"SMART PICTURES" OF ITALIAN BANKS' HUMAN CAPITAL: A SOFTWARE TOOL FOR MAPPING COMPETENCES AND PLANNING TRAINING COURSES

A. Boldi¹, E. Ciuffa², L. Pavone³, B. Romani⁴, G.B. Ronsivalle⁵

¹ WeMole srl (ITALY)
² Engineering SPA (ITALY)
³ Capitaneria di Porto di Civitavecchia (ITALY)
⁴ Ministero dell'Economia e Finanze (ITALY)
⁵ University of Verona (ITALY)

Abstract

Organizational changes lead Italian financial institutions to review their HR (Human Resources) management model. Therefore, banks need to reorganize themselves in order to rationalize and automate their processes, involving both HR and Training department. A significant starting point for this development is the implementation of an innovative method to map the skills, which should be also capable of giving a complex and clear "snapshot" of the Human Capital, so to preserve its complexity and its dynamic nature.

Currently Italian banks, which do not have an educational mission, analyse skills with methods and instruments which are developed in different institutions and domains of knowledge.

These tools have some particular characteristics: they are attributable to paradigms which are often in contrast, they mix “regulatory” (objective) methods with “based on the person” (subjective) methods. Furthermore, they are mostly built according to a linear measurement system and they are not well calibrated since the organizational context is different.

Basing on this approach, banks implement practices which are often ineffective in defining the criteria for the selection, mobility and training processes, since HR manager also have to consider the industrial relationships in their decision-making.

As an alternative to this view, we propose a new perspective both on the skills and the method to analyse them. According to this theoretical framework, skills are a) nonlinear, b) reticular and c) dynamic entities. More specifically, we define them as: a) "emergent properties" of a series of observable behaviors, which b) are placed and connected among them, according to a distributive logic c) in a defined time period.

Moreover, we believe there are two more levels of "explanatory emergency": 1) any professional profile is the non-linear combination of multiple skills; 2) human capital is the result of a topological distribution of cognitive-behavioral assets which are associated with professional profiles.

In order to manage this complexity, we have developed a software tool allowing us to represent human capital in a two-dimensional space within which the different features are placed: these elements occupy a specific area depending on the “intensity” levels of the distinctive skills of their role.

We have tested this hypothesis and the tool in analysing the Italian Banking System, using our software to generate "smart pictures" of the human capital considered as a whole: behavioral cognitive assets were placed inside different areas of the map, depending on their properties.

The software integrates a Self-Organizing Map of Kohonen – an Artificial Neural Network - trained by the administration of the FBA Fund data describing each professional-type profile, the so-called "best performers".

In our opinion, the tool has two potential and interesting applications:

1. It could support the HR department during the whole recruitment process: designing training plans, reorganizing educational activities and certificating new professional profiles;
2. It could process the data resulting from the assessment procedures currently used, focusing on the set of knowledge/ability to locate the position of a candidate within the map.
Of course, the model can be extended to other industrial and organizational contexts, according to the specific job profile (knowledge, abilities and skills) related to different professional backgrounds.

Keywords: Competences, skills, SOM, neural network, software, bank, training, HR.

1 INTRODUCTION

The current transformation of the Italian banking sector requires banks to optimize the processes of recruitment, evaluation and development of human resources. Such optimization implies an improvement in the mapping models of the competences that each professional profile must have in order to properly carry out their business within the bank. In fact, competences play a strategic role both in defining the criteria for placing human resources in the different functional areas of the company, as well as in planning courses, individual development plans and certification.

On the other hand, the transformation of the business model, the cross-checks of supervisors and the impact of new technologies have questioned the traditional view of “competence” and its effectiveness in the management of human resources in banks. The proliferation of new technical knowledge in international taxation and risk management, the inevitable contamination of technical and managerial skills, the emphasis on financial and capital advice and, finally, the need for a more consistent interpretation of the new economic-social scenarios complexity imply banks overcoming the “linear” conception of competences. This interpretation focuses on the atomic, parallel and distributed character of cognitive and behavioral assets based on the performance of a bank employee.

Banks do not develop internal know-how on this topic, in fact they import guidelines, tools and methods from different disciplines, typically from pedagogy and psychology. On the other hand, the indications from these sectors are not capable of integrating the qualitative and quantitative features of competences, effectively reifying the demarcation.

The fragility of the epistemological foundation of such competence models emerges, particularly, during the assessment: the assessment centers, tools widely used by most organizations, are based on the use of two different methodologies, which refer to conflicting theoretical paradigms. The results of the application of normative methods (such as simulation, observation in situ and attitudinal tests) and person-centered approaches (assessment interviews, skills portfolio, skill scales) are "summed up" to return a unique description of the person, according to a typically linear logic.

When a competence assessment triggers decision-making processes affecting the future of people, it becomes necessary to develop a solid and specific theoretical model and tools that enhances and promotes a more ethical treatment for people. In this perspective, we propose to develop a software tool for analysis of the knowledge/skills network, based on a topological representation of the bank’s human capital through the distribution of different profiles or roles within a two-dimensional map with different levels of intensity.

The project therefore aims to define an innovative mapping model, based on a nonlinear, reticular and dynamic interpretation of the organization’s competences. For us, "competence" is an emerging property of a series of behaviours that can be observed, connected with each other, according to a distributive logic, in a defined time interval. We also consider two additional levels of “explanatory emergency”: 1) each professional profile is the non-linear combination of multiple skills; 2) human capital is the result of topological distribution of cognitive-behavioural assets associated with professional profiles.

According to this view, organizational competences can be considered as observable, comparable objects within a two-dimensional map that graphically translates the concept of "organization’s human capital" based on rigorous mathematical models.

2 METHODOLOGY

Our goal is to define a model to efficiently support the HR function in the selection of banking staff, in the definition of training plans (which is equivalent to the distance between the position occupied by the individual and the expected focal point), in the reorganization of the Corporate activities and in the certification of new professional profiles.

In more concrete terms, this map that can provide operational answers to the following questions:
in which "point" of the map of the bank's human capital is located the human resource X (new hire, resource to convert or relocate)?

- How much is the human resource "X" far from the position of the best performer, on the specific professional profile?
- How much should I invest in training and development paths to fill the gap and resize the "distance" from the best performers?
- What is the "optimal path" of training for resource "X", that is aspiring to cover a given profile within the map?

2.1 The state of the art: the EQF-FBA model

Currently, besides the dimensional classes, the structural features and the territorial diversity, the human resources management in the banking sector is based on the commercial banks' qualification model developed by the FBA Fund (Banks and Insurances Fund) starting from the EQF scheme (European Qualifications Framework).

The model describes in detail the 69 core qualifications of an Italian commercial bank through a declaration of 81 knowledge and 24 capabilities of each professional profile (Compliance Manager, Private Manager, Small Business Manager, Credit Manager, etc.). Specifically, the description of each qualification includes both the list of distinctive knowledge and capabilities, and the precise indication of the expected EQF levels (0 = knowledge / capacity not required at 5 = maximum value).

Therefore, the EQF-FBA model describes the ideal identikit of each qualification through a multidimensional vector (at 105 dimensions) and through the values associated with each variable (the expected levels) - identifies the 69 best performers (the ideal profiles) that can effectively support the bank operation.

This model is the result of a coordinated work between FBA Fund members and the HR staff of a representative group of banks, differing from size classes (large groups, middle class banks, medium to small class banks). In that sense, it can be considered as a benchmark for the classification of professional profiles of an Italian commercial bank.

2.2 "Smart Pictures" of Italian Banks' Human Capital

In order to create a flexible and effective tool to represent the different intensity of the cognitive-behavioural assets of each human resource (knowledge and skills) and to support the classification activities of different corporate roles, we have translated and represented the EQF-FBA model using a Kohonen Map.

2.2.1 What is a Kohonen Map?

A Self Organizing Map (SOM) or Map of Kohonen is a non-supervised artificial neural network developed by T. Kohonen (1990). It simulates some brain functions (as the ability to process visual information) in order to classify a large amount of data: the Kohonen map goes through an adaptive transformation of multidimensional input signals into two or three dimensional topological maps. The
goal is to identify the structural features of incoming data and underlying their properties having no information about the expected output analysis - as in the case of supervised learning. This requires to adopt a "feed-forward" architecture without hidden layers, where all the outbound neuron are connected with all the input neuron. Training takes place through a competitive algorithm, so output neurons contend the "right" to be activated and they are called "winner" according to the minimum distance from each input pattern (BMU or Best Matching Units).

The final result is a reorganization of synaptic weights to obtain an optimal segmentation of the data structure in a discrete number of clusters or "bubbles" of activation. Thanks to these features, the various types of Kohonen maps are applied to: data compression, optimization of neural architectures, voice recognition and image recognition, and industrial process control.

2.2.2 Translation of the EQF-FBA model into a Kohonen map

We have designed and developed our Kohonen Map using the SOM Analyzer 1.01 software developed by Petri Hassinen. The process of creating the map has been divided into two basic phases:

• **STEP 1: Configuration of Neural Architecture**

First of all, we have configured a topology with 105 INPUT neurons, matching the knowledge and capabilities that identify a profile in the EQF-FBA model. Each input vector includes 105 values (min = 0; max = 5) that express the different degrees of knowledge and skills of a single user:

```
Input = {0 0 2 0 2 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 3 3 3 3 3 3 2 0 0 0 0 0 0 0 0 2 0 3 0 0 0 0 0 0 0 0 0 0 0 0 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 4 4 3 3 0 3 0 0 0 0 0 0 0 0 3 0 0 3 0 4 3 0 3 0 3 0 3 0 0}
```

Secondly, we have connected the 105 input neurons with a two-dimensional map composed of 82x65 neurons of output. The synaptic weights were set randomly. Therefore, the size of the map with output neurons is the space where the different spatial position of professional profiles is represented.

By an operational point of view, we also made the following steps in configuring the map:

• Training Data and Acceptance Data selection achieved by extracting 69 input vectors corresponding to the 69 best performers’ profiles provided by the EQF-FBA Model. The database was replicated for both training and control.

• Configuring the Initial Map Parameters:
Configure the Acceptance Data Parameters:

STEP 2: Artificial neural network training

In the second phase, the map of Kohonen was trained by repeating the data of the 69 vectors corresponding to the best performer’s profiles identified by the FBA Fund. At the end of the training process, the software generated an Unified Distance Matrix (u-matrix) capable of describing Kohonen's Map of Human Capital of an Italian Business Bank (82x65 artificial neurons):
3 RESULTS

Using the software we can draw a map, which represents the geography of the human capital in a complex organization like a bank, where it is possible to identify what individual are capable of (ability) and what they know (skills).

Therefore, this reference framework is not the result of an “a priori” hypothesis but is the result emerging from mathematical algorithms that enhance a reticular approach in analysing the human resources’ cognitive features. Consequently, the software can return different outputs depending on the different institutional interlocutors. These outputs depend on the various cognitive needs that may
be responsive to the new procedure: they can be summarized in a dashboard, an "ex-post" analysis of the investigation’s results, which should be available for both the single user and a top-level unit.

The software can give the user some “intuitive” indication about the organization:

1. Location of the individual user profile on the "competences map" of the banking sector;
2. The training effort valuation required to fill the gap, that is the distance from the desired performance

3.1 Location of the individual user profile on the "competences map" of the banking sector

The bank’s individual employee, undergone the assessment, receives the graphic description of his position in the bi-dimensional reference space. Basing on its indications about the individual skills’ level obtained through various assessment methods, the system elaborates a standard EQF profiles, which is the better estimate of the person’s skills.

The different colour intensity associated with the reference scheme identifies points of greater or less concentration of units in specific map areas. The placement of the individual in one of these areas approaches the "best performers" identified by the procedure and thus positively qualifies the placement in that area.

On the other hand, if the subject is placed in contiguous areas, it may have characteristics (knowledge and abilities) that are associated with several profiles, even though they are not located in an exact identified region of the map.

![Image: Kohonen Map]

*Figure 5: "Photography" of human capital ideal for a commercial bank through a Kohonen map (u-matrix).*

3.2 Estimating the training effort required to fill the gap, the distance from the desired activity

Through the Kohonen Map you can grade areas with various intensity of each individual knowledge/capacity depending on the location of the different professional profiles. There are people who have skills and capabilities related to a specific organization profile but are not yet in possession of specific qualities of the profiles as described from organization. In this sense, the system processes and identifies a number of standard profiles to which its skills/abilities are closer to the employee, identifying "the closest". The output of the procedure can help you identifying clearly the most valid training pathway that can cover missing skills. In addition, the system takes into account the competency / capability certifications already highlighted and the proximity evaluated developed by the
algorithm. In this case, the procedure would be able to highlight, even with intuitive graphical support, (using the intensity of the colours) the individual skills that has to be strengthened for an optimal placement in the desired profile.

This information would also be extremely interesting for the top management units responsible for strategic business management as it would provide a robust valuation of investment in training.

It is also evident that such a human capital picture would allow to validate and orientate the corporate restructuring actions where you need to know the framework of competences to make a drastic effort to refocus your business.

![Figure 6: Examples of Kohonen Maps that represent the different areas of intensity of specific competences.](image)

4 CONCLUSIONS

We think that dealing with the subject of human resource management in a complex organization, require to go beyond the traditional static and descriptive models to interpret the social, economic and institutional processes of the banking sector in a more accurate and innovative way.

In this specific case study, it is clear that different events (reorganization of business issues, the consequent need to convert some business processes, the impact of new technologies) have strongly criticized the vision traditionally based on the concept of "competence". Our work proposes a technologically advanced and a methodologically rigorous approach aimed to understand the distribution of cognitive and behavioral assets which are related to an individual's performance within a bank.

Furthermore, our model can be used for people, belonging or not the organization, who want to apply for a selection. By deploying the assessment, the user might be able to assess how much the competences they possess fit the professional requirements of the banking sector profiles and where. Additionally, if the procedure was used to evaluate the application for a specific profile, the output would be able to highlight the required training gap for the desired job placement.

In conclusion, depending on the potential of this study context, we believe we can continue on this path by adapting it to different areas.

The private sector is the first to react to critical stimuli, but it is not the only one that could implement this methodology.

In the public sector, since the 1990s, the role of the various components and operating structures, modified over time, is no longer clearly perceived today, either by individual public operators or in relationships with other system entities, including citizens. Organizations suffer from a general
disorientation leading to dysfunctional administrative behaviour among public entities and influencing
the overall performance of the system as a whole.

A general reassessment, a condition for a new revival of public action, depends on the redefinition of
professional profiles and on the optimization of training and recruitment systems: all these objectives
would be effectively supported by the adoption of innovative techniques. Our model could overcome a
self-serving approach in favor of a more scientific method, supporting the effective management of
human resources.

Our work determines the conditions for applying a new analysis scheme for the Public Administration.
It also proposes a common framework for redefining the professional profiles and the competences
required for the efficient exercise of public functions.

REFERENCES


edition.

Neural Maps “Photograph” the Human Capital. ICERI 2014, Seville.