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Design of a task delegation system in a context
of standardized projects

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Declaración jurada de autenticidad

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Dedicatoria

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Design of a task delegation system in a context of standardized projects

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Abstract. The task delegation, in the organizational context, is a process by which the responsibility of carrying out a task is assigned to a suitable person. However, in various companies, this process is carried out subjectively and manually, leaving aside the performance of the worker. This situation affects the effectiveness of the company's operation and produces dissatisfaction among the workers. In this article, based on a company in the telecommunications sector that operates under standardized projects, a scheme and a computer tool are established for the task delegation based on the performance of the worker. For this, a systematic mapping study was carried out in order to identify and characterize the existing solutions on delegation systems based on performance. Then, once the scope of the solution was delimited, the development of the “Delegator” computer tool and the validation of the delegation of tasks based on performance proceeded. From a practical perspective, the established assignment scheme allows a categorization based on the criteria: task start date, task deadline, number of inputs and number of skills required; and the tool facilitates its application to the defined case of the company. From a theoretical perspective, the categorization of workers using the SVM is performed according to four variables of the task to be delegated, two of them are new variables that count the required characteristics of the worker and the entries of the task.

Keywords: Task delegation, performance evaluation, standardized projects.

1 Introduction

The task delegation is essential for the development of organizations. This process, in a company, allows a manager to deploy specific tasks to specialized personnel [1] and prioritize their functions [2]. The heterogeneity in terms of the skills of the collaborators and the level of difficulty of the tasks play an important role in the delegation processes. In this sense, [3] make use of optimization models to assign tasks to collaborators with multiple skills; and [4] determine that greater benefit is obtained if artificial intelligence is the one that delegates tasks to human beings.

In order to delegate tasks objectively, in the context of a company, it is necessary to consider various factors, one of which is the evaluation of the worker's performance

[5]. In this case, some articles address the importance of performance evaluation. For example, a comparative analysis of performance evaluation is carried out, managing to support the advantages that 360° evaluation entails [6]. In addition, [7] and [8] analyze the impact of the delegation of authority on job satisfaction and performance, both concluding that the assignment of authority is statistically linked to organizational growth. Furthermore, the study conducted in [9], in the public domain, shows that the decision to delegate does not have an objective support beyond decentralization. In this way, this study differs from the others by introducing an objective variable such as performance.

On the other hand, some enterprise resource planning (ERP) system programs have been identified which allow tasks to be delegated, such as [10]: (i) SAP S/4HANA Cloud, (ii) WorkBook, (iii) Oracle Fusion Cloud ERP, (iv) Odoo ERP and (v) Microsoft Dynamics 365; but, they do not use worker performance as a delegation criterion. However, many of them offer programming environments to implement various features. For example, in order to better control the selection of available employees based on their characteristics, a software application was developed in Odoo ERP [11].

This article establishes a task delegation scheme based on the performance of the collaborator and its implementation as a computer tool. The article is organized as follows: in Section 2, the background of this article is presented; in Section 3, the research methodology based on a systematic mapping study is showed; in Section 4, the development of “Delegator” is described; and in Section 5, the final discussion is presented.

2 Background

In this section, task delegation and performance evaluation concepts are addressed.

2.1 Task Delegation

The delegation of task is essential in the collaborative effort at any organization [12]. Delegation is a key aspect of management in which both the person who delegates and the person to whom it has been delegated benefit [12]. Similarly, the delegation of tasks provides benefits such as the development of skills, better decision-making at work and adequate time management for the development of other tasks [13]. Also, an effective delegation comprises the following points [14]: (i) clarity in communication, (ii) available resources, (iii) monitoring progress, (iv) celebrating success and finally, (v) generating a report or reflection.

2.2 Performance evaluation

The performance evaluation [15] allows estimating the growth potential of the worker in his respective position and, whose responsibility for said evaluation, may fall on: (i) the manager, which leads to a centralized process; (ii) the employee, who decentralizes the process, but lacks objectivity; or, (iii) an evaluation committee, which provides objectivity by providing an impartial point of view.

The performance evaluation must be carried out through the evaluation of competencies, for which it is proposed the 360° Premium performance evaluation [16]. This

system allows the evaluated person to obtain feedback from their environment: (i) internal and external clients, (ii) subordinates, (iii) co-workers, (iv) boss, (v) other people and, (vi) the evaluated in question.

2.3 Standardized projects

According to [17], an organization's processes and procedures should be standardized. Also, [18] defines standardized projects as those that, through strategic planning, delimit the execution and monitoring phases, reduce variability and maximize their value.

3 Research Methodology

This section presents the realization of a Systematic Mapping Study (SMS) based on [19]. The purpose of the SMS was to identify studies related to performance-based task delegation (See Fig. 1). The identified algorithms and their characteristics are used for the design, implementation and testing of Delegator.



Fig. 1. SMS adapted from [19].

3.1 Planning and implementation of the SMS

Although task delegation is used in all types of organization, it is mostly done subjectively. In this context, it is necessary to identify studies related to the use of criteria for task delegation. In this sense, the research questions are presented below:

- RQ1 What criteria are applied for the task delegation? Are any of them related to performance?
- RQ2 What computer tools are reported? Which ones allow tasks to be delegated based on established criteria?
- RQ3 What performance evaluation method is used in organizations?

The search string, according to [19] was determined by identifying the Population and Intervention. The search string was left as: “Task Delegation” OR “Task Assignment” (Performance OR Behavior) AND (Evaluation OR Appraisal OR Assessment OR Rating OR Ranking).

The extraction process began with the execution of the search string in the selected databases: Scopus, Web of Science (WoS), ScienceDirect, Ebsco, and ProQuest. For this, the chain was adapted to the characteristics of the digital databases considered. In

this first stage, 573 studies were obtained. After the selection process, applying inclusion and exclusion criteria to the titles, abstracts and content, 13 primary studies were obtained (See Fig. 2) (See Table 1).

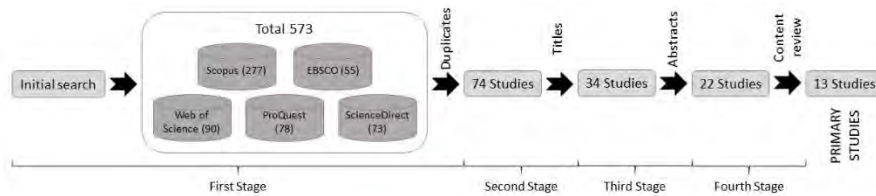


Fig. 2. Inclusion and exclusion criteria of the SMS.

3.2 RQ1. What criteria are applied for the task delegation? Are any of them related to performance?

Regarding the criteria used, the following aspects are considered:

- similarity: the similarity between the task to be delegated and a previously delegated task is considered [S01].
- patterns: the pattern of acceptance of tasks by workers is considered [S02].
- performance: both the individual and collaborative performances of the worker are considered, the latter based on the appreciation of the co-workers [S01], [S03], [S04], [S06], [S07], [S08] and [S11].
- workload: the workload of the workers is considered [S02], [S03], [S04], [S07], [S08], [S09] and [S10].
- requirements: task requirements to be delegated are considered [S03] and [S09].
- skills: the knowledge and talent of the worker are considered [S01], [S03], [S04], [S05], [S06], [S07], [S08], [S10], [S11] and [S13].

3.3 RQ2. What computer tools are reported? Which ones allow tasks to be delegated based on established criteria?

Regarding computer tools, the literature shows that there are several approaches to digitize the process. Among these, we can mention:

- SVM: Support Vector Machine, represents a robust learning method that solves big data classification problems [S01].
- IMIRT: Individualized Models for Intelligent Routing of Tasks, consists of a framework that assumes task delegation for crowdsourcing [S02].
- HQGA: Heuristic Quantum Genetic Algorithm, is an optimization method for task assignment and adopts a hierarchical network to illustrate task composition [S03].
- ASAP: Assignment and Appraisal model, destined for optimal resource allocation problems [S04].

Table 1. Primary studies obtained

Id	Title	Ref
S01	A learning feature engineering method for task assignment	[20]
S02	A Multi-armed Bandit Approach to Online Spatial Task Assignment	[21]
S03	An optimization method for task assignment for industrial manufacturing organizations	[22]
S04	Assign and Appraise: Achieving Optimal Performance in Collaborative Teams	[23]
S05	Competences-based performance model of multi-skilled workers with learning and forgetting	[24]
S06	Development of a task assignment tool to customize job descriptions and close person-job fit gaps	[25]
S07	Empirical analysis of reputation-aware task delegation by humans from a multi-agent game	[26]
S08	Employee-task assignments for organization modeling: a review of models and applications	[27]
S09	Enhancing the safety of construction crew by accounting for brain resource requirements of activities in job assignment	[28]
S10	Metanetwork Analysis for Project Task Assignment	[29]
S11	Screening Talent for Task Assignment: Absolute or Percentile Thresholds?	[30]
S12	Task delegation and computerized decision support reduce coronary heart disease risk factors in type 2 diabetes patients in primary care	[31]
S13	The prospective applicability of the strengths-based approach to managing and developing employees in small businesses	[32]

3.4 RQ3. What method of performance evaluation is used in organizations?

Regarding the evaluation method, the 360° performance evaluation is widely spread. In addition, as part of said evaluation, the following criteria are mentioned to be considered:

- Completion scenario: The worker's performance is evaluated based on the way in which the task was completed, considering whether it was completed within the established period or outside of it. In addition, the fact that the worker to whom the task was assigned or if it was reassigned was able to complete it is considered [S01], [S03], [S06] and [S07].
- Performance edges: Individual performance, cooperation performance within the organization, team performance and performance based on the worker's knowledge are evaluated [S03], [S04], [S06] and [S10].
- Time: The time it takes for the worker to perform the task is evaluated [S01] and [S08].

4 Implementation of Delegator

This section introduces key elements of implementing the solution named Delegator. It lists the high-level requirements, describes the main algorithm, presents the architecture of the solution, and describes the test cases applied.

4.1 High level requirements

In the development of a software solution, for a problem in an organization, there are general aspects and specific aspects to be considered. The main solution is a software that allows the delegation of tasks using criteria. The criteria are established by the nature of standardized projects. Standardized projects are the way in which companies in the telecommunications sector carry out their activities. Based on the above, the following can be pointed out as high-level software requirements that the user can perform: (i) register task to delegate, (ii) register urgent task, in the scenario that all workers are assigned, (iii) update workers (general data), (iv) complete tasks, including performance evaluation, and (v) issue reports.

4.2 Main algorithm

Delegator's main algorithm consists of a task categorization component and an assignment scheme based on that categorization considering organizational factors. From the SMS, for the categorization component, it was identified that the support vector machine (SVM) algorithm turned out to be more convenient for the task delegation problem based on a set of criteria. The SVM is a supervised learning algorithm [33] that categorizes tasks based on a historical record. In the particular case of Delegator, it was established to work with a base of historical records that will be used as training data (70%) and as test data (30%). Once the algorithm is trained, the real data is entered and the algorithm determines to which category the new entered task belongs. According to [34], the SVM can work with “n” categories. However, reliability decreases as the number of categories to identify increases [34].

For the established assignment scheme (software architecture), shown in Section 4.2, the different internal elements of the software were mapped and contrasted (see Fig. 3) with what was reported in the primary studies. With this, it was possible to confirm or discuss the decisions of the main algorithm.

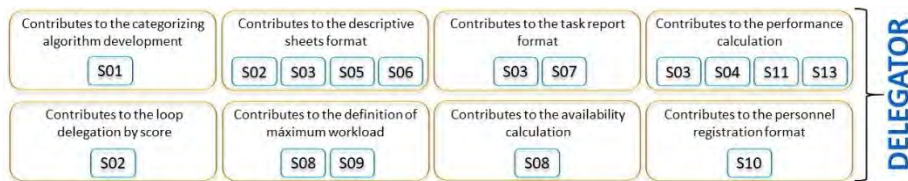


Fig. 3. Mapping between primary studies and elements of Delegator.

4.3 Delegator Architecture

Delegator architecture presents 3 workflows (see Fig. 4), which allow covering all the possibilities that may arise when delegating the task to a worker.

Regarding the conceptual variables, there are the following: (i) score: which corresponds to the experience of a worker having completed one or more tasks belonging to a certain category; (ii) performance: which is calculated through the weighted average of the performance edges: (a) individual performance, (b) collaborative performance, (c) team performance, and (d) knowledge-based performance; (iii) urgency: which is associated with the time remaining for a task, whether in process or new, to finish.

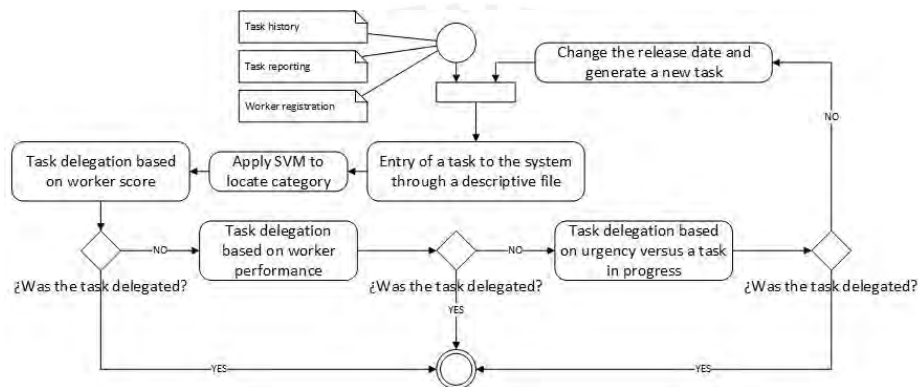


Fig. 4. Delegator - internal workflow.

The scoring flow begins with a process that locates the model category and orders the workers in that category from highest to lowest score. The sorted list is traversed until an available worker is found for assignment. If it is not found, it goes to the next flow.

The performance flow begins with a process that orders the workers from highest to lowest performance without considering the workers eliminated in the scoring stage. As in the previous case, the list is traversed and, if possible, a worker is assigned or the next flow is passed.

The urgency flow starts by consulting the user for the possibility of changing the start date of the new task. If possible, the user is requested to change the start date and a new task is generated. Otherwise, tasks in progress are sorted by start date, from oldest to newest. The task is delegated in case the new task is more urgent than the current task. In this way, the task in progress would be paused and the new task would be started.

4.4 Test cases

For the test cases, a scenario with 5 workers with the level of analyst to whom the tasks will be delegated was proposed. Regarding the tasks to be delegated, a format called a

descriptive sheet will be used and when the task has been completed, a format called a task report will be used. The tests carried out were satisfactory internally.

For the training of the categorizing algorithm, based on certain criteria, a database of 5000 records was created and entered, which present a tendency to differentiate the tasks into 2 categories.

For the test case developed, recurring tasks of the telecommunications company were defined. These tasks can be grouped into: (i) preparation of reports, (ii) review of formats, (iii) audit, (iv) preparation of procedures and (v) integration.

5 Final Discussion

This article represents a solution to the task delegation problem based on criteria, which occurs in a company. This problem is similar to other companies in the same telecommunications sector, which carry out standardized projects. The resolution goes through an SMS that allows identifying an algorithm for categorization and an architecture that allows flexibility for task assignment. The software tests, carried out internally, allow to verify that the software works completely and correctly according to the established requirements.

In relation to the operational part of the Delegator, the following limitations need to be mentioned, and should be investigated in future research: (i) the effectiveness of the categorizing algorithm could be verified for a scenario of 2 categories and 20 tasks to be delegated. Future work could implement more than 2 categories and other supervised learning model; (ii) it was found that the maximum number of tasks in the process is limited by the number of available workers, since the unit “day” was used as the minimum task delegation block. Future studies should change the unit to “working hour”; (iii) it was verified that the urgent condition allows prioritizing a task by pausing the current one and resuming it at the end of the urgent task; so, the maximum number of tasks to delegate is twice as many workers, since they would have one active task and another paused. Future research should consider the execution of concurrent tasks.

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