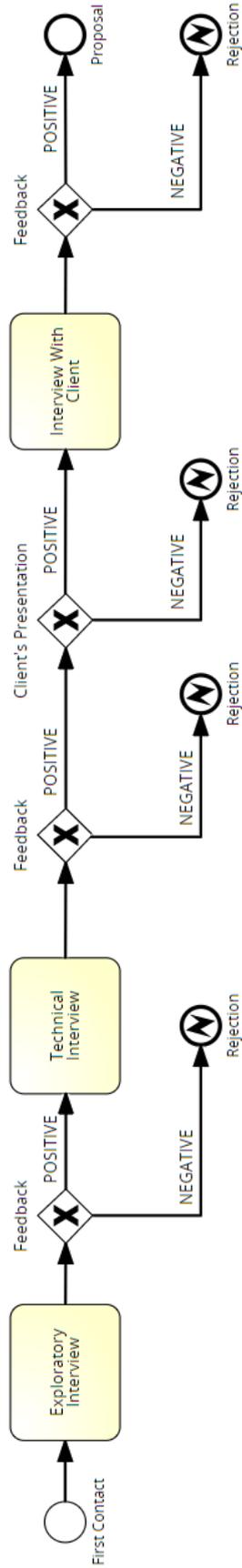


Figure 3-16 Applicant's Point of View

3.2 Tools

The description of some support tools will be made in these paragraphs, to have a better understanding of the whole process.

3.2.1 Database

The DB is a giant Excel file, where the data about the past-interviewees are stored. The aim of this file is to track the journey of the people through the recruitment process, and to keep useful information about them. The first column is dedicated to the “Status” of the candidate, that could be: hired, CV ok, CV ko, not available, refuse, resign or pending. The subsequent columns contain the personal data about the candidate (Figure 3-17) , then there is an area where the role and the skills associated with the candidate are maintained (Figure 3-18). Another area is aimed at maintaining information about the dates of the interviews and assessing the sources of the candidates and the project they were proposed for. Finally, two columns are dedicated to the notes, one for the recruiter and another one for the Business Managers (Figure 3-19). These notes aid in remembering the impression that the candidates have made, allowing to understand whether he could be suitable for another project or not.

STATO	DATA ULT. AGG.	COGNOME	NOME	TELEFONO	MAIL	LIVELLO	DIPLOMA	LAUREA	AZIENDA ATTUALE	voto	DISP A TRASFERTE	REFERENTE
IN CORSO	18/04/19	xxxxx	xxxx	xxxx	xxxx	Expert		Ing. Biom	xxx		SI	BM1
COLL. KO	18/04/19	xxxxx	xxxx	xxxx	xxxx	Senior	Per. Elettr.					BM2
NO DISP	19/04/19	xxxxx	xxxx	xxxx	xxxx		Liceo	Ing. Mecc	xxx			
ASSUNTI	19/04/19	xxxxx	xxxx	xxxx	xxxx	J/S		Ing. Mecc	xxx	106/110	si	BM1

Figure 3-17 Database: Personal Information

CV5	UGNX	Pro-E	FEM	Simulink	Project	ICEM SURF	ALIAS	C/C++	CAN	LABVIEW	ICROCONTI	AUTOCAD	INVENTOR	SOLIDWORKS
		xx												
					x									

Figure 3-18 Database: Skills

1° COLLOQUIO	2° COLLOQUIO	QUALITÀ REPERIMENTI	REFER./PROVENIENZA	NOTE RECRUITER	NOTE BM	ZONA PROVENIENZA/RESIDENZA	PROGETTO	Presentazione candidato al Cliente
18/04/19	09/05/19	RICERCA DIRETTA	LINKEDIN	XXXXX	YYYYY	TORINO	CLIENT 1 PROJ X	
02/04/19				XXXXX	YYYYY		CLIENT 2	SI
		RICERCA DIRETTA	LINKEDIN	XXXXX	YYYYY	TORINO	PROCUREMENT X	
13/05/19		RICERCA DIRETTA	LINKEDIN	XXXXX	YYYYY	TORINO	PROCUREMENT Y	
08/05/19		RICERCA DIRETTA	LINKEDIN	XXXXX	YYYYY	TORINO	GARA CNH	SI

Figure 3-19 Database: notes and source

In the DB a page is dedicated to a report where are summarized the data related to each active and closed Job Opening. In Figure 3-20 is presented the report for still active Job Opening, when a position is filled the relative row is shifted to another report, presenting the same structure, but storing the already closed, i.e. filled, position. Each column identifies the phase of the process and the figure represents the number of candidates that has gone through this phase. The percentages represent the Qualified Candidates. They differ from the one presented in the recruitment funnel, because they are referring to process still running.

	Stato	CV raccolti	CV colloquiati	CV presentati	CV scelti dal Cliente per il colloquio	Assunti
Job Opening1	in attesa di feedback	3	3	3		
Job Opening2	in attesa di feedback	18	15	14		
Job Opening3	attiva	11	6	6	4	1
Job Opening4	in attesa di feedback	1	1	1		
Job Opening5	in attesa di feedback	1	1	1		
Job Opening6	attiva	5	4	4	2	
Job Opening7	attiva	8	6	5	5	
Job Opening8	in attesa di feedback	3	3	3	3	
Job Opening9	attiva	7	6	6	3	
Job Opening10	attiva	5	4			
Job Opening11	attiva	5	5			
Totale		67	54	43	17	1
%			81%	80%	40%	

Figure 3-20 Database: Report

3.2.2 Interview's Sheet

It is an excel file, printed by the HR before the Technical Interview. It contains the personal information of the candidate and it is divided in sections that allows to take notes about the interview. The top of the page, marked in red in Figure 3-21, is dedicated to the personal data of the candidate and to the current work position, this section is filled by the HR. The central area, in yellow, filled by the BM, is related with the technical and linguistic knowledges, having also some spaces for relevant notes. The bottom part, in green, will be filled in case of a proposal and will contain the detail of the offer. At the end of the interview, the file shall be returned to the HR, allowing to store in the DB the new gathered material.

3.2.3 TT Sheet

This file is an anonymous presentation of the candidates to the client. Here are reported the relevant information regarding the education and the professional experiences as well as the technological skills

TURIN TECH												SCHEDE COLLOQUIO												ID		...	
COGNOME				NOME				Fonte CV				STATO CIVILE															
TEL.				MAIL				SOCIETA' ATT.				celiber/nubile															
ANNO DI NASCITA/AETA'				ISTRUZIONE				POSIZIONE				coniugato/a															
MACRO AREA				<input type="checkbox"/> AUTOMOTIVE		<input type="checkbox"/> AEROSPAZIO		<input type="checkbox"/> FERRAMENTI		<input type="checkbox"/> NAVALE		<input type="checkbox"/> INDUSTRY		<input type="checkbox"/> ALTRO													
AREA DI RILIEVAMENTO				Parizione ricomparsa				LIVELLO																			
ULTIMA ESP. PROFESSIONALE				Responsabilità/attività				L'IMPIEGO																			
				Eventuali risorse gestite				JUNIOR																			
				Motivazione al cambiamento				I/S																			
SELEZIONE				PROGETTISTA				P.M.				AMMINISTRATIVE															
FURA PROFESSIONALE				DATA COLLOQUIO				DISP. A TRASFERIMENTI				SI				NO											
HI FA IL COLLOQUIO				DATA COLLOQUIO				DISP. A TRASFERIMENTI				SI				NO											
RICHIESTA BUSTA				DISP. A TRASFERIMENTI				SI				NO															
CONOSCENZA SV				CONOSCENZA TECNICA																							
CATIA				ANTICAR				CFC...																			
PREE				INVENTOR				CAM																			
BC				SOLIDWORKS				LABVIEW																			
ALTRA				ALIAS / IGEN SBEP				MICROCONTROLLORI																			
NOTE																											
INGLESE				NOTE																							
ALTRA																											
LIVELLO				SITUAZIONE ATTUALE																							
RAI																											
BENEFIT																											
PROPOSTA																											
Inf. Colloquio				DATA																							
LIVELLO																											
RAI																											
BENEFIT																											
ACCETTAZIONE DIREZIONE																											
ESERIZIONE				DATA				PRECEDENTI CONTRATTI A TEMPO INDETERMINATO:				SI				NO											
DATA																											

Figure 3-21 Interview's Sheet

3.3 Talent Analytics Maturity Model

Josh Bersein proposed a 4 levels model of HR Analytics in 2014. In this model the organisations are categorized basing on the maturity of their approach towards the analytics, and the depth at which they use their people data.



Figure 3-22 Talent Analytics Maturity Model

The first level is the *Operational Reporting*: the situation is reflected via a range of HR measures. It is considered as a must-have for the HR department, and its absence generates a loss of credibility. Examples are turnover rate and costs related to HR. They represent a low value for the organization.

The second is the *Advanced Reporting*: the data gathered and elaborated are almost the same as the previous level, but they are utilized to track trends and the progress towards goals. It gives a frame of the current and historical state of the firm and could be useful for benchmarking.

The third level is the *Advanced Analytics*: the handling of the data is now designed to solve problems and take decisions. The information contained in the two previous levels, associated with statistical analysis, give insights about patterns,

trends and success so aiding in solving business problems. At this level of maturity, the analytics add value to the business, suggesting evidence-based solutions.

The last level is the *Predictive Analytics*: exploiting data of the previous levels and supported by machine learning algorithms, it simulates different scenarios finding optimal solutions. The final aim is to anticipate and satisfy strategic needs with data-driven decisions.

TurinTech is positioning itself at the second level because it started to implement some more advanced analytics, discussed further in this chapter, but is still stalled in employing them just for benchmarking. One of the aims of this thesis has been to provide some instruments and indications to ascend to the third level, starting to employ the indicators to discover significant and useful pattern to follow when making strategic decision in the field of recruitment. The technology employed is really basic and relies on Excel Files, both to store and process data.

3.4 Current Value Stream Mapping

The journey of the candidate and the information flow have already been depicted in the previous paragraphs, what is stressed now is how flows the value throughout the process and this has been done with the Value Stream Mapping Technique (VSM). The study is based on the Job Openings for position by a client, that has happened in the period March – October 2019, and between them were selected only the ones having all the data stored correctly and coherently. Process that have been on hold due to client request, has not been considered, to avoid inflation of the duration. A time analysis has been conducted with the aid of these data and with meetings with the HR department and the BMs. In order to have an estimation of the timeframe of the whole process, information about how many iterations of sub-processes are needed to end the process successfully, and the probabilities associated with each exclusive gateway in the process have been established. The iterations of the sub-process are directly related with the number of profiles needed at each step of the recruitment funnel, so going backward it is

possible to find how many candidates are needed initially. In the VSM, as shown in Figure 3-23 the candidates being processed are treated as work in progress. For each task the time needed has been discussed and where possible has been validated thanks to cross-check of emails, messages and information retained in the DB. In the VSM the Support Activities are represented as separate from the phase they are related to stress out their importance in the whole process. The phase of proposal to the candidate has not been included in the VSM for two reasons, first, the information related to that are not recorded and second, they are affected by big variance. Indeed, the timing of this process depends on the status of the candidate, if he is working or not, and on the client's specific needs. The variability of the activities' duration, as well as the waiting times, are really high, thus making precise estimation of the total duration of the process has not been possible. The method to identify the total time needed has been:

1. Identification of tasks duration
2. Identification of the numerosity of each task or sub-process iterations, thanks to the percentages discovered with the Recruitment Funnel
3. Identification of probabilities associated with the exclusive gateways, thanks to data stored in the database
4. Computation of the duration of each sub-process
5. Calculation of the theoretical completion's time
6. Validation of the theoretical time, thanks to the confrontation with the HR and the comparisons with real completion's times.

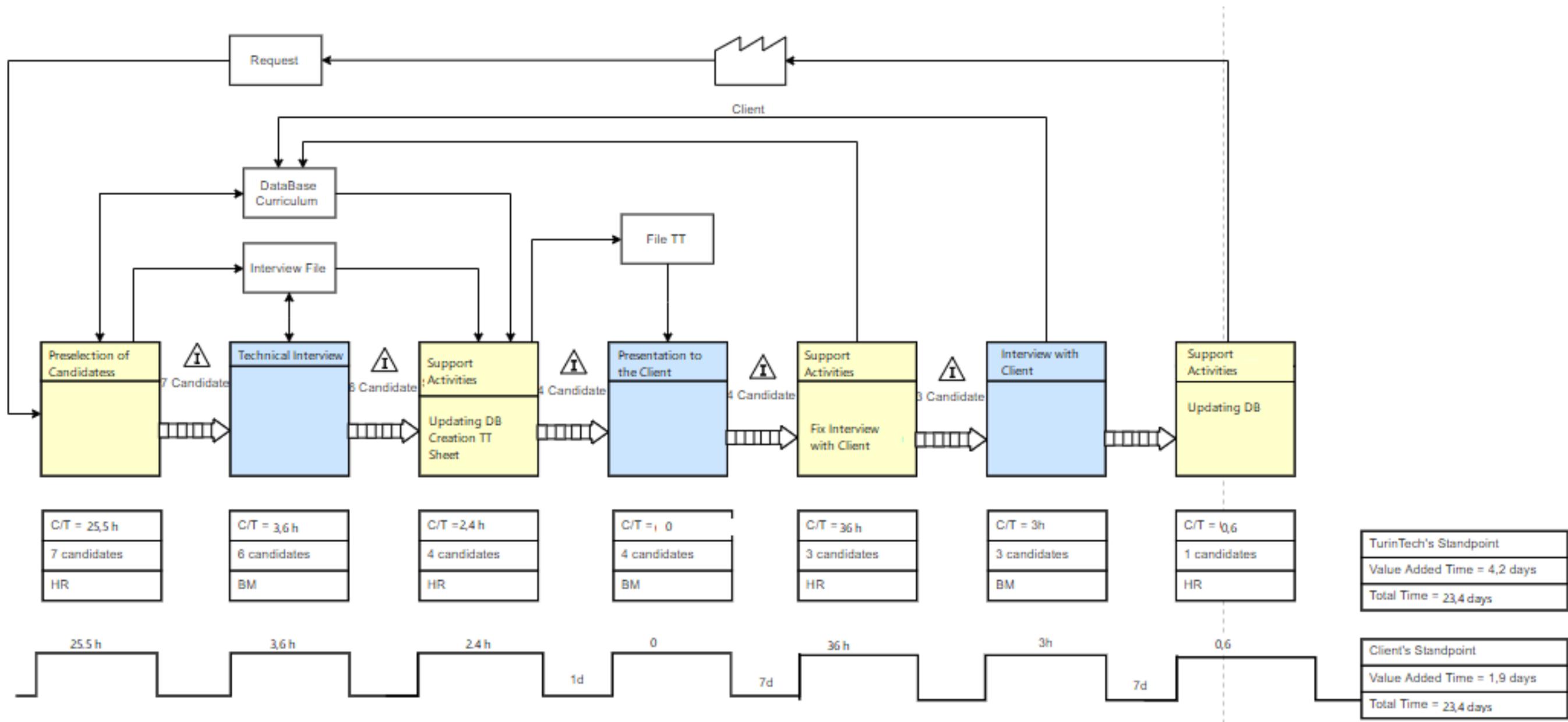


Figure 3-23 Value Stream Map

In Table 3-3, Table 3-4, Table 3-5, Table 3-6, Table 3-7, are given the durations of each task of each sub process and the total corresponds to the duration of the sub process. If the task is iterative, it is associated with the iterations needed, referring to those calculated in Table 3-2, and the time needed to complete the activity will be multiplied for the number of iterations. If the task depends from an exclusive gateway, it is associated also with the probability of taking that specific path during the execution of the process. The probabilities have been found thanks to the data related to the sources of CVs maintained in the DB.

As an example, the total time utilized for the *Preselection of Candidates* is calculated as follow:

$$1h * 7 * 10\% + 3,6h * 7 * 90\% + 0,3 * 7 = 25,5 h$$

The Preselection of the Candidates needs 7 CVs to guarantee a hiring at the end of the process, so the iterations needed are 7. The probability of the tasks has been identified thanks to the data extrapolated from the DB, its composition (further discussed with more detail) has been intended as an estimator of the probability to follow a certain path, therefore they have been used as weights to compute the duration. The probability to find a suitable candidate in the DB has been estimated with the HR, because this information is not tracked in the same DB. It has been accounted that the 10% of the Preselected Candidates was already registered in the DB, for the remaining 90%, a new research was needed. Finally, the total duration of the preselection sub-process needs therefore 25,5 h.

Preselection of Candidates			
Task	Duration [h]	Iterations	Probability
Search in the Database	1	7	10%
Search for New Profile	3,6	7	90%
Exploratory Interview	0,3	7	
TOT [h]	25,5		

Table 3-3 Duration of Preselection of Candidates

Search for a New Profile		
Task	Duration [h]	Probability
Position Published Online	1,0	3%
Direct Search on LinkedIn	4,0	80%
Screening of CVs from Universities	3,0	12%
TOT [h]	3,6	

Table 3-4 Duration of Searching for a New Profile

Technical Interview		
Task	Duration [h]	Iterations
Technical Interview	0,6	6
Updating DB	0,2	6
TOT [h]	4,8	

Table 3-5 Duration of Technical Interview

Presentation to Client		
Task	Duration [h]	Iterations
Creation TT Sheet	0,3	4
Waiting Time	8,0	1
Send TT Sheet to Client	0,0	1
Waiting Time Client's Feedback	56,0	1
TOT [h]	65,3	

Table 3-6 Duration of Client's Presentation

Interview with Client		
Task	Duration [h]	Iterations
Fix Interview with Client	32	1
Interview with the Client	1	3
Updating DB	0,2	3
Waiting Time Client's Feedback	56	
TOT [h]	91,6	

Table 3-7 Duration of Interview with Client

Table 3-8 depicts the General Process duration, just as the summation of the subprocess length, leading to 23,4 days.

General Process Duration	
Task	Duration [h]
Preselection of Candidates	25,5
Technical Interview	4,8
Client's Presentation	65,3
Interview with Client	91,6
TOT [h]	187,2
TOT [days]	23,4

Table 3-8 Duration of General Process

The idle time have been considered in this time analysis.

The duration found is coherent with the real duration of the processes.

The next step in the construction of the VSM has been to identify the Value Adding Activities, the Non-Value Adding not eliminable and the Non-Value Adding eliminable activities, holding in consideration the client's point of view. Due to the particularity of TurinTech, being a consultancy company, it has proven to be necessary to carry out the analysis also from the same company's perspective. The company, actually, could be considered as an internal client of the recruitment process.

3.4.1 Client's Standpoint

The value for the client is the capability of the service to meet its necessity, therefore, to find skilled people, suitable with the organization culture and available to start working.

Taking into consideration the Client's standpoint the VAAs are the activities that drives the 3 selected applicants to the final interview by the client himself: Preselection of 3 Candidates, Technical Interview for 3 Candidates, Interview by the Client for 3 candidates. The Client, indeed, doesn't estimate as value adding the time spent by TT evaluating all the candidates that goes through the funnel. He is not willing to pay for the initial screening, or for the technical interviews made by the BMs of all the candidates that have gone along the process, but only for the 3 candidates that have arrived to him. So out of 23,4 days, total duration of the

recruitment process, only 1,9 days are considered valuable by the client, i.e. the time spent to preselect, interview and present to the client of 3 applicants. The remaining 21,5 days, representing the 92% of the total process time, are NVAs.

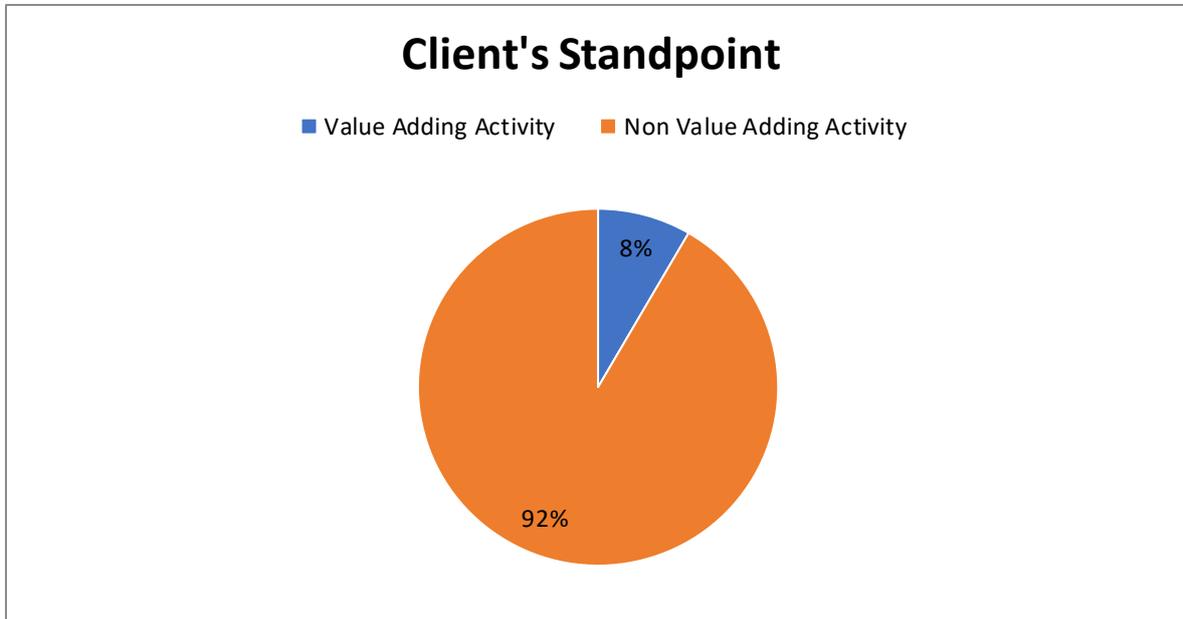


Table 3-9 VAA & NVA from Client's Standpoint

Further examination has been conducted to understand whether there are some eliminable tasks, but due to the current employed technology it is not possible to cut or to speed up the preselection phase and the other consuming time activities are mainly the waiting times due to the client, so not under the direct control of TurinTech.

Table 3-9, depicts how is distributed the ownership of the NVAs, having a great predominance the NVAs owned by the Client.

TT, basing its Recruitment activities on a basic technology such as Excel, couldn't exploit the benefits coming from data-driven decisions or artificial intelligence. The taken decisions are built on gut feelings of the HR and/or BMs. This condition leads to have the Recruitment Funnel (Figure 3-1) previously depicted, with its specific percentages that steers to the numbers of applicants needed at each step, represented in Table 3-2. Shifting to a more advanced technology, based on predictive instruments, would enable to lower the number of needed applicants

at each stage of the funnel, letting the time, needed to accomplish the whole process, decrease. The NVAs owned by the client, are for definition, not under control of TT, but a sensibilization toward the client should be made or a new system based on trust between the parties should be enabled, to shorten the process. More detailed explanations of this trust procedures are left to the following chapter.

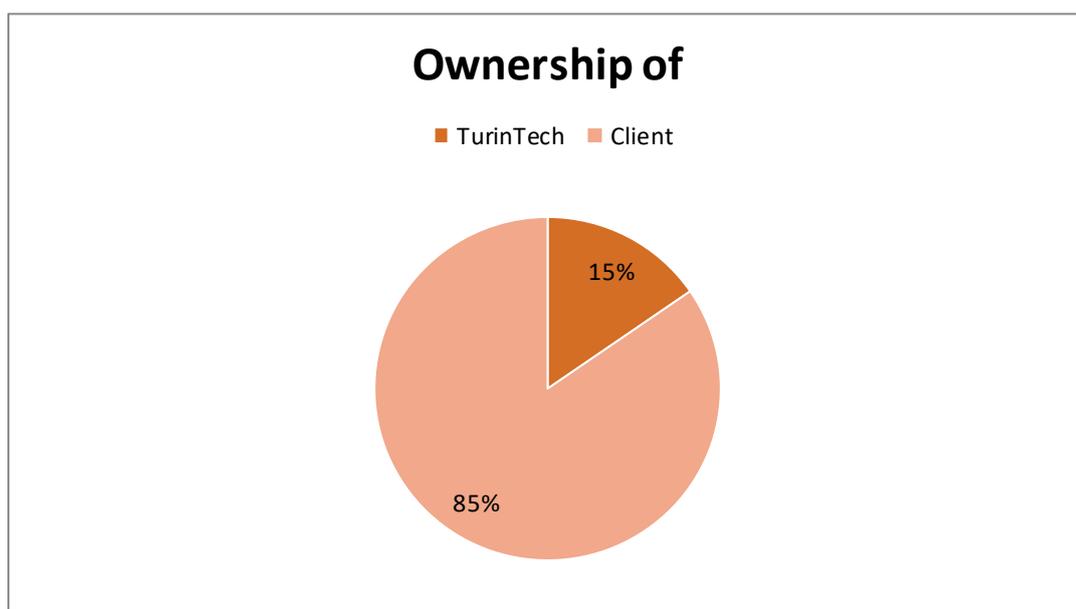


Table 3-10 Ownership of NVA

3.4.2 TurinTech's Standpoint

Changing point of view, also the VAAs and NVAs changes, as well as the value perceived. Indeed, getting the suitable candidate for the specific job opening, represents only a share of the perceived value. For TurinTech, the value results also from the data gathered and stored in the Database, so the VAAs are the interviews for all the candidates that are going through the funnel, and time dedicated to updating the database. The other tasks are all considered as NVAs, but not eliminable.

As it is possible to notice from Table 3-11, the VAAs are slightly major with a value of 4,2 days, with respect to the client's point of view. If analysing the

ownership of the NVAs in Table 3-10, as in the previous paragraph, it will turn out that they are caused mainly by the waiting time due to the client.

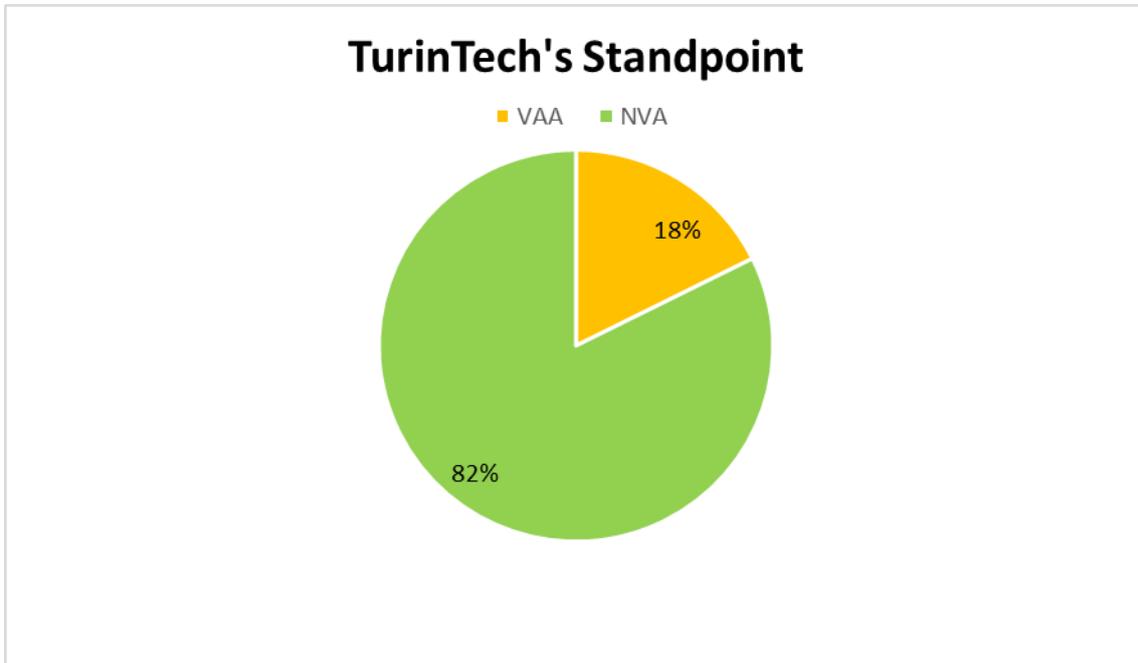


Table 3-11 VAA & NVA from TurinTech's Standpoint

3.5 Identification of the Criticalities

The process in the current state is presenting several minor criticalities, mainly due to lack of standardization.

The first issue, that bothers at a global level the recruitment process, is the absence of a standardized information flow between the different functions of HR's department and/or BMs. This criticality has been identified while studying how is run the process. While screening the DB, it turned out that some information where not coherent. For example, some of the candidates where accounted as already interviewed by the client, but they weren't referred as being presented to the client. For this reason, a more in-depth analysis has been conducted for what concerns the information flow. The first problem arises after the Technical Interview, because for each BM exists a different method to report how this step has gone. Moreover, not necessarily the BMs gives a feedback on the candidates

nor gives back the Interview's Sheet to the HR. This results both in difficulties to store relevant data in the database, and the impossibilities to keep the candidates update on which is their status in the recruitment process. Then, the second problem is originated at the presentation of the candidates to the client. The sending of the TT Sheet, from the BM to the client, doesn't happen concurrently with its receiving from the HR nor the BM notifies the HR of the occurred sending, so it is difficult to keep track of when and if it has happened. This could cause misunderstanding and may lead to forget to send some TT Sheet to the client, or in the best case just cause difficulties in controlling the state of the process. Moreover, the late sending of the TT Sheet may cause a delay in the whole process, that has not been accounted in the computation of the duration because it is considered as not usual. The last communication related problem regards the database, it has a column to track the status of the candidates and is a duty of the HR to change it. Everything flows quiet easily, until the proposal to the candidate, because his answer is not reported to the HR, usually accounted to manipulate the database. So, the status is almost never updated to "hired" or "refuse", causing misleading disinformation. Moreover, these issues will cause waste of time trying to understand or remember what happened in the past with certain candidates.

Being the DB regarded as a valuable tool for TT, since it contains, or at least it should contain, lot of useful data for the company, the media through which these data are gathered has been studied. This tool is the already mentioned Interview's Sheet, where all the relevant notes should be taken. A large number of already compiled documents have been revised and it turned out that the vast majority of them present blank areas. The motivations were investigated by direct discussion with the BMs accounted of their completion and the answers have highlighted 2 main reasons:

- Some areas are dedicated to useless information;
- Some areas require too much efforts to be filled.

Another issue related to the Interview's Sheet is the way of filling it. Every BM has a personal method and preferences on how to gather information and especially, how to summarize them. Someone writes proper words; some others assign a numeric value to assessed characteristics. This constitute a problem in the moment that the HR should transcribe them to the DB.

Another criticality encountered is about the manipulation of the data. In 2019 information of around 800 people were stored, but they are not manipulated. No insights have been extrapolated or trends discovered. There is not a clear aim behind the efforts made to store them, they are just gathered. The unawareness of the possible application of these materials, makes the collection unorganized and untargeted, resulting in messy and incomplete data that are even more difficult to be manipulated in the future to obtain relevant facts.

The last criticality regards the post hiring process, and it is related to disorganization and communication problems. Since there is not a perfect coordination between all the involved parties, it happens that the needed documentation, or the materials such as the workstations are not ready at the right timing. If the on-boarding time is not clearly communicated sufficiently far in advance, the newly hired would not be ready before the on-boarding time.

In Table 3-12, the criticalities are summarized, and it is indicated the phase where they happen.

Criticality	Phase Involved
Information Flow	
Reporting evaluation about the candidate	Technical Interview and Interview by the client
Keeping Track of TT Sheet	Presentation to the client
Keeping track of Candidate status	All phases, but especially Hiring Process
Data Gathering	
Interview's Sheet filling (I)	Technical Interview
Interview's Sheet filling (II)	Technical Interview
Data Manipulation	
Manipulation of Data	all phases
Coordination	
Newly Hired ready before the On-Boarding	Post-hiring Processes

Table 3-12 Criticalities

3.5.1 5 Whys Analysis

In this section the identified criticalities are deepened thanks to the technique of 5 Whys, a lean tool. It consists in asking, ideally, five times why something happens to get the root cause of a problem (Barucca, 2020).

a. Information Flow

Reporting evaluation about the candidate: the BMs doesn't report the feedback to the HR, nor the Interview's Sheet.

- Why? The BMs forget to give a feedback and/or to give back the Interview's Sheet to the HR. The Interview's Sheet is lost a lot of time or it is not known who got it
- Why? There is not a standardized procedure to do that and they don't account as a valuable activity for the business to report the feedback to the HR. Every BM does that according to his personal preferences
- Why? There is not a clear view why the feedback is important for the HR

Keeping Track of TT Sheet: the state of the TT Sheet is not tracked

- Why? BMs don't notify the HR of the occurred sending
- Why? There is not a standardized procedure requiring it and BMs don't know that for the HR is valuable knowing if it has been sent or not
- Why? BMs don't know the aim for which it is valuable

Keeping Track of the Candidate's Status: in the DB the status is not up to date

- Why? Since the candidate reaches the Interview's by the Client's phase, the HR is no more notified about the change of his status
- Why? The HR are retained responsible and therefore interested only to the phases related to the recruitment. In the truth, to understand if their way of working is aligned with the company's view and with what the client is looking for, information of what happens to the candidates after the Interview's by the Client, is vital. For example, if there is a trend of

candidates quitting after three months, they should be acknowledged of that, to understand the reasons standing behind that. Another explication of their interest in the candidate's status is that, in the Preselection of Candidates, they first search in the DB. If the status of each candidate is not up to date, they may call an already hired one, or someone that already reject a proposal

- Why? There is not a clear flow of information nor a clear allocation of responsibilities

b. Data Gathering

Interview's Sheet Filling (I): it presents large unfilled areas

- Why? Some required information in the Interview's Sheet are useless, some others needs to much time and efforts to be filled
- Why? The useless information regards area already investigated by the HR or information not needed for the aim of hiring. For example, the information about the actual job have already been asked by the HR in the Exploratory Interview, but the Interview's Sheet presents an area related to it. Moreover, it presents multiple rows dedicated to knowledge about specific software that may not be needed for the concerned position
- Why? The Interview's Sheet has been drawn up to cope with all the possible interviews that are conducted in TT, without any consideration for the differences among Job Openings, but still maintaining a high degree of specificity

Interview's Sheet Filling (II): the way information is summarized depend on the BM(?)

- Why? No standard has been decided

c. Manipulation of data

Manipulation of Data (I): the percentages calculated so far doesn't produce any insights about the state of the process

- Why? data are not organized or coherent. From the DB results that candidates have been interviewed by the client prior of the presentation to him or that they have never passed through the technical interview. Moreover, the data are full of typos, making impossible an automatic calculation based on Excel's formulas
- Why? BMs don't know which data are needed from the HR, and in which format do they need them
- Why? The aim of the gathering is not clear
- Why? The statistics made thanks to these data are not discussed and shared with the involved parties (BMs and HR)

d. Coordination

Newly Hired ready before the On-Boarding: idle time due to material or permits nor ready within the on-boarding time.

- Why? Lack of communication between the involved parties
- Why? The time needed to complete each operation is not known by all the involved parties
- Why? Lack of clear communication between the parties about how much time is needed to carry out operations
- Why? The interactions are based on what BMs were used to do in the past. Since TT is experiencing a period of significant growth, the time are dilatated due to the increased workload

In Table 3-13 are summarized the criticalities and the root causes, identified thanks to the 5 Whys technique.

Criticality	Root Cause
Information Flow	
Reporting evaluation about the candidate	There is not a clear view of the importance of feedbacks for HR
Keeping Track of TT Sheet	BMs don't know the aim for which it is valuable
Keeping track of Candidate status	Not clear flow of information nor allocation of responsibilities
Data Gathering	
Interview's Sheet filling (I)	Too specific
Interview's Sheet filling (II)	No standard has been decided
Data Manipulation	
Manipulation of Data	Not discussed and shared, Typos in the stored data
Coordination	
Newly Hired ready before the On-Boarding	Based on old standard

Table 3-13 Criticalities and root causes

3.6 Key Performance Indicators

In the preliminary study phase, some indicators have been proposed to the company. The computation of the values is made with reference to the timeframe between January 2019 and November 2019, because previously the needed information was not registered in the DB. The main objective of these indicators is to keep under control the whole process and for this reason the KPI should be assessed at least quarterly. As stated by Boudreau and Ramstad, the identification of appropriate outcome measures needs a deep understanding of the strategy standing behind the processes of recruitment and require the stakeholder (i.e. the BMs) to be strongly engaged in the procedure. Moreover, the gathered data should be the most appropriate and not just the easiest to be measured (Boudreau & Ramstad, 2007). Analysing the criticalities, it turned out that the awareness, among the company, about the importance of data, is really low. Therefore, also the engagement in the data collection is really low.

Initially, these KPI are being utilized as indicators of the process's state of the art, to have insights about its efficiency and effectiveness, to identify where the weaknesses and the room for improvement are localized, afterwards, employed to

track the trend of the process and to make predictive analysis, but also to make a comparison with the previous performances. It has not been possible to calculate all the indicators, due to lack of data or inconsistencies between the information coming from different sources. For most companies, the challenge in HR is simply to use data at all — the reason being that the data associated with different tasks such as hiring and performance management, often reside in different databases (Cappelli, 2017).

The Key Performance Indicators (KPI) identified has been categorized following the indication introduced by Boudreau and Ramstad (Boudreau & Ramstad, 2007). They propose three categories: *Efficiency*, *Effectiveness* and *Impact*.

The KPI linked with the Efficiency are mainly focused on speed and resources to outcomes ratio. They reveal the ability of the HR functions to avoid waste of time and money. On the other hand, measuring only the efficiency of a process could have misaligned results. Indeed, trying to accelerate as much as possible a process could affect its quality. To avoid that, indicators of Effectiveness are introduced. They are aimed at measuring the quality of a process, assessing to what extent the delivered outcomes respect what they were designed for. While Efficiency tries to minimize a single aspect (e.g. cost, time), effectiveness is aimed at balancing more aspects (e.g. time and quality) (Fink & Sturman, 2017). Finally, there should be indicators assessing the Impact on business. These indicators differ from the Efficiency and Effectiveness ones because of the stricter alignment to the company strategy. Table 3-14 below lists the KPI individuated, assigned to the category they own.

Efficiency KPI	Effectiveness KPI	Impact KPI
Time to Fill the Vacancy	Quality of Hire	Candidates to Fill the Vacancy
Time Wasted per Restarting	Hiring Failure Rate	N° of Process Restarting
Days Lost at On Boarding	Qualified Candidates	% of Gained Procurement
	Effectiveness of Source	
	Effectiveness of DB	

Table 3-14 KPIs

To identify these KPI, a study about the generally proposed KPI for HR has been conducted. Some of them have been employed as they were, while others have been adapted at the context of TurinTech.

In the following paragraphs these indicators will be explained and, for those that has been possible, associated with a numerical figure.

3.6.1 Efficiency KPI

The *Time to Fill* (TF) estimates the amount of time needed to accomplish the whole process (van Vulpen, 2017). The computation could be made as:

$$\sum_{i=1}^n t_i \quad \forall i \in \text{phases}$$

It could be computed from the perspective of the company, or from the candidate's perspective. The difference lies in which moment is considered the starting point of the process: for the company the onset is the reception of the client's request, while for the applicant shall be considered the first contact with the company. In the vast majority of cases, they match or at least the difference is of 1 day. This happens because in the very moment the request is received, the HR starts the process, reaching the first candidates. The time to fill resulted to be of about 23,5 days. As already discussed in the VSM, this duration is mainly composed by waiting times for client's feedbacks.

The *Time Wasted per Restart* (TWR) calculates how many days are lost in case of a restarting of the recruitment process due to too little candidates to guarantee a hiring. Computed as:

$$TF_X - \overline{TF}$$

It has not been possible to calculate it, because no useful data were kept, but it represents a significant measure because it highlights the importance of having the right number of candidates at each phase, and if not, the ability to recover.

The *Days Lost at On Boarding* represents how many hours the newly hired spent without the opportunity to perform their work due to missing Entrance Permits or Workstation. It is estimated as:

$$\textit{Day of effective starting} - \textit{Day of theoretical starting}$$

As the previous one, it has not been possible to compute it due to the lack of data. In the future it should be monitored and minimized. Indeed, HLOB is directly related to waste of money due to inactivity of the newly hired and delays. This indicator has been proposed to monitor the relative criticality and to have a higher engagement in keeping it as low as possible.

3.6.2 Effectiveness KPI

The *Quality of Hire* shall represent the fit of the newly hired candidate in the company, considering his performance and the length of his stay in the company. Manifestly, it is impossible to calculate this indicator immediately, but it could be employed as a post-assessment of the effectiveness of the new hiring and thus of the whole project. It wasn't possible to calculate the indicator because in the company doesn't exist an employee evaluation procedure.

The *Hiring Failure Rate* (HFR) could be calculated basing on the Turnover Ratio, discerning the voluntary from the involuntary turnover, and giving special care to the turnover related to recently hired employees (Early Turnover) (van Vulpen, 2017). The general formula for the turnover is:

$$\frac{\textit{Employees who Left}}{\textit{Average N}^{\circ} \textit{ of Employees}} \times 100$$

When computing this figure, it is important to carefully select the kind of "Employees who Left" considered, because otherwise it could be misleading. For example, the retired employees should not be considered in this calculus. The turnover rate has been calculated having little information about the employees who left and their reasons, and it is of 22%. It has been computed considering

average N° of employees working in TT in the period going from March to November 2019 and the N° of employees who left in the same period. Of the 31 outgoing employees, 5 has been hired in the same year, 71% of them were working by the client and the remainder was working at the site of TurinTech. These values emphasise the fact that employees working by the client have major risk to quit the company, because they could get noticed by the client himself and get a proposal to stay by him as internal employees.

The *Qualified Candidates* is an indicator aimed at assessing how many candidates out of the total applicants are qualified for the position they are applying for (Howden, 2019). It is a percentage that could be calculated referring both to the initial number of applicants or to the applicants' number in the earlier stage, depending on the purpose of the needed information. The formulas for the calculation of the KPI are the following:

$$QC_i = \frac{N^\circ \text{ of Approved Candidates}_i}{N^\circ \text{ of Candidates}} \quad \forall i \in \text{phases}$$

$$\text{Relative } QC_i = \frac{N^\circ \text{ of Approved Candidates}_i}{N^\circ \text{ of Candidates}_{i-1}} \quad \forall i \in \text{phases}$$

With regard to the initial number of candidates, the indicator represents the goodness of the total process while, if calculated with regard to the precedent phase it shows if the objectives of each step are aligned among them. This second method aids to investigate, in the case of a low quality of candidates at the end of the process, where the major loss of candidates happens and so, where the improvement should be made. In the table below are represented these percentages. The ones associated with the exploratory interviews are both 100% because the first screening is made at the same time of the research, so all the people who pass through the interview are then sent to the BM. Only who is not available for working doesn't go through the next phase, but no records about them is kept. The timeframe taken into consideration is from March 2019 to November 2019 because no earlier information is present in the DB.

Phase	QC	Relative QC
Exploratory Interview	100%	100%
Technical Interview	90%	90%
Presentation to Client	68%	76%
Client's Interview	51%	74%
Proposal	16%	31%

Table 3-15 Qualified Candidates

For example, considering the percentages related to the Presentation to Client in Table 3-15, the QC = 68% means that, of the initial number of applicants, the 68% is presented to the client. Instead, the Relative QC represents the percentage of the candidates existing in the Technical Interview's phase, that have been presented to the Client, the 76%. These percentages should be kept as high as possible, because they assess the alignment of the parties involved in the process. Going down the recruitment funnel, the Δ QC increases. This situation happens because the recruitment process is affected by a high degree of subjectivity and when a third party, the client, is involved in the process, his subjective preferences influence the choice.

The *Effectiveness of Sources* has to be determined as following:

$$\frac{N^{\circ} \text{ of Hiring}_i}{N^{\circ} \text{ of Candidates}_i} \times 100 \quad \forall i \in \text{sources}$$

The N° of Candidates_{*i*} represents the number of candidates associated with the source *i*, this figure could be derived from the DB, counting how many candidates are stored associated with the source *i*. The N° of Hiring_{*i*} is the number of candidates associated with the source *i* and with the status as *hired*.

Through this calculation it is possible to identify the most effective source in the DB in terms of hiring, further investigation should be done to assess if there is some correlation between the retention rate of the employees and the source they come from, or between the performance and the source (Lauby, 2018). Table 3-16, below shows the sources of candidates and the effectiveness of each source:

Source	N° CV	% CV	Hired	Effectiveness
Direct Research	568	80%	28	5%
Events in University	83	12%	10	12%
Advertisement	20	3%	3	15%
Referral	35	5%	1	3%
Unsolicited Application	7	1%	1	14%
TOT	713		43	6%

Table 3-16 Database Composition

For *Direct Research* is intended the search for passive candidates in platforms such as LinkedIn or Bakeka. The HR direct search for candidates having the required specifications for the job. The *Events in University* is associated with the CVs collected during recruiting days or career days in the Universities. In these kinds of events the gathered CVs are numerous, not all of them will be stored in the DB, but only the most coherent with the company's needs. The curricula associated with *Advertisement* source are the ones received by TT thanks to the publication of Job Openings in platform like LinkedIn or Bakeka. The difference between the *Direct Research* is the type of candidates: Advertisement is associated with active candidates while Direct Research is associated with passive ones. A CV signed as coming from a *Referral* is a CV that has been signalled by someone already linked with TT. The last source, *Unsolicited Application*, is associated with the applicants that send their resumes to TT, without applying for a specific position.

Table 3-16 clearly shows that the primary source for candidates is the Direct Research, that happens because the searched characteristics are usually really specific, and a direct research is the only mean to quickly find them. The effectiveness linked to this source is not the highest, because the passive candidates need a bigger push to change their work. Indeed, the sources associated with active applicants (i.e. Advertisement and Unsolicited Application) experience a higher effectiveness. The effectiveness of the source related to the advertisement is affected by the way of storing the applicants in the DB. Not every CV received by advertisement of Job Opening is stored in the DB. In fact, the applications are first

screened by the HR, and only the candidates meeting the specification will be interviewed and then their information stored in the DB. The effectiveness of this source is only able to capture these figures, related to the CV aligned, and not to all the application received and immediately rejected.

The *Effectiveness of the Database* computed as:

$$\frac{N^{\circ} \text{ of Profiles Found in the Database}}{N^{\circ} \text{ of Research}} \times 100$$

represents how many times out of the total an eligible candidate is found directly in the DB, skipping the Search for New Profile and the Exploratory Interview. This metrics enables HR to quantify the help provided by the DB. It may be used to persuade in making higher investment in it (van Vulpen, 2017). The calculation has not been possible due to the unavailability of data. It could be employed the same estimation utilized to calculate the duration, 10%. It means that out of 10 candidates, 1 could be found in the DB, as it is now. If the information will be gathered and maintained in a better way, this percentage could increase, letting the TF decrease. For example, the BMs could take notes about other possible Job Openings that fit the candidate

3.6.3 Impact KPI

The *Candidates to Fill the Vacancy* (CtF), is a figure that indicates how many applicants are needed to ensure a hiring at each stage of the recruitment process. It can be derived from the % of Qualified Candidates and used to drive the process, facilitating to avoid the need of go backward at the initial stage. The formula for the calculation is:

$$CtF_x = \frac{N^{\circ}_{x+1}}{\%_{x+1}}$$

In Table 3-17, are shown how many candidates are needed for each stage.

N°Exploratory Interviews	N°Technical Interviews	N°Presentations To Customer	N°Customer Interviews	N°Proposals
7	6	4	3	1

Table 3-17 Candidates to Fill the Vacancy

This metric should be assessed in order to have the right number of candidates at each stage, having less means that before finalizing a hire, the process may have to be rerun, having much more means that the company is wasting money and time processing more candidates than needed. The comparison of the how these values evolves in the months could highlight if there have been improvements in the process, as for example a major alignment with client’s desire. The CtF has been regarded as an Impact KPI, because is strongly related to the trust relationship that should be constructed with the client. As the trust will increase, the N° Presentation to the Customer will decrease, as well as the N° Customer Interview. The CtF could be utilized as an estimator of the trust relationship with the client.

The *N° of Process’s Restarting* represents how many times, the pool of candidates is too little in a specific stage to guarantee a hiring and therefore necessitate to go backward in the process to scout other possible applicants. This is a measure of the quality of the process in the extent that it means that something has gone wrong during the process, having not ensured the right numerousness of the pool. At the state of the art of the process, it is not possible to calculate this KPI, because the needed information is not gathered. It doesn’t need a calculation but just be tracked. It is considered as an Impact KPI because directly affects the business of the company, because the longest is the time needed to accomplish the process the highest are the probability that one between the candidate or the client has found another work or consultant.

The last indicator of the process’s quality is the *% of Gained Procurement*, calculated as:

$$\frac{N^{\circ} \text{ of Gained Procurements}}{N^{\circ} \text{ of Procurements}} \times 100$$

For procurements are intended the Job Opening by a possible client that goes through a competitive bidding process. These Job Opening needs particular consideration because if the procurement is lost, will be lost also the efforts done for that recruitment process. Indeed, while for a Job Opening directly required to TT, in the end a hiring will be made, for the procurement this is not ensured. This indicator is thought to help to identify whether the efforts, in terms of time and cost, to scout possible candidates to be presented for procurements, are worth it or not.

3.7 5s

To deploy some enhancements the lean tool of 5S have been implemented. The 5S, called pillar to remind their function of sustainment, are:

- *Seiri – Sort*: eliminate everything that is not needed in the working position, keep just the essential
- *Seiton – Set in Order*: the essential should be maintained in the correct place, to ensure immediate recovery
- *Seiso – Shine*: ensure keeping work areas clean
- *Seiketsu – Standardize*: create standards for organization and processes, by implementing continuously *Seiri*, *Seiton* and *Seison*.
- *Shitsuke – Sustain*: sustain the new practice introduced

This technique has been applied to the recruitment process, to enhance it.

3.7.1 Seiri – Sort

The working position for the recruitment process has been intended as the tool allowing to carry out the work. As discussed in the criticalities, the Interview's Sheet presents unfilled areas. Or, rather, the BMs just fill the area related to the notes and sometimes the part about the skills. A new Interview's Sheet has been proposed where the useless space related to the actual work have been eliminated. The specificity of the hard skills has been eliminated too. Previously, the top of the page was unexploited, as well as the rows dedicated to non-relevant software for the specific position. Moreover, it happened lot of time that the software needed for the specific position had not been foreseen in the format, and the BM should add it in the notes. That was causing difficulties in the readability of the Interview's Sheet. In the new designed one, the BMs is the responsible to decide and write down, directly in the area dedicated to the knowledge of software highlighted in green in **Errore. L'origine riferimento non è stata trovata.**, which software should be assessed.

3.7.2 Seiton – Set in Order

The second pillar states that the essential has to stay in order. This principle could be applied in many aspects of the recruitment process in TT.

In the Interview's Sheet, highlighted in blue in **Errore. L'origine riferimento non è stata trovata.**, a specific space is dedicated to the record of feedbacks. This facilitates the readability of the Interview's Sheet, reducing the time to transcribe it in the DB and avoiding possible mistakes. Previously, the feedback was written in the notes or at the top of the page or was just communicated orally.

Another section has been introduced in the Interview's Sheet, aimed at collecting in an orderly manner evaluation about the soft skills. This area has been signed in red in **Errore. L'origine riferimento non è stata trovata.**. The evaluations are based on a numerical scale and will guarantee an ordered collection of them.

Moreover, this new collection method will support the ranking method that is presented in Chapter 4.

Another example, is the updating of the Candidates' Status in the DB. These data should be kept in order, in the sense that should be updated and reflect the truth. The status of the candidate is needed to calculate how the Database is composed and its Effectiveness. If the information is not properly stored, the derived information will be misrepresented.

Not least, all the information's flow has been ordered. The procedure to communicate the tracking of the candidate have been decided and shared among the parties, enabling an organized information exchange.

3.7.3 Seiso – Shine

In this study, the cleanliness has been associated with the DB. The information is stored in a messy way, and lot of typos are present, for example in the sources there were references to "Politecnico di Torino" and "PoliTo". Being an Excel File, to support any kind of calculation, the data should be formatted in the same way. These typos have been cleaned in the column regarding the Source, the Degree and the Status.

The cleaning has enabled the introduction of a new page in the DB, where its composition and its effectiveness is automatically calculated and updated every time a new candidate is registered. Without cleaned information, the automatic calculation would not have been possible. The tables and graphs related are shown in Figure 3-24.

Fonte	Cv Reperi	%CV repe	Assunti	%Assunti	Efficienza Fonte
Ricerca Diret	568	80%	28	65%	5%
Eventi Scuole	83	12%	10	23%	12%
Annuncio	20	3%	3	7%	15%
Referenze	35	5%	1	2%	3%
Candidatura	7	1%	1	2%	14%
TOT	713		43		6%

ricerca diretta					
FONTE	CV reper	%CV repe	Assunti	%Assunti	Efficienza Fonte
Linkedin	308	54%	14	50%	5%
Database	10	2%	2	7%	20%
Universita'	250	44%	12	43%	5%
tot	568		28		5%

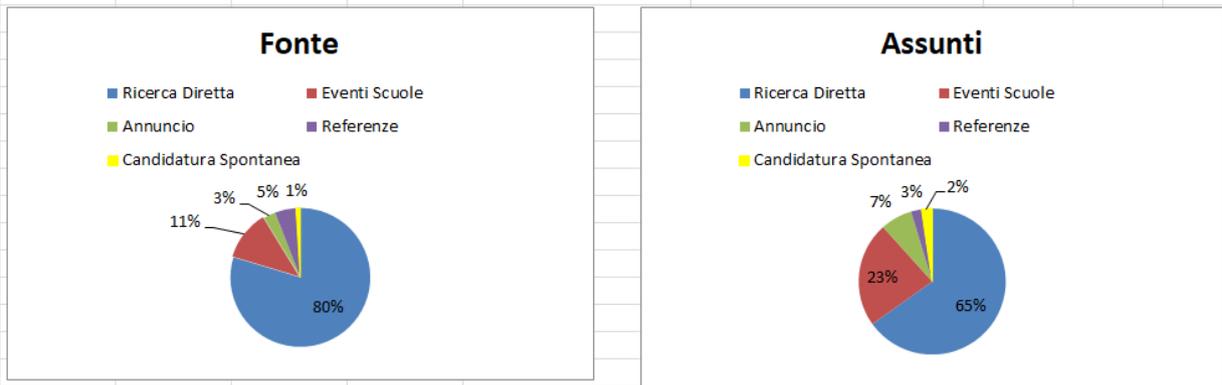


Figure 3-24 Database: Sources composition

3.7.4 Seiketsu - Standardize

Have been defined the function accountable for the updating of the DB, assigning to the HR the task. The flow of information to make it possible have been defined and standardized. The KPI introduced have been explicated to the BMs and HR, to make clear the scope of the data gathering and the most proper way to collect them.

3.7.5 Shitsuke - Sustain

This last pillar is based on the engagement of people involved in the processes, but also of people standing at the top of the hierarchy. It is possible to pursue the continuous improvement only if the people are highly involved in following this aim.

		SCHEDA COLLOQUIO										ID	...
COGNOME	NOME	SOCIETA' ATT.											
TEL.	MAIL	POSIZIONE											
ANNO DI NASCITA/ETA'	ISTRUZIONE		FONTE CV										
TIPOLOGIA PROFESSIONALE <input type="checkbox"/> DISIGNATORE <input type="checkbox"/> PROGETTISTA <input type="checkbox"/> P.C. <input type="checkbox"/> T.L. <input type="checkbox"/> P.M. <input type="checkbox"/> CALIBRATORE <input type="checkbox"/> PERFORMANCE <input type="checkbox"/> AMMINISTRAC.		LIVELLO <input type="checkbox"/> TECNICO <input type="checkbox"/> GESTIONALE <input type="checkbox"/> 1/5 <input type="checkbox"/> SENIOR <input type="checkbox"/> EXPERT											
COLLOQUIO		1		2		3		4					
DATA													
REFERENTE													
LUOGO ATTUALE		DISP. A TRASFERIRSI <input type="checkbox"/> SI <input type="checkbox"/> NO		DISP. A TRASFERIRSI <input type="checkbox"/> SI <input type="checkbox"/> NO		FLESSIBILITA' ORARIA <input type="checkbox"/> SI <input type="checkbox"/> NO							
CONOSCENZA TECNICA													
CONOSCENZA SOFTWARE		1.		4.									
		2.		3.									
		3.		5.									
NOTE													
SOFT SKILLS													
COMPETENZE COMUNICATIVE		1 - 2 - 3 - 4 - 5		ABILITA' DI CAPIRE E RISPONDERE		1 - 2 - 3 - 4 - 5		NOTE					
FLESSIBILITA'		1 - 2 - 3 - 4 - 5		TEAM WORKING		1 - 2 - 3 - 4 - 5							
LINGUE													
INGLESE		A1 - A2 - B1 - B2 - C1 - C2		ALTRO		A1 - A2 - B1 - B2 - C1							
ATTUALE SITUAZIONE CONTRATTUALE													
IMBARCAMENTO/ RAL													
PRETTIVO													
LIVELLO													
PROPOSTA													
ACCETTAZIONE		SI <input type="checkbox"/> NO <input type="checkbox"/> DATA		ACCETTAZIONE DIREZIONE		SI <input type="checkbox"/> NO <input type="checkbox"/> DATA		BENEFIT		DATA			
ASSERZIONE		SI <input type="checkbox"/> NO <input type="checkbox"/> DATA		TEMPO INDETERMINATO		SI <input type="checkbox"/> NO <input type="checkbox"/>							
FEEDBACK				FEEDBACK CLIENTE									

Figure 3-25 New Interview's Sheet

3.8 Conclusion

The study of all the processes involved in the Recruitment and Selection has enabled the understanding of all the dynamics and interactions involved. At the beginning of this work, the roles and the responsibilities were not clearly defined among the parties involved. This confused situation has caused communicational problems, that on their behalf have led to a poor flow of the information about the state of the processes.

The graphical representation of the processes has favoured the understanding of the different phases and tasks that are required to hire an employee. Making clear the steps involved, the flows of information needed have been better understood by the participants. Moreover, the representations have enabled to identify what should be controlled to verify the state of the processes, concretizing in the identification of the KPIs.

Then, thanks to the instruments provided by the lean approach, it has been possible to evaluate the “wastes” that take place in these processes, with the VSM, and their root causes, with the 5 Whys. Finally, some enhancement has been introduced thanks to the application of the 5S.

CHAPTER 4 MULTI CRITERIA DECISION METHODS: FROM LITERATURE TO TURINTECH

The aim of this chapter is to review some frameworks employed in Personnel Selection, that are already discussed in the literature, and to find the most suitable to be applied to the TurinTech's context. The reason is to avoid any subjective opinion to influence the choice of the applicants, or to reduce at its minimum the subjectivity in-built in the process. Having a systematic approach allows to demonstrate the relationships between selection criteria and predictors, satisfying the requirements of being an objective and non-discriminatory procedure and resulting in selecting the best candidate (Stone, Human resource management, 1998). The ambition is to construct a reliable tool that allows the reduction of the *CtF* (i.e., *the candidates to fill the Job Opening*) in general, but especially during the phases with the interaction with the client. In the future, this method could be employed, in accordance with the client, as "*Quality Assurance*". Basing on defined procedure, it should generate trust in the client that may decide, in a first phase to eliminate the Presentation to the Client and in a second one to directly accept the candidates without interviewing them. Before putting forward the method to the client, it should be tested and verified its validity. Until now, the method is still in construction, because the criteria driving the acceptance of the applicant by the

client are not clearly defined. In the following paragraphs the methods and their relative case studies, that could be implemented in TurinTech, have been analysed. The last section is dedicated to a proposal for TurinTech's case.

4.1 Literature review of Multi Criteria Decision Making (MCDM) applied to Personnel Selection

Nowadays the business environment is fast-changing and complicated, leading the selection and recruitment process to be critical. A poor selection of personnel has severe consequences such as unsuccessful performance in the job and it imposes extra cost to the company, as for example training costs (Aswathappa, 2008). Technological changes, globalisation, social trend and changes in the organization of work have brought new challenges in the field of personnel selection. The traditional *modus operandi* is no longer effective and should be reconsidered. Basing on stable jobs and focused on individual performance, the classic methods are not suitable for the fast-changing modern jobs, where the teamwork and the change of work roles are very frequent (Lievens, van Dam, & Anderson, 2002). These methods generally come to a conclusion on the basis of the subjective judgment of decision-maker, which makes the accuracy of the results highly questionable (Dağdeviren, 2008).

Personnel selection is the process of choosing certain qualified candidates to fit to do the job flawlessly among many others who have applied for a given job in the company. With the increasing competition in the global market, modern organization face great challenges. The future survival of companies depends mainly on the contribution of their personnel to companies (Zhang, 2011). Organizations are always in the seek for powerful and reliable methods to recruit and hire the appropriate people to match their needs. Moreover, one of the greatest problems faced with the usual selection methods, is the halo effect, defined as the tendency of the interviewer to be influenced in his or her assessment

by one of the attributes of a candidates, such as being good-looking (Gibney & Shang, 2007). Other clouts are made by the first impression, contrast effect and similar-to-me effect (Anderson, 1993). Another criticism mounted against the traditional interviews is that candidates actively alter their behaviour to conform to perceived organizational values (Judge & Ferris, 1992). On the other hand, the value for the employer related to the social character of the traditional recruitment practices should be maintained in consideration (Townley, 1989).

The consideration of multiple criteria is needed in the recruitment and usually these criteria are conflictual. So being the personnel selection a multi-dimensional problem, the MCDM should be taken into consideration. Having, also, most of these criteria a qualitative nature, associated with vagueness and complexity when defined, the fuzzy theory could be associated with the MCDM.

In the scientific literature are present various studies where a MCDM technique is employed to cope with the problems of the traditional selection and recruitment methodologies. Some studies are only based on the application and comparison of different MCDM tools, completely neglecting the conventional methods. Jasemi & Ahmadi introduce in their article a novel fuzzy ELimination Et Choix Traduisant la REalité (ELECTRE) based method, employing the ELECTRE to choose the best action between a set of action and the fuzzy logic to tackle with the uncertainties due to verbal expression employed (Jasemi & Ahmadi, 2016). Fan & Wu propose an evaluation method that combines Analytical Hierarchy Process (AHP) and Grey Relational Analysis to identify which university designs the most appropriated curriculum to satisfy hiring needs (Fan & Wu, 2009). Widianta & Al propose a comparison of four MCDM methods for employee placement, i.e. AHP, Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), Simple Additive Weighting (SAW) and Preference Ranking Organization Method for Enrichment Of Evaluations (PROMETHEE), offering a ranking of them (Widianta, Rizaldi, & Setyohadi, 2017).

The application of MCDM methods in the recruitment field has not widely been associated with other already existing HR techniques, depriving the recruitment from the advantage of already existing methods. A study that takes in consideration these two sides is made by Zarei & Wong. They present a two-phase approach, that couples the qualitative tools with the quantitative ones, having a first HR-based step and a second MCDM-based one. Each phase is aimed at eliminating the shortcomings of the other phase (Zarei & Wong, 2014).

4.2 MCDM techniques

Multi-Criteria Decision Methods is a sub-discipline of operations research, employed to evaluate multiple conflicting criteria in decision making processes. When different options shall be appraised, it is typical having to manage conflicting criteria. In the day to day life, these kinds of decisions are taken basing on the intuition (Rew, 1988). Giving the problem a specific structure allows to take better informed decisions.

MCDM have experienced a great increase in their exploitation since the 1970s, both because of the implementation of new techniques and the improvement of the old ones. Their applicability varies from real world decisions to more complex decision analysis. Usually they are classified in:

- *Multiple-criteria evaluation problems*: a finite number of alternative possible solution is known from the beginning of the solution process
- *Multiple-criteria design problems*: the alternatives are not explicitly known.

For the purpose of this thesis, the study will be focused on the first class of problem. Indeed, the MCDM is intended to determine the best candidate out of a set of possible ones, already known.

4.2.1 AHP

The AHP makes a prioritization of the hierarchy and consistency of judgment's data given by a group of Decision Makers (DM). The output of this process is a final decision, where the evaluations of all the DMs involved are incorporated thanks to pair-wise comparisons of the alternatives (Fan, Tsai, & Lee, 2008). The AHP allows to break down the problem into several sub-problems, then it allows to solve them, providing an overall solution. The method allows to assign a priority to a set of different decisional alternatives or to establish a connection between criteria coming from qualitative and quantitative evaluations, that are not directly comparable, combining multidimensional scale of measurements into a single scale of priority. (Saaty, 1980) (Figueira, Greco, & Ehrgott, 2005). The result of the process is therefore a ranked list where the DM could select the best alternative.

The process consists in 4 major steps:

- Definition of the hierarchy
- Completion of pair-wise comparisons
- Synthesis
- Consistency check.

In the first step, the goal is identified and may be split into sub-goals to give a clearer image of the problem. Then, the criteria that make possible the satisfaction of the goal should be defined and finally the alternatives should be listed (Saaty, 1990). Referring to a recruitment problem, the goal is the recruitment of the most suitable candidate, the criteria are the characteristics he has to meet, and the alternatives are the candidates themselves.

The second step, the pair-wise comparisons, is the heart of the AHP.

Defining A_i each alternative, a_{ij} the value coming from the comparison between alternative i and j and n the total number of alternatives compared, generating $\frac{n(n-1)}{2}$ comparisons. Generally, the evaluation scale taken in consideration is the

one outlined in Figure 4-1. The matrix $A_{n \times n}$, being positive and reciprocal, contains these values

$$A_{n \times n} = \begin{bmatrix} 1 & a_{12} & \dots & a_{1n} \\ a_{21} & \ddots & a_{ij} & \vdots \\ \dots & a_{ji} = \frac{1}{a_{ij}} & \ddots & \dots \\ a_{n1} & \dots & \dots & 1 \end{bmatrix}$$

Pair-wise comparisons are made until all the alternatives have been compared, and a matrix is created for each criterion. These matrices are called *pair-wise comparison matrices of alternatives*. Another matrix, called *pair-wise comparison matrix of criteria*, is created and contains the comparisons among criteria.

Values in the matrix $A_{n \times n}$ are characterized by the following properties:

1. If $a_{ij} = a$, then $a_{ji} = 1/a$, with $a > 0$
2. The principal diagonal of the matrix $A_{n \times n}$, i.e. $a_{ii} = 1$.

Intensity of importance on an absolute scale	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
3	Moderate importance of one over another	Experience and judgment strongly favor one activity over another
5	Essential or strong importance	Experience and judgement strongly favor one activity over another
7	Very strong importance	An activity is strongly favored and its dominance demonstrated in practice
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order of affirmation
2, 4, 6, 8	Intermediate values between the two adjacent judgments	When compromise is needed
Reciprocals	If activity i has one of the above numbers assigned to it when compared with activity j , then j has the reciprocal value when compared with i	
Rationals	Ratios arising from the scale	If consistency were to be forced by obtaining n numerical values to span the matrix

Figure 4-1 Absolute Scale of Importance (Saaty, 1990)

Once the matrix $A_{n \times n}$ has been obtained, the synthesis could be made. It consists in the normalization of all the pair-wise comparison matrices of alternatives found in step 2, by dividing the value of each column by its sum and then taking the

average of the values in each row. The result for each matrix is a vector representing the priorities of alternatives with respect to their corresponding criterion. These vectors are joined, forming a new matrix called *preference matrix*. These actions are made also for the pairwise comparison matrix of criteria, creating a vector called *criteria matrix*. The preference matrix and the criteria matrix are multiplied, establishing a ranking of the alternatives.

The final step involves the check for consistency within the model. Humans are considered to be unable to cope with more than seven categories simultaneously, for this reason each element of the hierarchy must be assumed not to exceed seven elements. Above this constraint, reasonable comparisons could be made, and their consistency could be maintained (Saaty, 1990). To assess the consistency of the matrix $A_{n \times n}$ some index and their relative tolerance limit, already adopted in the literature, shall be identified. With reference to what Saaty states in his article “*How to make a decision: The Analytic Hierarchy Process*”, the *Consistency Index* (CI), is the value obtained with this formula:

$$CI = \frac{\lambda - n}{n - 1}$$

Where λ could be computed as the summation of the elements of the *criteria matrix* multiplied for the sum of the column of the *pair-wise comparison matrix of criteria* and n represents the number of criteria involved.

If $CI = 0$, the process is perfectly consistent. Else, determine the *Consistency Ratio*

$$(CR) = \frac{CI}{RI}$$

where RI is the random index obtained from Table 4-1. If $CR < 0.1$, consistency is guaranteed.

RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49
n	1	2	3	4	5	6	7	8	9	10

Table 4-1 Random Consistency Index

4.2.2 ANP

The *Analytic Network Process* (ANP) is the generalization of the AHP, and it has been developed because some decision-making problems cannot be structured hierarchically being some lower level elements interacting with higher level ones and depending from them (Saaty, 1996). Saaty states that “For instance, not only does the importance of the criteria determine the importance of the alternatives, as in a hierarchy, but also the importance of the alternatives may have impact on the importance of the criteria”.

The ANP requires three steps:

1. Creation of a pair-wise matrix evaluating all proposed criteria (as for AHP), neglecting the interdependence among them. Once the comparisons have been completed, the synthesis is done, finding the criteria matrix, w_2 . See AHP for further detail.
2. Resolution of the effects due to the interdependence between criteria, by analysing the impact of each criterion among the others. Pair-wise matrices are formed for each criterion. Matrix B is composed by vectors representing the synthesis of interdependence matrices.
3. Interdependence weights are obtained by synthesizing the results as follows:

$$w_c = Bw_2^T$$

The outcome of the process is a ranked list of the alternatives.

4.2.3 TOPSIS

The *Technique for Order of Preference by Similarity to Ideal Solution* (TOPSIS) is a MCDM that has been developed by Hwang and Yoon in 1981 (Hwang & Yoon, 1981). The ideal solution has the shortest geometric distance from the positive ideal solution (PIS), and the longest geometric distance from the negative ideal solution (NIS) (Assari, Mahesh, & Assari, 2012).

The TOPSIS is based on the following steps:

- Construction of a decisional matrix, $D = \begin{bmatrix} f_{11} & \cdots & f_{1n} \\ \vdots & \ddots & \vdots \\ f_{m1} & \cdots & f_{mn} \end{bmatrix}$

Each row is dedicated to an alternative A_i , $i = 1, 2, \dots, m$; each column is dedicated to a criterion F_j , $j = 1, 2, \dots, n$; f_{ij} is the value indicating the performance rating of each alternative

- Calculation of the normalized decision matrix $R = [r_{ij}]$, where

$$r_{ij} = \frac{f_{ij}}{\sqrt{\sum_{j=1}^n f_{ij}^2}}$$

- Calculation of the weighted normalized decision matrix as:

$$v_{ij} = w_j \times r_{ij}, j = 1, 2, \dots, n; i = 1, 2, \dots, m$$

where w_j is the weight of the j th criterion

- Determination of the PIS and NIS as:

$$PIS = \{(max_i v_{ij} | j \in J), (min_i v_{ij} | j \in J')\}$$

$$NIS = \{(min_i v_{ij} | j \in J), (max_i v_{ij} | j \in J')\}$$

where J is associated with positive criteria and J' with negative ones

- Calculation of the L^2 -distance between each alternative and both, the PIS, D_i^+ , and NIS, D_i^- .

$$D_i^+ = \sqrt{\sum_{j=1}^n (v_{ij} - v_j^+)^2}, i = 1, 2, \dots, m$$

$$D_i^- = \sqrt{\sum_{j=1}^n (v_{ij} - v_j^-)^2}, i = 1, 2, \dots, m$$

- Calculation of the relative closeness of each alternative and the ideal solution as:

$$C_i = \frac{D_i^-}{D_i^- + D_i^+}, i = 1, 2, \dots, m$$

Where $0 < C_i < 1$. The larger the value, the close to the ideal solution

4.2.4 Multi-Attribute Modelling

Multi Attribute Modelling implies the subdivision of the problem into smaller, more manageable sub-problems. The structure, as it is possible to see in Figure 4-2, is hierarchical: higher levels depends on the lower ones.

Each option (i.e. applicants, in the case of personnel selection) is described associating to it a value for each attribute. To take the decision, the DM, will evaluate each option thanks to a utility function, $F(x_1, x_2, x_3, \dots, x_n)$. This utility function is defined by the DMs and it represents their goals. Thanks to the utility function the options are ranked, and the best one could be identified by the DM (Greco, Matarazzo, & Slowinski, 2002).

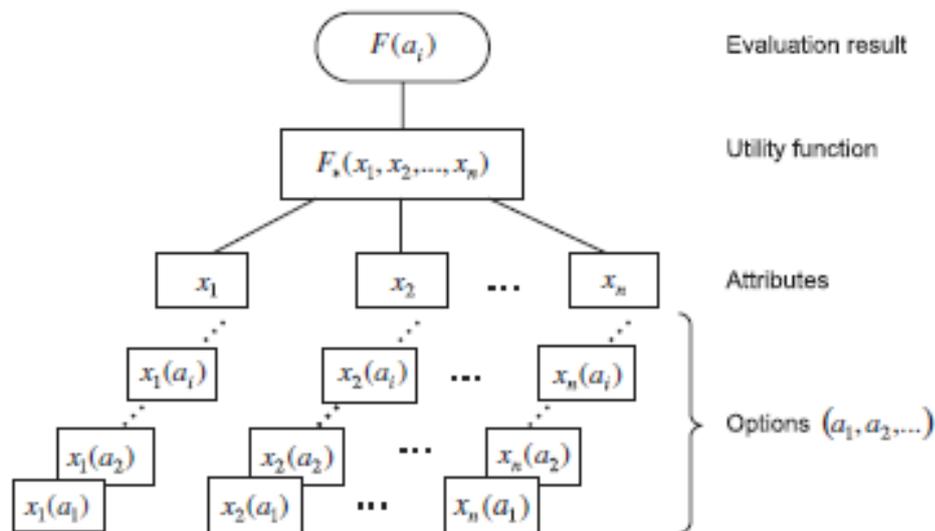


Figure 4-2 Multi-Attribute model (Jereb, Rajkovic, & Rajkovic, 2005)

4.3 Model in literature

The following section is dedicated to the analysis of some of the model already present in the literature, that have been successfully implemented in a business context.

4.3.1 HR methods + AHP

Zarei and Wong propose in their article *“Making the recruitment decision for fresh university graduates: A study of employment in an industrial organisation”* a model that relies both on the traditional HR methods to recruit personnel and on the ability to make consistent decision deriving from the AHP. Their model consists in two phases, the first one HR-based while the second one relies on a MCDM, specifically AHP.

Each phase eliminates the shortcomings of the other: in phase I the applicants are reduced, making possible and quick the application of the AHP, while in phase II, AHP makes possible to eliminate or at least reduce the halo effect, that would have been present if only phase I were run.

In Figure 4-3, it is possible to see a representation of the proposed model. First, a job analysis is conducted in order to encounter the needed specification, then a preliminary screening of the CVs is made, to select who meets them and will face the interview. Just the most eligible candidates keep going through the process, and they will be ranked thanks the AHP were the criteria are a sub-set of the specifications found with the job analysis.

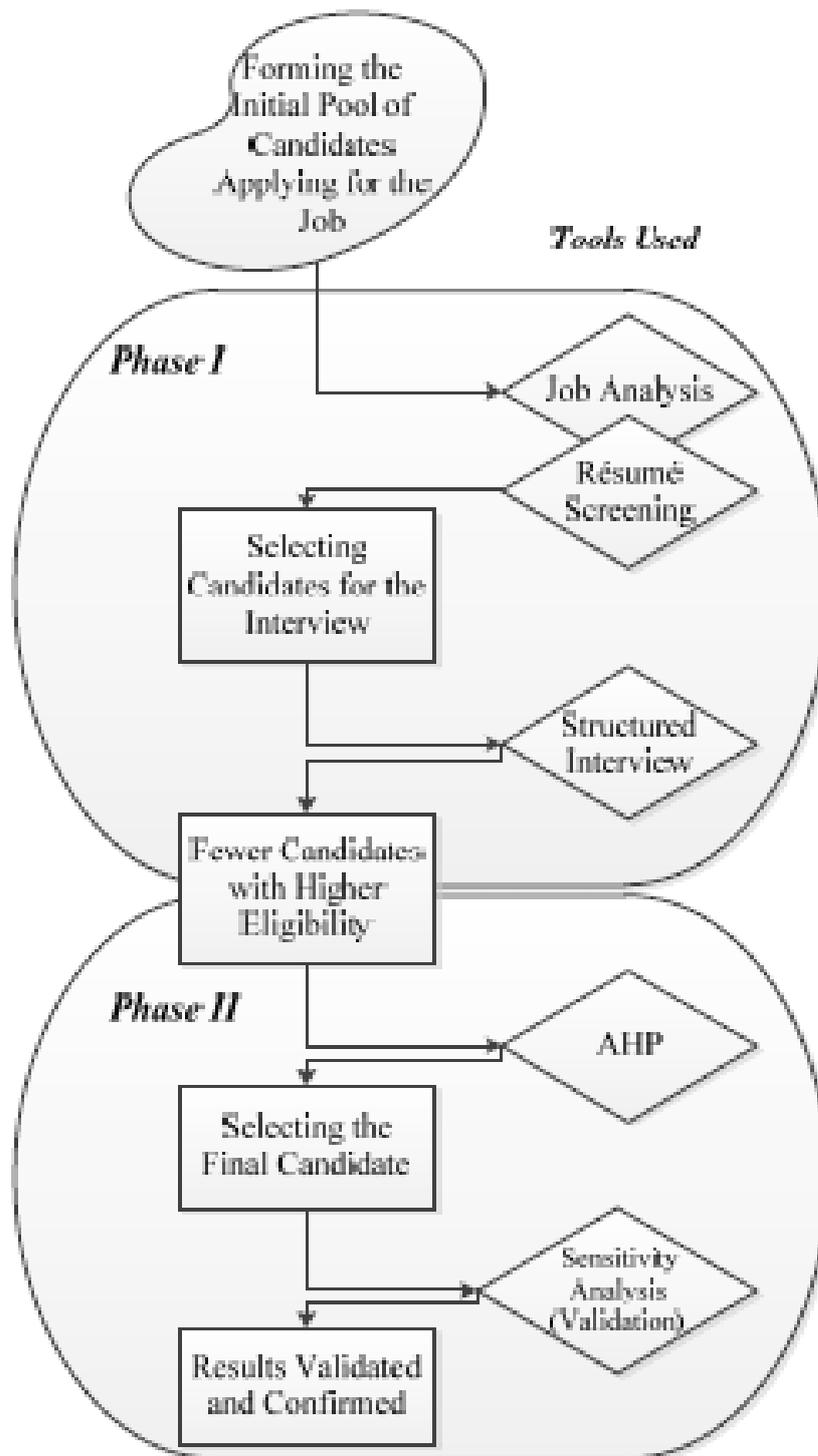


Figure 4-3 Multi Attribute Model (Zarei & Wong, 2014)

4.3.2 Model in the Literature: ANP + TOPSIS

Dağdeviren proposes in his article a hybrid model, where the ANP and TOPSIS are run in succession. The ANP is devoted to find the criteria, their weights and to establish the dependence among them, the TOPSIS is included to shorten the process. Indeed, without the help of this second tool, a large number of matrices should be constructed to get the ranking of the applicants. More precisely, to run a full ANP, when the n criteria have already been assigned with a weight, $n \cdot m \cdot (m - 1)/2$ pair-wise comparisons should be carried out, where m are the alternatives (i.e. the applicants) (Shyur, 2006). The introduction of the ANP, as a substitute of the previously employed AHP, in the personnel's selection is due to the fact that the specifications searched could not be assumed as independent. Therefore, the omitted dependency among criteria, when using the AHP, leads to imprecise ranking of applicants (Dağdeviren, 2008).

Figure 4-4 shows the steps needed for the proposed framework.

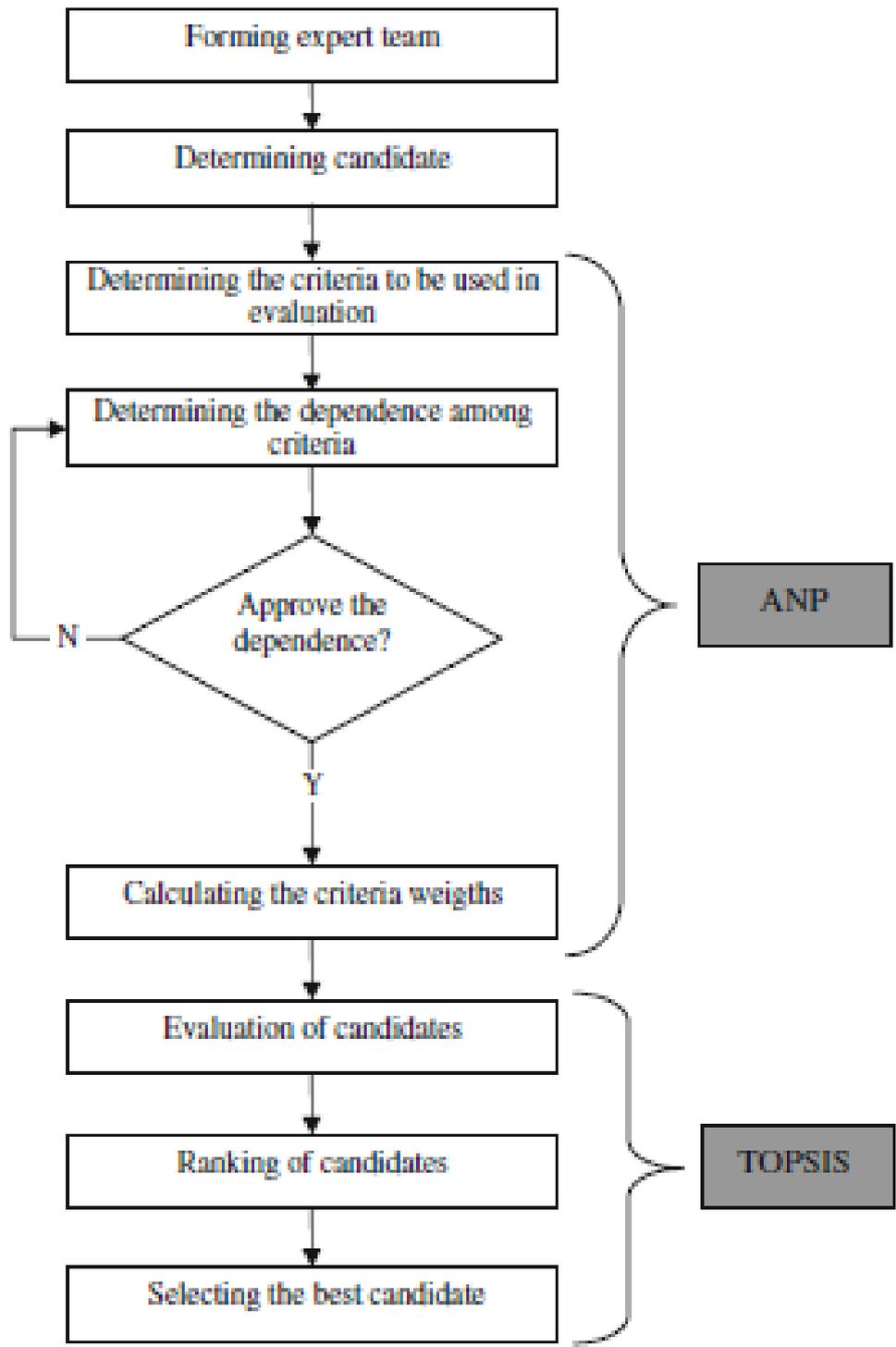


Figure 4-4 ANP and TOPSIS Method (Dağdeviren, 2008)

4.3.3 DEXI and Multi-attribute Modelling

Jereb, Rajkovic U. and Rajkovic V. in their paper “A Hierarchical Multi-Attribute System Approach to Personnel Selection” offer a framework based on Multi-Attribute hierarchical model and implemented via an already existing information technology, DEXi. This tool, developed with the collaboration between Jozef Stefan Institute and the University of Maribor, allows to acquire the model structure, the decision rules and check their consistency, to describe, evaluate and analyse the options and finally to explain the evaluation results. The inputs required are a tree structure, the utility functions to aggregate sub-attributes into upper attributes on the hierarchy and the options (i.e. the candidates). The stages to solve the problem are listed in Figure 4-5.

The modelling is the most time-consuming and difficult part of the framework, here lays the foundations for the good solution of the problem. The decomposition of the problem should be defined, as well as the relevant attributes and the relationship among them. Then, the utility functions shall be mapped. DEXi allows the evaluations of options that have not the complete set of attributes defined. The options are evaluated in a bottom-up way, giving as a result an evaluation value, that is the product of the decision rules. The following step is the option analysis, thanks to what-if analysis techniques, sensitivity analysis and selective explanations ones. Finally, the decision is taken and supported via graphical explanations.

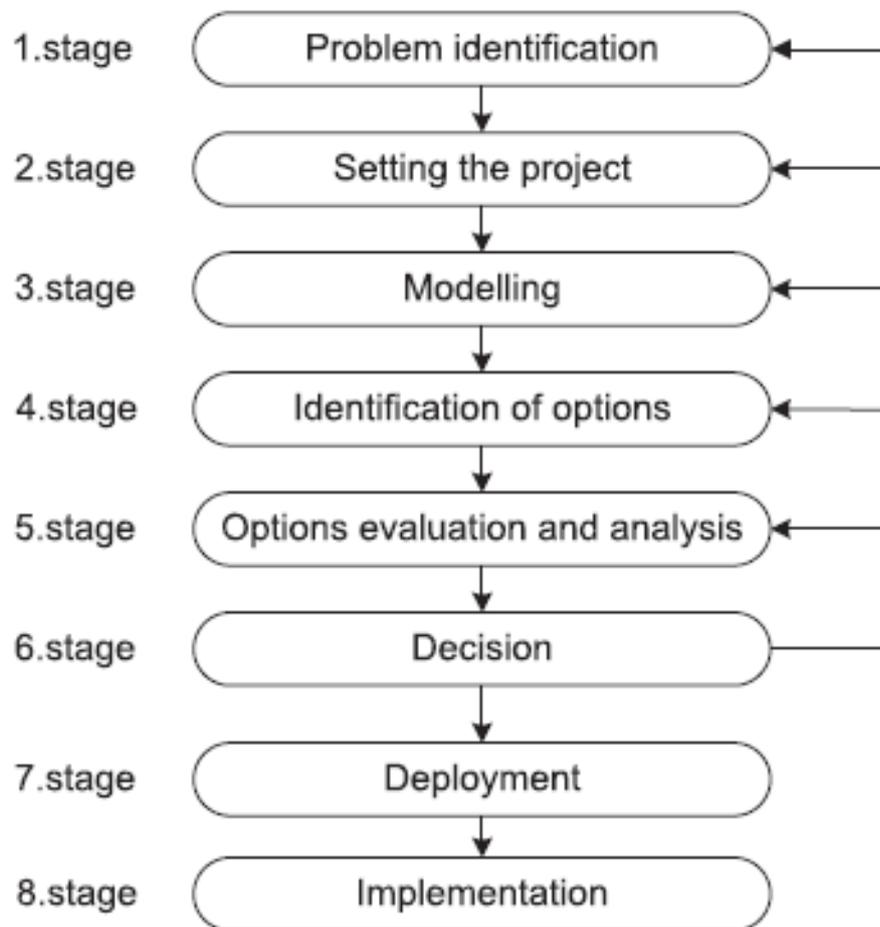


Figure 4-5 Multi-Attribute Modelling and DEXi (Jereb, Rajkovic, & Rajkovic, 2005)

4.4 Comparison of the Framework

The framework introduced previously are of great interest, because all of them allow the reduction of the halo effect and being structured processes bring with them a higher degree of certainty. Of the model found in literature, the one applying Fuzzy Logic have been immediately discarded, being too difficult to be comprehend and applied. The instrument needed in TurinTech is something really simple to be understood and especially to be carried out, in order not to charge the recruiting process, and so the HR and BMs, with more workload. Table 4-2 depicts the main advantages and disadvantages of the analysed models. The last two rows

are dedicated to two discarded framework that are too complicated for being applicable in TT.

Model	Advantages	Disadvantages	References
HR techniques + AHP	Quick, reduce the halo effect, do not require specific knowledges or abilities	Do not consider the dependence among factors nor deal with verbal expression	(Zarei & Wong, 2014)
ANP + TOPSIS	Taking into account the dependence among factors, shortened thanks to TOPSIS	Do not deal with verbal expressions	(Dağdeviren, 2008)
MAM + DEXi	Graphical support and explanation of results	Need of a complex modelling phase	(Jereb, Rajkovic, & Rajkovic, 2005)
GRA + AHP	Ability to cope with vague information	Too complicated to be approachable in TT	(Fan & Wu, 2009)
GRA + Fuzzy	Allows to deal with imprecision in the expression of criterion, translating verbal expression into numerical ones	Need of 2 DMs, too complicated to be approachable in TT	(Zhang, 2011)

Table 4-2 Models' Comparison

Also the model applying MAM with the aid of DEXi is a too complex approach toward the problem, because it needs a long phase of implementation through a software that first needs to be learned. The two frameworks remaining are the one based on AHP and ANP + TOPSIS. Their greatest advantage is that once the pair-wise matrix of criteria has been created, the performance of the methods is really fast and could be supported by Excel Files pre-programmed.

4.5 Proposed framework in TurinTech

A sustainable framework should start with traditional techniques. The initial part of Preselection of Candidates could not be substituted, because it represents a peculiarity of TT, related to the kind of Job Openings it has. Indeed, since it requires specific skills or knowledge, it is mainly based on search of passive candidates that presents the characteristics sought. Once the initial pool of candidates has been

composed and screened thanks to the Exploratory Interview, and the Technical Interview, a MCDM tool could be applied. The choice stands between ANP and AHP. The aim of the application is to have a ranking of the candidates, and thanks to it, bring to the client just the most eligible. The introduction of the new procedure shall consist in these steps:

- Finding of the most suitable techniques
- Validation of the technique
- Proposal to the client and elimination of the Presentation Phase
- Proposal to the client to accept basing on trust thanks to the quality assurance generated through the procedure.

In phase 1, two group of people were involved: the *problem owners*, i.e. the BMs, being the one that should make the final decision and the *experts*, i.e. the BMs and the HR, being the knowledgeable in the field of the decision. The collaboration with them has driven to the construction of the structure and the identification of the criteria. The implementation of the decision-making aid should run parallel to the introduction of structured interviews and the new *Interview's Sheet* (presented previously). In its application, the tool, needs some information about the applicants that could only be produced during the Exploratory and Technical Interviews. The information gathered should be finalized at assessing the criteria that will be processed by the tool itself. To support that, the new Interview Sheet proposed facilitate and focalize on certain areas the operations of data's collection. The collaboration between the parties involved was based on meetings, brainstorming, interviews and questionnaires.

Phase 2 will consist in a silent application phase. The procedure will be carried out, without the client being acknowledged, and verifying if the results of the procedure are consistent with the final choice of the client. The discrepancies should be taken as opportunities to upgrade and refine the method.

In the third phase it will be possible to experience the first real benefit: avoiding the presentation to the client, also the NVA linked with the waiting time for the

feedback are avoided. Therefore, the time to complete the recruitment process will be sharply reduced.

The fourth phase will represent the major contraction in terms of time possible, as permitted by the context of TT. Here will be eliminated also the Interview by the Client, avoiding the waiting time related to the feedback.

To make it possible, a relationship based on trust should be constructed between client and TT. This will be easier if the decisions are taken basing on systematic procedures and data. In this way the judgements made could be supported by hard fact and explicated more easily, generating trust in the counterpart.

4.5.1 Implementation

First, a subassembly of Job Opening has been selected as recipient of the framework. Position requiring really specialized profile have been discarded, because usually the candidates respecting the essential features are really low and do not need to be ranked. Another requisite of the subset was the possibility to comprehend more Job Openings possible, without losing its soundness. Finally, the ensemble identified is the one whose intent is to hire recently graduated. Assuming that for equal degree, they all possess the same technical skills, they should be evaluated mainly basing on soft skills. This allows to enlarge the subgroup to all the position reserved for newly graduated without any regard if it is a position related to a Mechanical Engineer rather than a Managerial one. The technique applied has been the simplest one, the AHP because to introduce and gaining acceptance, the framework should be the easiest and least time consuming possible. When its soundness and usefulness has been proven, it could be upgraded and made more complex. For example, the interdependence among criteria could be held into account in the future, or the fuzzy logic could be introduced. The aim is to find a framework capturing the decisions of the client.

Then, a list of criteria, being regarded as indicative of the quality of the candidate, has been drafted. The 8 criteria found have been reported in Table 4-3.

Cr 1	Proficiency in oral communication	Cr 2	Ability to understand and answer
Cr 3	Ability to work in a team	Cr 4	Previous experience
Cr 5	Flexibility	Cr 6	Hard skills
Cr 7	Fluency in a foreign language	Cr 8	Problem-solving skills
Cr 9	Degree		

Table 4-3 Criteria

Not all of these criteria have been introduced in the developed framework. Some specifications are so important, that if not met, causes the rejection of the candidate during Exploratory Interview and/or Technical Interview. Examples of these specifications are the *degree*, *hard skills* and *fluency in a foreign language*. If these traits are wanted and specified by the client, respecting them represent the base to be considered in the process of recruitment. Hence, they are not included in the AHP framework. The *problem-solving skills* have been accounted by the BMs too difficult to be assessed in a way that reflects the truth with the only media of the Exploratory and Technical interview, therefore this criterion won't be considered in the framework as well. Finally, Cr1 to Cr5 will be comprised in the framework. A BMs and the HR were involved in the construction of the *pair-wise comparison matrix of criteria*. The scale employed in the evaluation is the absolute scale of importance introduced by Saaty (1990).

Table 4-4 shows the pair-wise comparison, while Table 4-5 shows the results of the synthesisation. The pair-wise comparison has been made evaluating the criteria in the optic of what is sought after by the client. In other words, evaluating what drives the acceptance of the candidates by the client.

		Cr 1	Cr 2	Cr 3	Cr 4	Cr 5
Proficiency in oral communication	Cr 1	1,00	0,20	0,20	0,33	3,00
Ability to understand and answer	Cr 2	5,00	1,00	1,00	5,00	7,00
Ability to work in a team	Cr 3	5,00	1,00	1,00	3,00	7,00
Previous experience	Cr 4	3,00	0,20	0,33	1,00	1,00
Flexibility	Cr 5	0,33	0,14	0,14	1,00	1,00
<i>Sum</i>		14,33	2,54	2,68	10,33	19,00

Table 4-4 Pair-wise comparison matrix of criteria

		Cr 1	Cr 2	Cr 3	Cr 4	Cr 5	Criteria Matrix
Proficiency in oral communication	Cr 1	0,07	0,08	0,07	0,03	0,16	0,08
Ability to understand and answer	Cr 2	0,35	0,39	0,37	0,48	0,37	0,39
Ability to work in a team	Cr 3	0,35	0,39	0,37	0,29	0,37	0,35
Previous experience	Cr 4	0,21	0,08	0,12	0,10	0,05	0,11
Flexibility	Cr 5	0,02	0,06	0,05	0,10	0,05	0,06

Table 4-5 Aggregation of pair-wise

The vector, called *criteria matrix*, represents the priorities of the different criteria. It results that the most important characteristics are *Cr 2* and *Cr 3*, followed by *Cr 4*.

The consistency of the results was checked:

$$\lambda = 14,33 * 0,08 + 2,54 * 0,39 + 2,68 * 0,35 + 10,33 * 0,11 + 19,00 * 0,06 = 5,37$$

$$CI = \frac{\lambda - n}{n - 1} = \frac{5,37 - 5}{4} = 0,92$$

$$CR = \frac{CI}{RI} = \frac{0,092}{1,12} = 0,08$$

RI has been taken from Table 4-1.

The consistency is ensured.

To check the soundness of the model, it has been applied to a Job Opening already filled. Four candidates have been presented to the client (C1, C2, C3 and C4), finally only one has been hired (C4). Table 4 - 6 to Table 4 - 10 represent the pair-wise matrix for each criterion. The priorities associated are the priority of each candidate in relation with the specified criterion.

To facilitate the computation of the matrix, in this experimental phase, each candidate was associated with a value for each criterion. The values have been deducted by notes taken by the BMs and are represented in Table 4-6.

	Cr1	Cr2	Cr3	Cr4	Cr5
C1	3	4	2	5	3
C2	4	4	3	3	4
C3	4	4	4	1	2
C4	1	2	4	5	2

Table 4-6 Evaluations

The values are on a scale from 1 to 5, where 1 is the lowest and 5 the highest values possible.

In the future, the new Interview's Sheet employed will facilitate the completion of this work, because it presents a structure where the BMs could directly sign the evaluation for each criterion, on the same scale base.

Cr 1	C1	C2	C3	C4	PRIORITIES
C1	1,00	0,33	0,33	3,00	0,15
C2	3,00	1,00	3,00	5,00	0,49
C3	3,00	0,33	1,00	5,00	0,29
C4	0,33	0,20	0,20	1,00	0,07
sum	7,33	1,87	4,53	14,00	CR = 0,1

Table 4-7 Cr 1 Proficiency in oral communication

Cr 2	C1	C2	C3	C4	PRIORITIES
C1	1,00	1,00	1,00	5,00	0,313
C2	1,00	1,00	1,00	5,00	0,313
C3	1,00	1,00	1,00	5,00	0,313
C4	0,20	0,20	0,20	1,00	0,063
sum	3,20	3,20	3,20	16,00	CI = 0

Table 4-8 Cr 2 Ability to understand and answer

Cr 3	C1	C2	C3	C4	PRIORITIES
C1	1,00	0,33	0,33	0,20	0,08
C2	3,00	1,00	1,00	0,33	0,20
C3	3,00	1,00	1,00	0,33	0,20
C4	5,00	3,00	3,00	1,00	0,52
sum	12,00	5,33	5,33	1,87	CR = 0,02

Table 4-9 Cr 3 Ability to work in a team

Cr 4	C1	C2	C3	C4	PRIORITIES
C1	1,00	5,00	7,00	1,00	0,43
C2	0,20	1,00	5,00	0,33	0,14
C3	0,14	0,20	1,00	0,14	0,05
C4	1,00	3,00	7,00	1,00	0,38
sum	2,34	9,20	20,00	2,48	CR = 0,08

Table 4-10 Cr 4 Previous Experience

Cr 5	C1	C2	C3	C4	PRIORITIES
C1	1,00	0,33	3,00	3,00	0,25
C2	3,00	1,00	5,00	5,00	0,55
C3	0,33	0,20	1,00	1,00	0,10
C4	0,33	0,20	1,00	1,00	0,38
sum	4,67	1,73	10,00	10,00	CR = 0,02

Table 4-11 Cr 5 Flexibility

All these pair-wise comparisons are consistent.

The *preference matrix* has been created, and it is shown in Table 4-12.

	Cr 1	Cr 2	Cr 3	Cr 4	Cr 5
C1	0,15	0,31	0,08	0,43	0,25
C2	0,49	0,31	0,20	0,14	0,55
C3	0,29	0,31	0,20	0,05	0,10
C4	0,07	0,06	0,52	0,38	0,10

Table 4-12 Preference Matrix

To get the ranking of the candidates It has been multiplied for the *Criteria Matrix*, so the final ranking is shown in Table 4-13.

Candidates	Value	Ranking
C1	0,23	3°
C2	0,28	1°
C3	0,23	3°
C4	0,26	2°

Table 4-13 Ranking

Following this method, the most eligible candidate would have been C2. Instead, the candidate that have been hired is C4, being the second in the ranking.

Thanks to the interaction with BMs and HR, the reasons for the failure have been identified. The BMs have discussed with the client the specification that represents the greatest interest for them. Finally, the misjudgement was discovered as having underestimate the previous experience of the candidates.

Being the major clients of TT big companies related to the automotive field, for them it is really valuable having a previous experience in a structured company, because it ensures that the candidates already know how the dynamic in big companies are.

The pair-wise comparisons of criteria have been deployed one more time, under this perspective. The new pair-wise comparison matrix of criteria is shown in Table 4-14.

Unnormalized pairwise criteria matrix		Cr 1	Cr 2	Cr 3	Cr 4	Cr 5	Criteria Matrix
Proficiency in oral communication	Cr 1	1,00	0,20	0,20	0,20	3,00	0,92
Ability to understand and answer	Cr 2	5,00	1,00	1,00	1,00	7,00	3,00
Ability to work in a team	Cr 3	5,00	1,00	1,00	1,00	7,00	3,00
Previous experience	Cr 4	5,00	1,00	1,00	1,00	7,00	3,00
Flexibility	Cr 5	0,33	0,14	0,14	0,14	1,00	0,35
	<i>Sum</i>	16,33	3,34	3,34	3,34	25,00	CR = 0,02

Table 4-14 New pair-wise comparison matrix of criteria

The new ranking will be the one showed in Table 4-15, in accordance to the preferences of the client.

Candidates	Value	Ranking
c1	0,26	2°
c2	0,25	3°
c3	0,19	4°
c4	0,29	1°

Table 4-15 New Ranking

The framework proposed doesn't ensure 100% the right candidate, and it needs to be refined to mirror in the best possible way the client's preference, but it surely constitute a ground from where to start.

Possible enhancements are the switch to an ANP, where the relationships among criteria are considered. For example, the proficiency in oral communication and the ability to work in team are correlated, as well as the flexibility and the ability to understand and answer.

4.6 Conclusion

The framework proposed, if correctly implemented, could produce large time savings. Avoiding the *Presentation to the Client* and the *Interview with the Client* mean to eliminate the two NVA activities that are responsible of about the 80% of the total duration of the processes.

The duration of the general process will be 15,23 days, as showed in Table 4-16, when the *Interview by the Client* will still happen and 3,79 days, as showed in Table 4-17, when the *Interview by the Client* is eliminated.

General Process Duration TO-BE with Interview by the Client	
Task	Duration [h]
Preselection of Candidates	25,5
Technical Interview	4,8
Interview with Client	91,6
TOT [h]	121,9
TOT [days]	15,23

Table 4-16 General Process Duration TO-BE with Interview by the Client

General Process Duration TO-BE	
Task	Duration [h]
Preselection of Candidates	25,5
Technical Interview	4,8
TOT [h]	30,3
TOT [days]	3,79

Table 4-17 General Process Duration TO-BE

Here it has not been considered the time needed to run the AHP, because it has not been possible to estimate the real time that will be needed in the future when the framework will be definitely defined.

CHAPTER 5

CONCLUSION

The following paragraphs are aimed at assessing the expected benefits for the company object of the thesis, coming from the proposed framework and, analysis. Then, will be analysed the limitation of this work due to the nature of the processes involved. Finally, will be suggested the steps that TurinTech might follow in the future

5.1 Expected benefits for TurinTech

The first expected outcome, coming from this work, is an improvement of the internal information flow. The BPMN models developed in Chapter 3, from Figure 3-9 to Figure 3-16, have enabled a wider and complete understanding of the processes by the different people involved. Having a full view of how the processes are run and how the value flows through the tasks, have sensitised the parties involved. This has immediately resulted in an improved information flow.

Second, thanks to the identification of KPIs, the Recruitment and Selection Processes will be easily kept under control. This control is useful both for the operative staff, that directly run the tasks, and for the managerial one that supervise the outcomes. The former, are interested in the operative indications

supplied by the KPIs, as for example the *Candidates to Fill the Vacancy*, while the latter care about having a view about how develops the KPIs over time.

Finally, the benefit that will have the greatest impact will be due to the implementation of the framework proposed in 4.5. The method, if applied will permit a contraction of about 35% of the *Time to Fill the Vacancy*, when the *Presentation to the Client* is skipped. Indeed, 65,3 h out of 182,2 h will be saved for each Job Opening. In a second stage, when the *Interview with the Client* will be avoided too, the time contraction will be of about 80% with respect to the initial duration, resulting in an additional reduction of 91,6 h.

5.2 Limitations of the Work

This work presents its share of limitations. The economic aspects related with the Recruitment and Selection processes has not been covered. Therefore, the possible monetary benefits related to the proposed improvement could not be accounted for.

A precise time analysis of the processes relying on the new framework has not been possible, due to the early stage of the implementation. The framework is still in a fine-tuning phase, characterized by trial and error procedures that requires long time. Once the process will be better defined and agreed with the client, these time-consuming activities, won't be executed. For this reason, making an estimation of the duration connected with the performing of the framework presented in Chapter 4, will lead to an overestimation of the time needed for it and, therefore, to an underestimation of the savings in terms of time.

Other limitations are concerned with the employment of the AHP in the framework proposed in TurinTech. On one hand, it is the easiest MCDM that could be implemented, and that matches with the needs of TurinTech, but on the other hand it doesn't consider the interdependence existing among the criteria employed for the candidates evaluation and that it is not perfectly suitable for judgements based on verbal expressions.

5.3 Next Steps for TurinTech

The action that TurinTech should carry out in the future are concerned with maintaining the control over the KPIs identified in Chapter 3, and constantly updating the DB. These actions will allow a deeper understanding about what the clients wants, enabling the alignment of the criteria used in the framework with client's expectations.

TurinTech shall keep working in the direction of constructing a trust-based relationship with its clients, as to make them accept to avoid the phases of *Presentation to the Client* and *Interview with the Client*.

For what concerns the Lean Management, TurinTech shall keep utilize the tools provided, seeking for the continuous improvement as stated in the *Shitsuke*. This work has provided an application of Lean Management in a specific aspect of HRM, now it's up to the company to assimilate the methodology and apply it to others.

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