Artificial Intelligence In Project Management: An Application In The Banking Sector

Proje Yönetiminde Yapay Zeka: Bankacılık Sektöründe Bir Uygulama

Yavuz Selim BALCIOĞLU[1], Melike ARTAR[2], Oya ERDİL[3]

Öz

Amaç: Bu makalenin amacı, yapay zekanın insan kaynakları fonksiyonlarında kullanımına ilişkin akademik çalışmalara yeni bir yaklaşım getirmektir. Personel seçme/yerleştirme ve ekip oluşturma süreçlerinde doğru işe doğru kişinin bulunması yapay zeka desteği ile gerçekleştirilecektir.

Tasarım/Yöntem: Yapay sinir ağları (YSA), birden fazla girdi ve birden fazla çıktının elde edildiği, problemlere etkili çözümler getiren programlama tabanlı yöntemlerden biridir. YSA, ilk olarak sayısal verilerin ve matematiksel problemlerin içerik analizlerini ölçmek için kullanılsa da sonraları daha çok sosyal sorunların ve projelerin etkinliklerin ölçümlerinde uygulanmıştır. Bu çalışma ile belirlenen sözel değişkenlerin sayısal ifadelere dönüştürülmesi sağlanmıştır. Sonraki aşamada, analiz için oluşturulan YSA modeli, dönüştürülen sayısal ifadelerin girdi olarak kullanılması sayesinde, çıktı olarak en yüksek puana sahip değişken id'lerin belirlenmesi sağlanmıştır. Son aşamada yapılan veri görselleştirmeler ile çalışma tamamlanmıştır.

Bulgular: Bu çalışma ile insan kaynakları fonksiyonlarında yapay zeka ile ilgili akademik çalışmalara yeni bir yaklaşım getirilmiştir. Örneğin personel seçme/yerleştirme ve ekip oluşturma süreçlerinde yapay zeka ile süreçler hızlanacaktır.

Sınırlılıklar: Yapay sinir ağlarının genel yapısının belirlenmesi için belirli bir kural yoktur. Doğru ağ yapısı, deneyim ve deneme yanılma yoluyla elde edilmektedir. Bununla birlikte, YSA'lar sadece sayısal bilgiler ile çalışabilmektedir. Bundan dolayı, değişkenler sayısal değerlere dönüştürülmelidir.

Özgünlük/Değer: Projelerin başarısında en önemli faktör insan olduğu için projelerde insan unsurunun yapay zeka yardımıyla seçilmesi incelenmiştir.

Anahtar Kelimeler: Yapay Zeka, Proje Yönetimi, Çalışan Yetkinlikleri, Yapay Sinir Ağı, İnsan Kaynakları

Abstract

Purpose: The purpose of this paper is to a new approach has been introduced to academic studies on the use of artificial intelligence in human resources functions. In personnel selection/placement and team-building processes, finding the right person for the right job will be accomplished with the support of artificial intelligence.

Design/Methodology: Artificial neural networks (ANNs) are one of the programming-based methods that provide effective solutions to problems where multiple inputs and multiple outputs are obtained. Although ANN was first used to measure the content analysis of numerical data and mathematical problems, it was later applied to measure the activities of social problems and projects. In this study, the verbal variables determined were converted into numerical expressions. In the next step, the ANN model created for analysis, using the transformed numerical expressions as input, the variable ids with the highest score were determined as output. The study was completed with the data visualizations made in the last stage.

Findings: With this study, a new approach has been introduced to academic studies on artificial intelligence in human resources functions. For example, in personnel selection/placement and team-building processes, processes will accelerate with artificial intelligence.

Limitations: There is no certain regulation for determining the general shape of artificial neural networks. The right network shape is accomplished through experience and case and error. However, ANNs can only work with numerical information. Therefore, variables must be converted to numeric data.

Originality/Value: Since the most crucial factor in the success of the projects is humans, selecting the human element with the help of artificial intelligence in the projects is examined.

Keywords: Artificial İntelligence, Project Management, Employee Competencies, Artificial Neural Network, Human Resources

[1] Öğr. Gör. Dr., Gebze Teknik Üniversitesi, İşletme Fakültesi, Yönetim Bilişim Sistemleri, ysbalcioglu@gtu.edu.tr, ORCID: 0000-0001-7138-2972

[2] Arş. Gör., Gebze Teknik Üniversitesi, İşletme Fakültesi, İşletme, artar@gtu.edu.tr, ORCID: 0000-0001-7714-748X

[3] Prof. Dr., Gebze Teknik Üniversitesi, İşletme Fakültesi, İşletme, erdil@gtu.edu.tr, ORCID: 0000-0003-3793-001X

1. INTRODUCTION

Today, organizations face high competition due to increasing level of uncertainty and complexity in the markets (Demirkesen & Ozorhon, 2017). Due to the increasing complexity of the jobs and the increasing competition, the companies' efforts to organize the jobs more efficiently and with fewer human resources have emerged, and the projects have attained a prominent position at this point. The projects cover the works aiming to offer new products and services in high competition to the ever-changing markets (Radujković & Sjekavica, 2017). Successful project management includes risk and compliance management, with the inclusion of identifying, evaluating, prioritizing, and addressing both risks and opportunities effectively (Hillson, 2002). One of the most critical factors for fulfilling project functions, preventing risks and uncertainties, and realizing a successful project is determining the personnel to be included in the project team.

In the project management process, the personnel competencies must be compatible with the project process. It has been revealed that staff competencies in modern organizations are the sources that enable companies to make profits and maintain their competitive advantage (Díaz-Fernández et al., 2014). In the project management process, organizations focus on personnel competencies that are significantly affected by their employees' skills and knowledge to create strategic competitive advantage (Youndt et al., 2004). Personnel competencies are critical in defining the workforce's knowledge and competencies level and determining the job descriptions of the staff (Marković, 2008; Potnuru & Sahoo, 2016). Competencies can have various dimensions, such as essential and expert competencies, depending on the work's scope. The specific competence group allows us to determine the competencies that must be in the specified position and where the staff is at the specified level. In order to, fulfill specific functions in the project management process; it is necessary to select qualified personnel suited for the qualifications structure (Tambe et al., 2019).

The effective management of internal resources in the project management process is ensured by the project team, which consists of people who are systematic, are able to fulfill the necessary conditions, and have high competencies. Therefore, systematically businesses need applications and system designs with which they can manage their resources effectively. Accordingly, managers are looking for innovative ways to re-establish their organizational tactics in the project management process (Whitfield & Farrell, 2010). In recent studies it is stated that artificial intelligence is the most prominent supporter of establishing these systems that will lead organizations to success.

Artificial intelligence algorithms appear in many parts of our daily life with the latest developing technologies. The pace of artificial intelligence in healthcare, the automobile industry, social media, advertising, and marketing is remarkable. On the other hand, much less progress has been made on employee management issues (Ahmed, 2018; Tambe et al., 2019). With the rapid increase in technology and the development of artificial intelligence, studies on the use of artificial intelligence related to human resources functions in businesses have started to accelerate.

In line with the increase in technological developments and the need for a new approach in project management processes, this research has two main objectives. One of these goals is to develop a new approach to creating the project attachment through artificial intelligence in project management processes. The second main goal is to combine personnel competencies with artificial intelligence practices to create an exemplary model for selecting personnel. The aim of this paper is to develop a new perspective on project management processes in line with the developments in the field of artificial intelligence. In the first part of the study, the structure and importance of staff competencies are mentioned. Then, the structure and application methods of artificial intelligence are described. Finally, within the research model's scope, by using the competencies that should be included in the project team, depending on these qualifications artificial intelligence assistance has been shown how team members can be determined.

2. LITERATURE

2.1 Employee Competencies

The term "competence" was first introduced in 1959 by Robert W. White (1959). It emerged in an article written by White as the concept of performance motivation (Potnuru & Sahoo, 2016). In the period until 1970, staff competencies were generally defined as "professional and important qualifications." In his book "Authorized Manager," Boyatzis (1982) defined competencies as "the basic characteristics of a person, which gives effective and superior performance results in a job." (Newton, 1983). In the following definitions, competencies are stated as the capacities that exist in a person and predict superior performance (Collis & Montgomery, 1995). Generally, it is stated that the staff's competence predicts the performance based on the knowledge, skills, and behaviors related to the specified job. Competence can also be viewed as a series of defined behaviors that provide a structured guide that enables defining, evaluating, and developing behaviors in employees (Salman et al., 2020).

While competencies carry elements of corporate culture, on the other hand, it enables the development and dissemination of this culture (Lee, 2010). In other words, competence is the organization's expectations from its employees in line with its own culture and values. Competencies help employees take individual responsibility for continuous learning and personal development (Naquin & Holton, 2006). In order for the personnel competencies model to be sustainable, a sufficient number of categorized competencies must be found by using methods appropriate to the enterprises. The core competencies are the features required in every job and role and most of which are expected to be demonstrated by all employees, based on the values of the business (Ibrahim et al., 2017). Technical/functional competencies bring success to a particular job, role, or level (Ally et al., 2020). When combined with essential competencies, they form a full set of competencies. It is the characteristics that are determined by considering the management understanding of the organization and by taking into consideration the duty/expertise area and position of the employee (Potnuru & Sahoo, 2016; Ley & Albert, 2003).

The success of the projects is closely related to the performance of the project managers and other staff in the project team to achieve their project goals. While forming a team in management is vital for success, it increases the importance of team building in working environments where there are complex interdisciplinary works that require the integration of functional experts and support groups. According to the size of the project, activities must list to identify the elements that will form the project team in terms of number and quality (Silvius & Schipper, 2014; Bjorvatn & Wald, 2018). When we examine the project management processes of global and local organizations, we see that staff competencies are among the essential inputs in the activities related to staff selection and placement (Tabassi et. al., 2019). In the personnel selection process, after determining the specific position's competencies, it is possible to recruit suitable personnel for this competence. However, determining the most suitable candidates by measuring these personnel's competency in terms of intended for the organization (Ley & Albert, 2003). With the support of artificial intelligence algorithms, determining competencies, and selecting the most suitable candidates will be more comfortable. Appropriate personnel selection will be carried out more actively in a shorter time.

When it comes to the machine learning, a study of Cowgill (2018) showed that increase in ML for personnel selection, particularly because of data availability, and some potential issues to consider when using ML in personnel selection. Also, they explain the potential advantages of ML for personnel selection, including a potentially higher predictive accuracy and objectivity than traditional processes. In another study on machine learning for personnel selection, Radujković and Sjekavica (2017), demonstrated that AI has a significant impact on HR, with advantages and disadvantages for humans. Also, they provide answers to ethical questions regarding the advantages and disadvantages of AI and recommends how to address them.

2.2 Artificial Neural Network

Artificial neural networks (ANNs) are created based on the human nervous system. in 1943, war-ren mcculloch and walter pitts (McCulloch & Pitts, 1943) discovered the first artificial neurons used to simulate the human biological nervous system. since then, ANN has been developed

independently in various fields. it is now an essential tool of artificial intelligence and widely use in machine learning. figure 1 shows the way it works. in statistics, ANN is considered as a nonlinear modeling tool that uses high accuracy in forecasting and a security descriptor of intricate patterns in the dataset.

Figure 1: Model of an Artificial Neuron According to McCulloch and Pitts
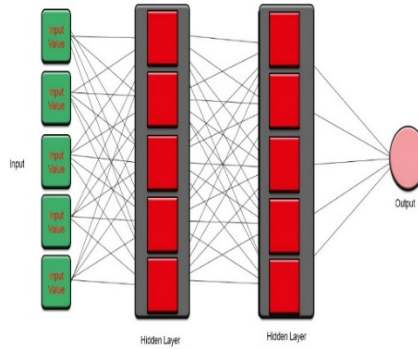
Kaynak: McCulloch & Pitts, 1943

Artificial Neural Networks is an information processing system that demolishes the structure, functions, and ways of functioning neurons that are found biologically in every living thing. Artificial neural networks consist of computing elements that act in the form of a mesh called a neuron. Signals are used as communication between these neurons. Figure 2 shows the working principle of artificial neural networks. The communication device carrying these signals is called the synapse. Synapses provide communication between neurons (Guarnieri et al., 2006).

Figure 2: Artificial Neural Networks Working Principle
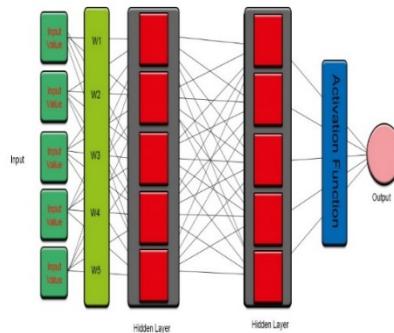
Kaynak: McCulloch & Pitts, 1943

There are five variables in artificial neural networks. These are given as follows;

Inputs: Expressions or numerical values that are given to the system from outside. No mathematical calculation takes place at this first stage. Data is prepared for the next process.

Weights; shows the numerical effect of each data on the cell. It varies according to the problem to be solved. There is no fixed numerical weight determined for the analyzed data. The working principle is shown in figure 3.

Total Function: The point where the data entered into the system intersects after multiplying the specified weights.

Activation function; It is used in the process of processing complex data entered into the system. The reason for this is its detailed and considerable capacity of computing ability. If not used, the learning process remains limited (Kubat, 1999).

Output; The last stage of the data processing process is the numerical value determined by the system as a result of the activation function. Although the data is broad and has many variables, the output is always unique (Foody, 1995).

Figure 3: Working Principle of Weight Values
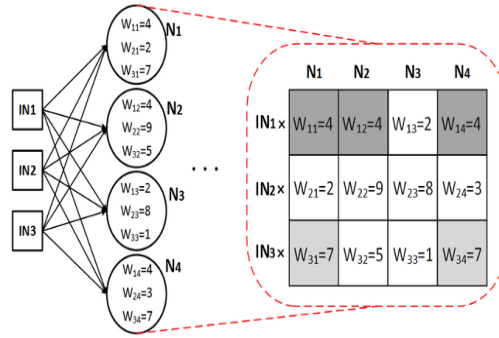
Kaynak: Yasoubi et al., 2017

Table 1: Variables of Basic Competencies

Technical/Functional Competencies
Search and follow up current technologies
Business area and related skills
Technical problem analysis
Problem solution and focus
Work and time management
Making predictions and projections
Stakeholder planning and communication
Project time, cost and risk planning management

3. DATA AND METHOD

Competencies used in our research model are generated for the IT unit of are set by the company. Competencies are defined within the company and used in critical human resources functions such as recruitment and job description. The personnel competency set we used in the research has been used in the bank for years. Our aim in this study is to show how the competency set can be used effectively in the selection and placement of personnel through artificial intelligence. While the structure of competencies, which are necessary skills depicts general skills expected from employees, Technical / functional competencies are determined within the scope of project management. We chosed Artificial Neural Networks as a method, because One of the sub-titles of machine learning is neural networks. Neural networks are one of the cornerstones of deep learning algorithms. Neural networks rely on training data to improve and learn their accuracy over time.

Thanks to artificial intelligence in the model we have established, it is classified according to the necessary core competencies of 601 employees in line with the determined weights defined by the variables we obtain. In total, a ranking made according to 15 different criteria. Anaconda software used for these processes. Fifteen different criteria owned by 601 employees are scored by artificial intelligence. The data obtained is divided into 75% learning and 25% testing.

These variables are divided into two main categories.

Table 2: Variables of Technical/Functional Competencies

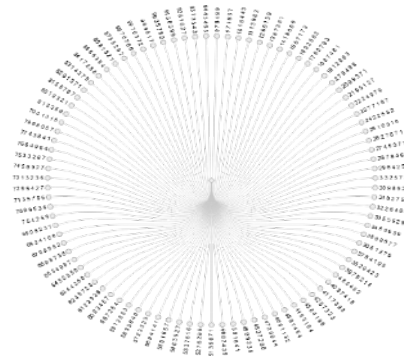| **Basic Competencies** |
| --- |
| Building trust |
| Internal and external customer orientation |
| Adapting |
| Effective communication and collaboration |
| Corporate learning and development |

Table 3: All Variables

The dependent variable	Independent variables
Calculation of the employee with the highest score	Basic Competencies
	Building trust
	Internal and external customer orientation
	Adapting
	Effective communication and collaboration
	Corporate learning and development
	Technical/functional Competencies
	Search and follow up with current technologies.
	Business area and skill development
	Making predictions and projections
	Stakeholder planning and communication
	Project time, cost, and risk planning management

4. FINDINGS

In the analysis, 32 hidden layers used. The resulting analysis produced 84.43% percent success rate determined. The total number of Neuron used was 746. The ten employees with the highest scores are listed below in the table.

As given in this research, artificial intelligence gives the most objective and accurate to the project managers results regarding personnel selection. The 15 different variables used are divided into two different classes, and artificial intelligence determines the person to be chosen most accurately in terms of the weights of all variables. Therefore, the human resources managers' selection pool consists of fewer and better candidates. In light of this information, it will be possible to determine the most suitable candidates in the project management process with more accurate results in a shorter period.

Figure 4: Analysis Results of Basic Competencies Variables

(The first 100 people shown graphically)

Figure 5: Analysis Results of Technical/Functional Competencies Variables
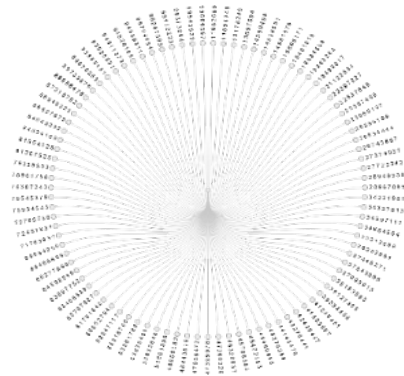
(The first 100 people shown graphically)

Table 4: Analysis Results of the First Ten People

Score of Basic Competencies	Score of Technical/Functional Competencies
9,25	6,3
6,5	5,65
9	7,6
6	7,35
7	5,4
5	6,25
6,5	3,85
6,25	5,4
5,25	3,7
7	3,65

Table 5: Top 10 People with The Highest Scores

Employee No	Average Score
263	7,95
365	7,875
1	7,775
36	7,775
393	7,65
99	7,625
569	7,575
481	7,55
66	7,525
412	7,475

5. CONCLUSION

The success of the projects carried out by organizations in an increasingly competitive environment in the 21st century has gained much more critical attention for businesses to remain in the market. The importance of project management is increasing day by day because of the more comprehensive and complex structure of the projects held today. This complexity makes it mandatory to use project management widely by companies (Huemann et al., 2007). The project team, which is within the project management scope, is one of the most critical factors affecting the project's success. The achievement of the projects planned to be achieved at desired dates is realized by the implementation of the planning determined for the project. Selecting the personnel suitable for the project's scope will ensure the project's success with the most efficient, highest quality, and the least cost.

With the rapid increase in technological developments and the integration of artificial intelligence in many areas of our life, the importance of academic research on this issue is increasing. Academic studies on the use of artificial intelligence in personnel selection and placement processes are mostly limited in the theoretical field (Tambe et al., 2019; Ravichandran, 2018; Dietvorst et al., 2015). Along with this research, an applied model of the development of artificial intelligence in businesses is presented within the article's scope. With the new approach included in the article, we see that artificial intelligence is an auxiliary element in explaining and implementing the decisions taken in critical human resources functions such as personnel selection and placement. At the same time, with this study, the drawbacks of using artificial intelligence in HR applications are eliminated in the literature.

When the literature is examined in the selection and placement of artificial intelligence, one of the most critical problems is justice-related concerns (Ravichandran, 2018). People are social and psychological beings that are affected by their environment. In decision-making processes, people can be influenced by some perceptual illusions and the effects of its prejudices. However, it will be possible to identify only the most suitable candidates for work away from sexist or racist judgments by standardizing the application in the selection by use of artificial intelligence algorithms (Ley & Albert, 2003; Cowgill, 2018). During the selection process, the creation of a pool with the help of artificial intelligence known as without making any discrimination among the personnel and taking into account the personnel's job-related competencies will enable to build the best of candidates. We also argue that artificial intelligence can be useful as a decision process, given the difficulties in making customary and appropriate decisions (Denrell et al., 2015; Goldfeld et al., 2018).

Another critical discussion topic in the literature review is explain ability. It carefully explained with the concept of justice. Decisions on personnel selection are closely related to several concepts among employees, such as value and status, perceived fairness, contractual and relational expectations that affect individual and institutional outcomes (Denrell et al., 2015; Lind & Van Den Bos, 2002). As

in our research model, a machine learning algorithm based on competencies can prevent these concerns. Artificial intelligence algorithms will provide great convenience, especially in terms of employees' making comparisons and learning the causes of the results. The process and reasons for the decisions taken will be explained by the algorithm (Goldfeld et al., 2018; Cowgill, 2018).

Another critical discussion in the literature is about the responses of employees to artificial intelligence algorithms. Although past studies have found that employees react to these decisions, recent research has shown that the decisions determined by artificial intelligence algorithms are more readily accepted by staff (Sekaran & Bougie, 2016). With artificial intelligence in all areas of life, people now accept these decisions more comfortably. An example is research done by uber on his employees. During the study, it was found out that the staff wage policies determined by the algorithms, not the people, and their acceptance levels increased. Employees' responses to algorithmic decisions were more positive than emotional and individual decisions (Dietvorst et al., 2015). We suggest that artificial intelligence applications will increase rapidly in the coming periods, and the responses of the employees will be more moderate in this direction.

The theoretical implications of ANNs are that they are a method that is learned by making inferences directly from the numerically modeled data. After the established network obtains this information through training relationships, it can be applied to unpredictable models such as classification, prediction, time series analysis. However, unlike traditional statistical methods, ANNs do not require the application of appropriate algorithms to identify existing relationships. Managerial implicatons is this approach to assessing the significance and accuracy of a neural network model is to compare it with a simpler statistical model. While a statistical model can automatically handle variable values, neural network models can handle variable values, missing values, data gathered over time and multiple simultaneous factors, which may have high interdependencies. Neural network models are not influenced by how data are missing or noisy.

While providing important information on staff selection/placement with artificial intelligence support, this research has some limitations. The results obtained from this study should be evaluated together with its limitations as well as producing some innovative solutions regarding the use of artificial intelligence in personnel selection and placement processes. First of all, this study was carried out by considering only information technology employees and their competencies. In order to generalize the results of the research, a larger study including the competencies of those working in different sectors and units is recommended. Second, the information of the participants in this study should be collected by companies or HR. Afterwards, conducting a similar study in a large sample and sharing the success of the teams determined by artificial intelligence algorithms will make an important contribution to the literature. Finally, making a comparative study using different methods other than the artificial intelligence method used in the research will ensure that human resources and artificial intelligence applications work in the most efficient way.

As a result, in today's fast-changing environment, companies need to follow the technologies to integrate their functional processes and use their resources efficiently to respond quickly to the changes and increase their ability to compete. With this study, a new approach has been introduced to academic studies on the use of artificial intelligence in human resources functions. In personnel selection/placement and team-building processes, processes will accelerate with the support of artificial intelligence.

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