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# APPLICATION OF THE ALM MODEL IN THE ANALYSIS OF CHANGES IN THE WORK CONTENT OF ORGANIZATIONAL POSITIONS IN A MUNICIPAL ENTERPRISE

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**Purpose:** The aim of the paper is to identify the changes in the area of work content in a selected municipal enterprise in the following years: 2009, 2018 and 2023.
**Design/methodology/approach**: The study presents the results of the analysis of the work content of jobs of the municipal company according to ALM model and job evaluation. In the observations carried out on the general population there were also used following methods: interview, document analysis and group discussion. Similar approach is commonly used in the analysis of changes in work content under the influence of technology in sectoral and economic research. However, there is little research showing the application of such an approach in relation to individual enterprises, particularly all positions in the enterprise.
**Findings:** Potential for automation of manual jobs have been limited to the greatest extent in core activities, which may suggest that it is in this area that technical progress in work processes, especially manual jobs, is implemented first and relatively most intensively. Additionally, technological progress in work processes implemented in core and auxiliary activities limits routine manual jobs, but is associated with an increase in routine cognitive jobs.
**Research limitations/implications**: (if applicable) The research assumed that the change in the content of work occurred as a result of technical progress, which is justified especially in the case of analysis of all organizational positions in the company. However, further research should directly investigate the impact of technological progress on changing job content especially in the cross-section of individual organizational units in the management and auxiliary areas of the enterprise.
**Practical implications:** Identification the different specificity of the impact of technical progress on the content of work in individual areas of the company's activity. Empirical confirmation of the sequence of automating work within individual areas of the company's activities.
**Originality/value:** While researches on changes in work content in the context of technical progress across economies and sectors are relatively common, in relation to the general population of employees in an enterprise it is rather absent.
**Keywords:** work content, ALM model, technical progress, municipal company.
**Category of the paper:** Research paper, case study.

## 1. Introduction

Technical progress that involves the use of modernized technologies in the production of goods and services is a key factor shaping changes in the business models (Blaschke et al., 2017), corporate structures (Brown et al., 2014; Snow et al., 2017), sectors and economies (Godin, 2006). Technology determines the way of working, the scope of tasks performed by the organization's human factor and the working methods at individual positions and eventually employees' skills required on organizational positions. Generally, technology refers to knowledge used in the production processes of goods and services, i.e. the ways of combining organizational resources to generate value. Organizational research often distinguishes between technological and organizational changes to emphasize the specificity, reference and scope of modifications made in enterprise structures. However, the final result of the changes taking place (technological and related organizational changes) in the organization is the modification of the work content at individual organizational positions, especially when diagnosed in different periods, which clearly identifies the impact of changes taking place in the area of work as a result of technical progress in work processes.

The literature on the subject identifying changes in the scope of job tasks and required employee skills is rich, especially in the area of analyzes of economies and sectors, or certain groups of enterprises. This is diagnosed in the context of automation, robotization and digital technologies (i.e. AI, VR, AR). However, there is a noticeable research gap in the field of research relating to individual enterprises (Heyman, 2016), illustrating changes taking place over time in the area of work content.

The aim of the study is to show changes in the area of work content in a selected municipal enterprise in the following periods, i.e. 2009, 2018 and 2023. This company is one of the largest in southern Poland, implementing basic, auxiliary and management processes. The study presents the results of the analysis of the work content of employees of the company according to ALM model (Autor et al., 2003, 2011) and job evaluation. In the observations carried out on the general population (all employees in the company) there were also used following methods: interview, document analysis and group discussion. Similar approach is commonly used in the analysis of changes in work content under the influence of technology in sectoral and economic research. However, there is little research showing the application of such an approach in relation to individual enterprises, in particular all organizational positions in the enterprise.

## 2. Theoretical background

Technological progress in the production of goods and services enables to replace humans in work processes or increases the productivity of capital in these tasks (Acemoglu, Restrepo, 2020). It may concern the complete substitution of humans with machines and devices, but more often it concerns the replacement of certain groups of activities within the functions of the workplace. As a result, humans perform tasks that are complementary to technology, i.e. those that the currently used technology in production is unable to perform. Therefore, human work, which is not substituted by technology, might be considered as complementary to technology (Autor, 2015). Extensive literature on the subject indicates that tasks usually performed by low-skilled workers are most often replaced by technological progress (Fierro, Caiani, Russo, 2022). This applies especially to routine work and earlier technological progress, therefore it's referred to skill-biased technical change (Author, Acemoglu, 2011). Currently, there is a slightly different trend in which technical progress is replacing routine, low-skilled work, but at the same time generating new jobs requiring high-skilled tasks. For instance, there is an increase in demand for: abstract thinking, creativity and problem solving, but also for experts and talents in the field of: robotics, artificial intelligence and data science. This tendency in modern labor markets is referred to as talent-biased technical change (Brynjolfsson, McAfee, 2014). However, progress in robotics, machine learning and artificial intelligence over the last twenty years has strengthened the parallel occurrence of these two trends, i.e. replacing unskilled and low-skilled people, striving to replace workers in more complex professions.

The impact of technology on the content of work in contemporary sectors and economies is examined using the ALM model (Terzidis et al., 2017; Coelli, Borland, 2016; Goos, Manning, 2007; Autor et al., 2006; Autor, Handel, 2013; Goos, et al., 2010). A similar approach, combined with job evaluation methods, might be used in analysis of content of work of all job positions within one company. Observed changes in work content at positions within one company in particular periods of time can be treated as a derivative of technological progress in work processes. Especially when the company has not undergone drastic structural and organizational transformations related to the division of labor between organizations cooperating within the sector in the value creation chain or changes in the scope of functions performed in the environment.

The ALM model that allows to estimate the potential scope of automation in the examined system or object, i.e. sector, economy and company, divides tasks based on the work content criterion (see: Fig. 1). This typology conceptualized each occupation as a series of tasks, which determine the necessary skills possessed by employees. Therefore, the terms "tasks" and "skills" are used interchangeably, depending on whether referred to an occupation or an employee. The ALM model takes into account the innovativeness of tasks, which are: routine, non-routine

as well as problem solving and requiring interpersonal adaptability. In particular, according to typology tasks are distinguished at first between (Author, Acemoglu, 2011, pp. 1076-1079): routine tasks (including manual and cognitive) and nonroutine tasks (including manual and abstract) (see: Tab. 1).

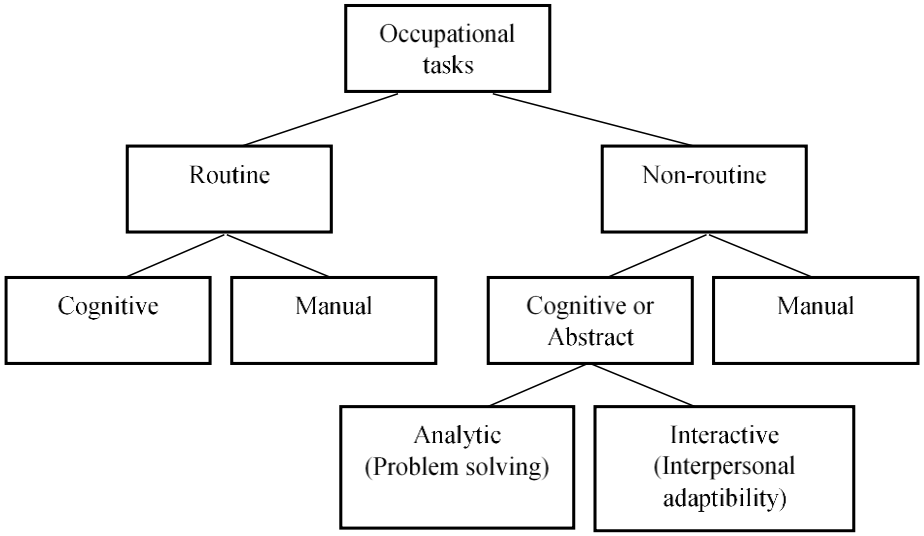


**Figure 1.** the ALM model.

Source: (Autor et.al., 2003).

Routine tasks relate to sequential and structured activities based on rules and procedures. Nonroutine tasks include manual and cognitive tasks. Nonroutine manual tasks mainly refer to the ability of adapting manual activities to specific situational changes, including visual and linguistic recognition, direct interaction, and interpersonal and environmental adaptation. Cognitive tasks consist in performing activities based on: problem solving, intuition, persuasion and creativity, and they relate to specialized, managerial and technical posts. Due to the fact that abstract non-routine tasks require interpersonal or situational adaptability, the task model divides these tasks into: analytic (requiring advanced problem solving) and interactive (requiring interpersonal adaptability) ones.

**Table 1.**
*Type of jobs and their main functions*

| Type of job | Groups of positions | Main function of groups of positions |
|---|---|---|
| Routine manual | Production, repair and craftsman tasks | Manual activities based on rules and algorithms |
| Routine cognitive | Salespersons, administration and office staff | Simple information-related tasks: organizing, storing, retrieving and manipulating information |
| Nonroutine manual | Service sector | Manual tasks requiring interpersonal and environmental adaptability |
| Analytic (problem solving) | Specialists, technicians | Non-routine Analytical tasks requiring: problem solving, intellect-based considerations, assessment of information, creativity |
| Interactive (interpersonal adaptability) | Managers | Interactive tasks requiring interpersonal or situational adaptability Problem solving, assessment of information, creativity |

Source: own elaboration based upon: (Autor, Acemoglu, 2011).

The division of positions into individual job groups (see: Tab. 1) is based on the following criteria: type of job positions, required creativity and interpersonal adaptability in individual positions. First, positions with manual and cognitive work are identified based on the type of work. In this respect, the current division of organizational positions in the enterprise/institution can be used. For example, blue-collar jobs could be classified as manual, and white-collar jobs as cognitive. Then, identifying the level of creativity required in job positions (within particular job groups identified in former step) allows to determine whether the work is routine or non-routine. There ought to be assumed – according to Leavitt's Socio-Technical Systems (STS) theory (Leavitt, 1964) – that creativity is a synergistic outcome of interactions within and between the people, structure, task, and technology components (Ciriello et al., 2024; Indriartiningtias et al., 2019). Such interpretation of creativity is consistent with the understanding of this concept in job evaluation processes (Armstrong et al., 2005; Arthurs, 2015). When assessing work, creativity is related to specific types of thinking required on the job, i.e. routine, semi-routine, analytical, synthetic and creative (Martyniak, 1998). Therefore, creativity is interpreted as an input in job function fulfilment and it is inferred from the work content of the job. Such orientation of the study of creativity enables to take into account the synergy of resources on the job. The creativity of an organization member is determined by the function of the workplace, because the scope of job tasks forces specific behaviours that may be creative. Such approach is consistent with the key thesis in management and quality sciences that value is created at the interface of resources (by combining resources) as a result of human activities. Finally, interpersonal adaptability is applied in reference to non-routine content jobs in order to identify those of them which are interactive. And non-routine cognitive jobs that are not interactive will be included in the analytic group. The review of organizational positions in accordance with the above can be made taking into account various criteria, including: a type criterion (administrative and office positions, workers' positions), a structural criterion (across organizational units) and a functional criterion (basic activities, supporting activities and management activities).

## 3. Data and methods

The data was collected in one of the Krakow agglomeration' municipal companies, i.e. municipal company with specific characteristics (Narmania, 2018). The stages of the research procedure included:

1. Inventory of organizational positions, taking into account the criteria of type (administrative and office jobs, worker jobs), structural (across organizational units) and functional (core activities, supporting activities and management activities).

2. Identification of manual and cognitive work (workers and administrative and office positions).
3. Identification of factors determining the degree of innovation and creativity of work carried out in organizational positions. The purpose of this stage is to determine what type of thinking (i.e. routine, semi-routine, analytical, synthetic and creative thinking) is required at the job to implement the functions of the work.
4. Classifying organizational positions into ALM model.

The research tasks were performed on the basis of three major internal sources of information: the list of organizational positions, the scopes of responsibilities of organizational positions and the results of interviews with executive staff and employees in particular posts. In that respect there were following methods implemented within research process, i.e. documentation analysis, interview methods and the Delphi method. The research methodology was supposed to enable identification of particular type of jobs (see: Tab. 1) according to adopted classification.

Documents provided by the HR Department of the municipal enterprise were used to specify manual and cognitive work in the set of organizational positions. In this respect, the division of organizational positions in the company into worker's and offices' positions, applicable in a municipal enterprise, was used. Organizational positions were also divided using a functional criterion so as to identify among the positions those related to: the core (basic), auxiliary and management activities of the enterprise.

Then organizational documents were used to identify factors which determine the degree of creativity related to particular work stations, which were derived from job descriptions and concerned: tasks performed on the job, methods of their implementation as well as types of thinking used at the job. The interview method was used to verify the degree of creativity of organizational positions. Interviews were conducted with the managers of all organizational units and with employees representative to each job position existing in the organization. From the group of employees working on the same job position, the head of the organizational unit indicated a typical employee, due to work pace and job performance. The interviews were conducted in following periods: October-December 2009, January-March 2018, January-March 2023. The interviews were preceded by a review of formal responsibilities (job descriptions), which were verified during interviews with managers and employees. All interviewees were asked a set of open-ended questions and all respondent answers were transcribed. The interviews were based on checklist forms. The structure of the sheets were composed of data sheets, the registration of key elements of responsibilities (functions – tasks), and methods of their implementation as well as types of thinking used at the job. Interview sheets and the collected organizational documentation (organizational charts, formal job descriptions) were a basis for the next stage conducted by a team of experts (composed of company executives and external experts), focused on the identification of the degree of creativity, particularly the types of thinking (routine, non-routine) employed in performing work functions. Additionally,

this made it possible to specify Analytical and Interactive positions among non-routine cognitive jobs. A position where the work is individual and does not require frequent arrangements with other employees was considered an analytical position. However, managerial positions requiring coordination of work were considered interactive.

# 4. Results

## 4.1. Change in the share of organizational positions in accordance with the classification used

The results of empirical research in the analysed periods show changes of the share of particular posts in the total number of employed staff. The percentage of routine jobs is relatively lower, in particular it decreased from 61.04% to 23.69% (see Fig. 2). However, divergent trends were identified in the share of routine jobs in the group of workman tasks and administration and office posts, in particular, while in the former group the share of routine jobs decreased (from 49.52% to 2.42%), in the latter group their share increased (11.52-21.27%) (see: Table 3).

It is interesting that the share of routine cognitive positions decreased in the period 2009-2018, and increased almost twice in the next period, i.e. 2023. So, as the share of routine manual jobs was reduced, the share of routine cognitive jobs increased. Additionally, the decline in the share of non-routine cognitive positions is accompanied by an increase in the share of non-routine cognitive jobs at the expense of non-routine cognitive jobs. The identified changes might be related to the fact that the automation of manual jobs, resulting in a decrease in the share of routine manual jobs, was coupled with an increase in routine cognitive jobs (routization of cognitive jobs) and decrease of share of analytic and interactive nonroutine cognitive jobs.

**Table 2.**
*The share of particular types of work in the examined municipal enterprise*

| **Types of jobs** | **2009** | **2018** | **2022** |
|---|---|---|---|
| Routine manual | 49,52% | 16,72% | 2,42% |
| Nonroutine manual | 11,79% | 38,82% | 49,71% |
| Routine cognitive | 11,52% | 11,09% | 21,27% |
| Nonroutine cognitive | 27,18% | 33,36% | 26,61% |
| *Analytic* | *16,01%* | *18,86%* | *13,59%* |
| *Interactive* | *11,17%* | *14,51%* | *13,01%* |
| Number | 1137 | 1172 | 1199 |

Source: own work.

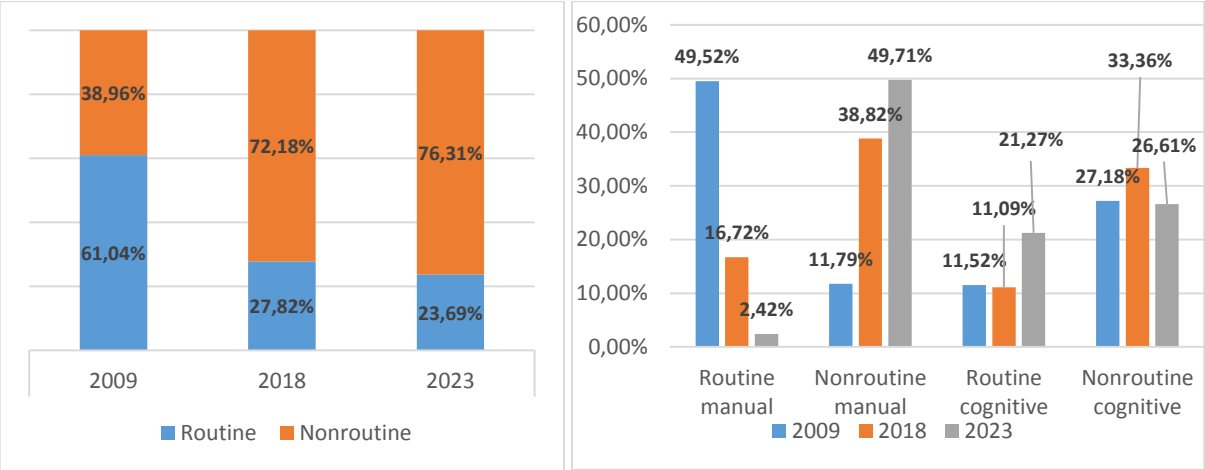


**Figure 2.** Change in the share of particular jobs in the enterprise.

Source: own work.

## 4.2. Change in the share of particular types of work in basic (core), auxiliary and management activities

The research also attempted to identify the share of individual jobs in core (basic), auxiliary and management activities in the examined municipal enterprise (see: Tab. 3, Fig. 3). Similar trends in changes in the share of particular groups of jobs were recorded in core and auxiliary activities, in particular, there was an increase in the share of non-routine jobs and a simultaneous reduction in the share of routine jobs. However, in the three periods of the analysis, a gradual decline was observed in the share of routine positions in core activities. While in auxiliary activities throughout the research period (2009-2023) there was a decrease in the share of routine positions, in the middle period, i.e. 2018, the share of routine positions was recorded (compared to 2009).

**Table 3.**

*The share of particular types of jobs work within particular types of activity in the examined municipal enterprise*

| | Core activities [%] | | | Auxiliary activities [%] | | | Management activities [%] | | |
|---|---|---|---|---|---|---|---|---|---|
| | **2009** | **2018** | **2023** | **2009** | **2018** | **2023** | **2009** | **2018** | **2023** |
| Routine manual | 59,59 | 15,80 | 0,82 | 31,13 | 26,75 | 10,48 | - | - | - |
| Nonroutine manual | 4,44% | 43,18 | 54,55 | 45,75 | 39,92 | 60,95 | - | - | - |
| Routine cognitive | 11,15 | 8,56 | 20,75 | 6,60 | 14,40 | 13,33 | 26,37 | 24,00 | 38,89 |
| Nonroutine cognitive | 27,18 | 33,36 | 23,89 | 16,51 | 18,93 | 15,24 | 73,63 | 76,00 | 61,11 |
| *Analytic* | *14,99* | *18,70* | 12,35 | *5,19* | *8,23* | 6,19 | *50,55* | *47,00* | 31,75 |
| *Interactive* | *9,83* | *13,75* | 11,54 | *11,32* | *10,70* | 9,05 | *23,08* | *29,00* | 29,37 |
| Number | 834 | 829 | 858 | 212 | 243 | 210 | 91 | 100 | 126 |

Source: own work.

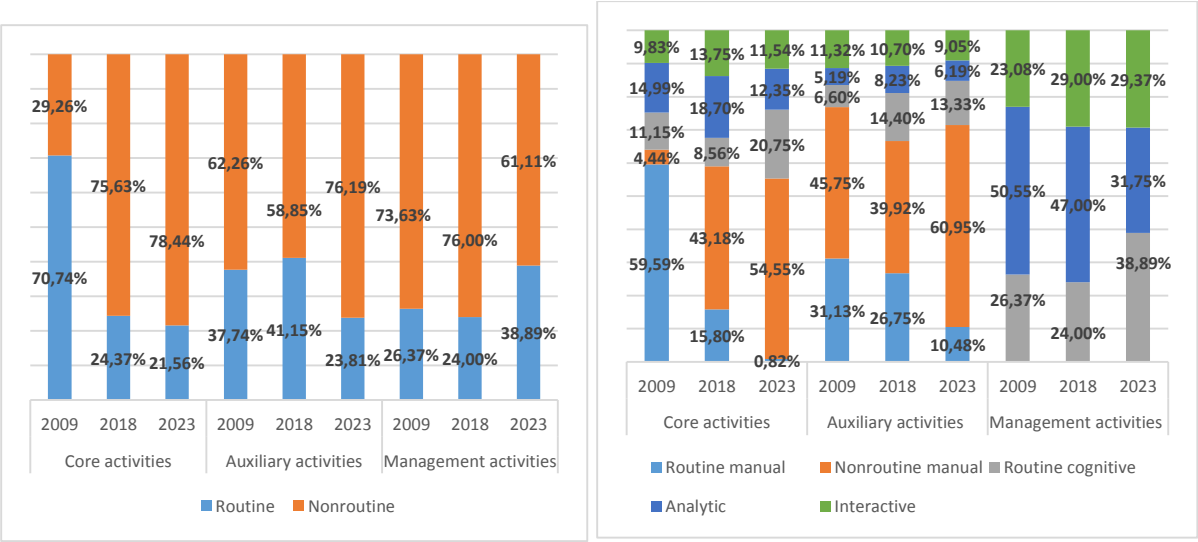


**Figure 3.** Change in the share of jobs within core, auxiliary and management activities of an enterprise. Source: own work.

As a result of the research, it was shown that in the period under study, the share of routine manual jobs decreased within the basic and auxiliary activities. However, this reduction occurred to a greater extent within the scope of core rather than auxiliary activities.

Interesting results were observed within the change of cognitive routine jobs, which share increased almost twice in both basic and auxiliary activities. However, a greater increase in the share of routine cognitive jobs was recorded in the field of basic activities than in auxiliary activities of the enterprise. Therefore, a greater increase in the share of this type of positions was recorded in this activity of the enterprise, in relation to which in the analysed period there was a greater reduction in the share of routine manual positions. However, during the period under study, some differences were observed within these two areas of operation of municipal enterprises. Particularly, in the period 2009-2018, their share in core activities decreased, while in auxiliary activities it increased. In turn, in the period 2018-2023, the share of these positions in core activities more than doubled, and in auxiliary activities it slightly decreased. During the period under study, i.e. 2009-2023, there was observed app. 1% decrease of the share of non-routine cognitive jobs in the core and auxiliary activities of the enterprise. However, especially in the area of core activities, in the middle period of the analysis, i.e. in 2018, a relatively strong change was recorded, i.e. the share of non-routine cognitive jobs increased in 2019 from 24.82% to 32.45%, and then decreased to 23.89% in 2023. A similar tendency was noted in the area of auxiliary activities, where the share of non-routine cognitive positions increased from 16.51% in 2009 to 18.95% in 2018, and then decreased to 15.24% in 2023.

A different tendency, consisting in an increase in the share of routine jobs during the period under study, was recorded in the management area of the examined municipal enterprise, where there was an increase in the share of routine cognitive jobs. The analysis of changes in individual groups of positions in the management area of the enterprise indicates that the increase in routine cognitive positions took place at the expense of analytical, non-routine

positions. In the management area of the company, there was an increase in interactive jobs, with a simultaneous routinization of cognitive jobs.

## 5. Conclusions

Based on the research conducted, an assumption can be made that should be verified in the course of further in-depth research, i.e. what is the justification for the routinization of cognitive jobs that took place in the research enterprise.

The research shows that the potential for automation of manual jobs have been limited to the greatest extent in core activities, which may suggest that it is in this area that technical progress in work processes, especially manual jobs, is implemented first and relatively most intensively. Additionally, in the light of the research conducted, it can be concluded that technological progress in work processes implemented in core and auxiliary activities limits routine manual jobs, but is associated with an increase in routine cognitive jobs. Therefore, the conducted research shows that the ongoing automation of manual work increases the potential for automation of cognitive positions in all areas of the company's activity, i.e. core, auxiliary and management. The research also revealed interesting conclusions resulting from the change in the share of individual positions in the management area of the enterprise. Research has confirmed the increase in the potential for automating cognitive work, as in the case of other areas of activity. At the same time, there was a decrease in the share of analytical work and a significant increase in the share of interactive work. Therefore, it can be concluded that in the period under study, non-routine cognitive analytical positions were reduced in favor of an increase in the share of routine cognitive positions and an increase in the share of interactive positions, i.e. those relating to tasks requiring strictly social skills.

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