KNOWLEDGE FLOW DURING THE PRODUCT DEVELOPMENT PROCESS AND ROLE OF THE MEDIATOR: A MODEL PRESENTATION

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Abstract

Innovation, and therefore product development process became the essential competence of an organisation. Competition will be retained by the generation of new concepts with innovative ideas for developing products. In fact, competitors might replicate a firm's performance for a lesser expense by exploiting knowledge that inadvertently spills outside the firms' boundaries. Hereby, the importance of the knowledge flow in the product development process is obvious. This study focuses on the crucial element of the process; a coordinator who has to follow all the environmental factors, create and generate ideas, help the knowledge flow throughout the product development team and organisation's members by using several managerial capabilities. We simply call such a person the *"mediator",* and developed a model that would reflect his managerial capabilities in such a position. The model is also implemented in one electronic goods manufacturing company in Turkey in order to maintain general view of the model's theoretical assumptions.

Keywords: product development, knowledge flow, mediator.

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1 Introduction

Today's organisations must be global and must quickly respond to the needs and requirements of their customers. Here, we can refer to the importance of the capability of continuous innovation development (Busacca 1994) prior to the achievement of the competitive advantage. Competition will be retained by the generation of new concepts with innovative ideas for developing products. In fact, competitors might replicate a

firm's performance for a lesser expense by exploiting knowledge that inadvertently spills outside the firms' boundaries (Mc Evily, Das, Mc Cabe 2000). Enabling necessary knowledge sharing environment within the company can usually be a challenge. Multiple barriers exist both to the stimulation of divergent thinking (Leonard, Sensiper 1998), which stimulate intangible assets and provoke innovation under various disciplines. For example supporting the teamwork within interdisciplinary groups, sharing diverse visions deriving from different backgrounds, may lead to sophisticated solution that may cause also competitive advantage through a new product development for the firm. In order to maintain this shared vision held by the group, particularly in this case; the product development team, the major role in the knowledge-creating process is realised by the vital member of the group; which we prefer to name as the *"mediator"*.

This study attributes to the importance of these so-called mediators, as ambassadors of knowledge facilitating in the group. The paper includes the proposal of a model, created along with data collected in a research conducted through the product development team in one of the largest companies in the Turkish electronics industry. The company holds the title of the first manufacturer of DVD-TV in the world, and is well-known in the country with its innovative projects, each of which is claimed to be in line with the company's strategy. The product development team consists of members from various departments and backgrounds, which are necessary for the success of the team and the firm, as mentioned before.

2 The Mediator's Role in the Knowledge Flow During the Product Development Process

Personal creativity, tacit knowledge and team environment makes it possible for team members to innovate. But the main factor is the coordination of these vital elements in the knowledge creating process.

The mediator has apparently a very important role in the knowledge flow during the product development process. He can be considered as the person in the middle of everything related to the process. He is aware of the importance and value of creating and capturing the tacit knowledge (Nonaka 1995, Polanyi 1967). Some articles refer to various characteristics of such a person, which can be summarised into four basic titles: Holding the know-how, being capable of proper judgement, having intuition and using little tricks that constitute the noncodifiable knowledge that may make the difference between failure and success in the transfer (O'Dell, Grayson 1998). Others

also emphasise on the importance of managerial competences while enabling knowledge flow. Flow is what facilitates the connections between seekers of specific knowledge and the providers of needed knowledge (Holtshouse, 1998). This led us to consider the characteristics of the mediator through a broader paradigm that focuses on this person based on his managerial and technical skills.

There are several classifications in the literature that organise a manager's skills into specific categories. One very well-known approach is the *"Managerial Roles Approach"*, developed by Mintzberg back in 1970's that groups ten roles of a manager into three categories; interpersonal, informational and decision roles (Mintzberg, 1975). Another famous proposal was made under the title of *"McKinsey's 7-S Approach"* that is highly influenced by the Japanese teamwork culture in a total quality perspective (Koontz, Weihrich 1988; Pascale, Athos, 1981; Peters, Waterman, 1982). In fact, since we had the intention to develop a basic model that exhibited the role of the mediator in right in the middle of the knowledge flow during the product development process, we decided to use a simpler classification of capabilities that attributes a manager's role in behavioural perspective. The mediator is not exactly a manager, at least not an entitled one, but on the other hand, he needs to act like a manager in our case's circumstances. Thus his role would seem like just a coordinator while he keeps on facing problems to be solved with some managerial capabilities along with the technical ones. Therefore, the mediator who can be referred to as the *"secret manager"* in such a process would have three capability dimensions, which are proposed as the *"three-properties approach"* in management literature (Eren 1993); intellectual capabilities, characteristic capabilities and social capabilities.

Intellectual capabilities draw the thinker side of the mediator that helps him interpret, use his mind and plan according to environmental conditions and objects. Such capabilities can be considered as the mediator's general knowledge, logic, spirit of analysis and synthesis, intuition, vision, judgement, focusing on issues, neat and direct expression, and more that help the mediator to influence and orient individuals. Characteristic capabilities provide a trustful portrait for the mediator against other individuals and harmonising objectivity with subjectivity, adaptation to changing conditions, paying attention, being serious, dignity, memory, determination, tidiness, dynamism, methodological action might be given as examples for such capabilities. Social capabilities are the ones that open the mediator to the surrounding individuals. Such capabilities are highly related to group issues and team culture, including the communication and collaboration skills harmonised with group culture and values.

Nevertheless, it is the technical capability, which the mediator uses as the driving force in such circumstances, however his behavioural capabilities enhances the use of technical capability. The technical capability includes the mediator's educational background (in this case, engineering), and experience from previous projects concerning these very issues regarding the innovative processes.

Due to his qualities, the mediator is responsible for creating an equally balanced push-pull flow of knowledge enabled by a work environment that nurtures and accelerates the expansion of knowledge (Holtshouse 1998). The flow of knowledge initiates from the corporate culture and involves knowledge-sharing, dialogue and interactive problem solving, recognizing the importance of tacit knowledge, experimenting and creating the team's own culture with common focus and common fate (O'Dell, Grayson 1998). The creation and catalogue corporate memory of an organisation's expertise leads us to sharing the tacit and explicit knowledge in the firm, taking the necessary components in order to establish the balanced team and its culture, discussing the very issues concerning the creation of concepts and methodology with necessary regulations on work environment and finally, building an archetype with the support of cross-leveling knowledge.

According to the above mentioned framework that designs the mediator's position in knowledge flow during the product development process; a basic model can be illustrated as shown in the figure below (Fig.1). This model focuses on the knowledge flow in a product development process, regarding the vital role of the mediator with his technical, intellectual, social and characteristic capabilities. The phases mentioned in the flow build a cycle, which enables us to realise the feedback of the process and the roles of each phase in the communication process throughout the team members. Backgrounds of individuals recruited in this team, attitudes and perspectives of these individuals towards innovation and use of knowledge are also important.

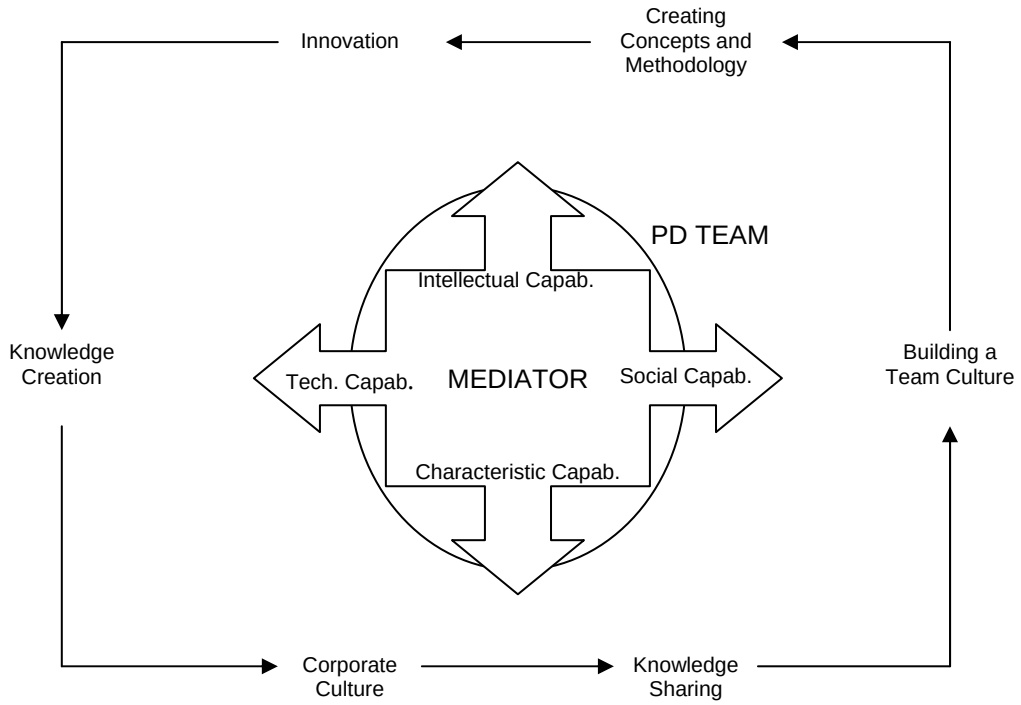

Fig. 1. Model for Mediator's Role in Knowledge Flow During the Product Development Process

3 Theoretical Assumptions

As shown in the model the investigation of the role of a mediator in product development team begins with the establishment of the group. All group members, being a part of the corporation share the same experience at the very first meeting. Their common experience is the corporate culture they have been sharing during their career in this very firm. So corporate culture is the start because it has already tried to gather people with the same values, traditions, conventions, myths, norms, ways of thinking, where the employees receive the guidelines of behavior and responsibility (Hinterhuber).

According to Schein the organizational culture could be analyzed in three different analytical levels:

- Artifacts (Physical manifestations, Language, Stories, Technology-*Materials, Operations, Knowledge*-,Visible Traditions)
- Values (Authenticity, Autovisuality, Credibility, Domesticity, Essentiality, Individuality, Inventiveness)
- Basic Assumptions (Reality and Truth, Time, Space, Human Culture, Human Activity, Human Relationships)

Among the tools mentioned as artifacts, the role of technology and the use of knowledge in the technology is not to be overseen. Values, norms and practices, which are seen as the elements of culture influence behavior through which knowledge creation, sharing and use arise.

Cultural knowledge includes the assumptions and beliefs that are used to describe and explain reality, as well as the conventions and expectations that are used to assign value and significance to new information (Choo, 1998). According to De Long and Fahey there are four frameworks linking culture and knowledge: Culture shapes assumptions about which knowledge is important, culture mediates the relationships between levels of knowledge, culture creates a context for social interaction and finally culture shapes creation and adaptation of new knowledge (De Long and Fahey, p.116-123).

The first point in this issue is very much related to managerial actions since it is vital to underline how different cultures or subcultures support knowledge sharing, determining essential ways of behavior, which are critical for knowledge- building activities and to be aware of the barriers for sharing existing norms and practices. Schein also emphasizes the founder/leader's decisive significance in formulating new values for affecting and changing the existing culture. (Schultze, p.28)

Among the levels of the organizational knowledge, the most specific is individual knowledge which also creates the organizational knowledge through group influence. Nowadays in the modern organizations the most common place where collective knowledge is created is the team. (Probst)

Different capabilities of the team members is the most important aspect for creative problem solving in a team. (Probst, p. 200) Yet different kinds of perception and behavior patterns might also influence the efforts in establishing a team culture. Compared to the organization, a smaller social group, the team should show almost the same effort in order to build its own values, norms, stories, language, technical knowledge in an innovative team like product development like the organization building its corporate culture. The mediator in this sense is responsible for this social interaction in the group, with the routines which enable team member communication at a high level. These set activities evolve in time into commonly shared concepts and methodology which creates not only technical knowledge but also social knowledge. Independence, coordination and innovativeness are critical in certain teams like research, product development, administrative and information systems teams (Janz et al. 1997) which are defined as knowledge workers teams who apply theoretical and

analytical knowledge, acquired through formal education, to developing new products or services. (Drucker) Mediators who are aiming at establishing an information exchange and innovative behavior among team members use clear mission statements, coordination and cohesiveness.

Innovation in any sense is not only a technically related issue. Successful innovation has always been the combination of technical and social aspects (Hinterhuber). In organizations where core capabilities are technology based, the knowledge creation process is very much dependant on the development of new products and services, innovation (Choo).

If we compare the different knowledge creating processes, also investigated by Choo, we face a lot of similarities in the method and process.

Wikström and Norman suggest a process where generating new knowledge, operationalizing it and finally diffusion and transfer of new knowledge is underlined, whereas Nonaka and Takeuchi explain the process in steps like sharing tacit knowledge, creating concepts, justifying concepts, building an archetype and cross-leveling knowledge. Leonard and Barton on the other hand, emphasize the importance of shared problem solving, experimenting and prototyping, implementing and integrating new processes and tools and finally importing knowledge (Choo- Nonaka and Takeuchi).

In a product development team like in our example, the knowledge creating process started with the previously acquired knowledge of the team, their former experience in a broader sense, the corporate culture. It evolved through knowledge sharing activities; even shared ideas are mostly about technical issues, the way of becoming a team, coming together as a social group for the same aim created the team culture which has its own concepts and way of practicing through its self created terminology. Creativity is supported in this environment through team culture, a result of social interaction. The mediator especially at this point is the one who gives rise to potentially creative alternatives in the group. Innovation itself is the collective experience of the team members so they have to be aware of the knowledge creating environment and the knowledge flow, shared tacit and explicit knowledge during this very process.

4 Implementation of the Model: An Example from An Electronic Goods Manufacturing Company

In order to examine whether our assumptions can be validated in the real environment, we have decided to apply our model to the product development team of an electronics company, which is among the major TV manufacturers in Europe. The company's main policy is to produce innovative goods that comply with customer demands and maintaining the brand comes after. In other words, the company prefers to be in *"every kind of market"* with bottom cost while maintaining *"everyone's"* satisfaction. Up to date, the company is renowned with *"futuristic"* projects like Internet TV, DVD-TV, and few others. The two projects mentioned have been quite famous, particularly the DVD-TV, which combines DVD player and the TV goods together intone single product.

Projects in the company are conducted through product development teams, each with strong bonds with the research-development department. Basically, the teams consist an average of five members that have such various backgrounds and talents as technicians for mechanics, software and hardware, engineer of electronics and marketing agent. Obviously such working groups have the potential of idea generation in various perspectives, but there might also be miscommunication and even conflicts during the product development process. The group happens to be a *"zero hierarchy"* type of team but all the members agree that one person in the team seems to be more sensitive to developing issues in every field in the environment. This person might not be titled officially as the leader or head of the team but he is considered to be the key member who acts like the policeman in the middle of the crossroads or simply what we prefer to call the *"mediator"*.

An interview with such a mediator was conducted regarding the factors that build our proposed theoretical model and questions developed earlier are asked to the interviewee at the presence of other members of the team and research and development department employees. These factors include the corporate culture, knowledge sharing, building a team culture, creating concepts and methodology, innovation and knowledge creation and interviewee was expected to describe and interpret his status, efforts and attitudes in terms of his intellectual, technical, characteristic and social capabilities. The interview was performed face to face by using a micro cassette recorder within the company's environment.

Mediator's position and status within the team and the R&D department was the starting point of the conversation. Basically responsible for supply management, project management and coordination among the members within the product development process; the mediator described his status and duty as coordination of supply, orienting team members in project development and finding more realistic and more efficient solutions to various problems while monitoring the latest developments in the environment and in the market in order to submit necessary details to the research development department. Such details include information about the latest trends in the market, customer demands, threats in the business environment, etc. The interviewee, who personally thought that his technical identity came forth to his intellectual capabilities, has mentioned that his position required a high level of intuition in order to see the threats and opportunities in advance and naturally being realistic with *"realistic"* imagination was also essential. He added that general knowledge played an important role in terms of several issues from economics and finance to engineering, as well as management, marketing, production and other business functions. Our interviewee is an engineer of electronics with a master's degree in business management and organization. When he was asked which party (top management or the product development team) he represented during the above-mentioned issues, he emphasised the corporate culture's vital existence in his company's strategies. The mediator, who claimed to support justice in his team with reporting every negative or positive facts in his tasks, strongly believed in recognition of success throughout strategic management. However, he faced many difficulties in the coordination of ideas and requirements between the team and the top management of the company. He strongly indicated that since he should keep his intimate relationship with the R&D, he preferred to communicate with them in a more technical language and to look towards the problems (like project quantities and magnitudes, timing and financing projects, etc.) through their perspectives. Moreover, he tried to convince these people with the commercial value of the projects they conducted and the benefits that the company will acquire along with the employees themselves. He briefly described this process as being the managerial embassy in communication with R&D in terms of technical issues. Another feature of their corporate culture was their reaction speed within the market. The company has the intention to make quick decisions and their quick applications. This was also imposed by the mediator during the product development process. Projects in the company were conducted in cost-effective flexible conditions that in case of lower cost opportunities occurred, the projects were directly and quickly transferred into its new operation level. Company's strategies and policies were based

on the *"futuristic products"* concept that the production of future technology adopted goods were supported. In fact interrelations within the team varied from one person to another. The mediator mentioned that he needed to be social in his behaviours when dealing with the product development activities and while he communicated easily through intranet with one colleague, he might have spoken face to face with another. While he had to be neat and open in his spoken language, he sometimes used his convictive skills to persuade his colleagues with the shared tasks within the product development process. He should communicate his colleagues with company's aims and targets and penetrate the mission and vision into his team's activities. Furthermore, in case of problems related to the knowledge flow during the product development process, the mediator had to cope with the responsible individuals even if they were from the upper hierarchical levels. He strictly emphasised the vitality of determination in his manners as a mediator between several colleagues and employees from different hierarchical levels within the company. Sometimes, he acted like the natural spokesman of the team when defending reasonable facts against the top managers. On the other hand, the same mediator sometimes exhibited the manner of a referee in a football game who shows yellow and red cards to the players and he warned his colleagues to do better their tasks and cooperate with the company's culture, when necessary. This warning could be either the implication of such unwanted behaviours or writing a report to the upper level managers about the situation. Therefore, a mediator should be able to harmonise his behaviours according to the environmental factors, as well as according to different types of personalities. The mediator mentioned that his position never offers the person the luxury of being timid in his relationships with others.

It was an obvious fact that the engineering background of the mediator helped the mediator himself to create new ideas, which would enhance the initiative to develop new products. Moreover, his engineering background has been appreciated by all of his colleagues either with a technical background or with social ones. Innovation was mentioned to be flourished through such properties of the product development team, in which the mediator played the major role. Furthermore, idea generation by the team would be very brilliant in terms of technical factors but in some cases, top management has shown resist to implement them. In such circumstances, the mediator had the greatest role, he even had to behave like a hero who played *"the voice of people"* that inadequately intended to explain futuristic brilliant ideas, in which the top management could hardly believe. The mediator, in these cases, became an engineer with high level of managerial skills who had the ability to defend the idea in technical terms through

managerial perspectives such as; strategic management (coping with competitors), total quality management (conducting well operated process from supply to customer care), financing, marketing (market's dynamics and customer profiles), logistics, etc. Thus, the brilliant promising ideas would not disappear due to top management's resistance. Here, the mediator confessed that he based his defence for such brilliant ideas with basic managerial principles of his company; minimum and effective use resources and cooperation with subcontractors. This refers to the mediator's characteristic capability of using methodology; realising tasks or ideas in accordance with formerly proved procedures and methods.

Knowledge sharing, on the other hand, was mentioned to be the crucial element of the knowledge flow. The interviewee emphasised such a major difficulty as acquiring tacit knowledge from members of the team or employees in the R&D department. In such circumstances, the mediator mentioned that the expected knowledge might not come directly from the knowledge holder but from the manager or head of his department. In fact, this solution was preferred as the ultimate decision by the mediator. Prior to such knowledge supply through indirect channels, the mediator tried to gain the intimacy and trust of the knowledge holder himself for a better communication and knowledge sharing. The problems usually arose from the misinterpretation of the knowledge holder, who only thought to give straight knowledge without further details or comments and such knowledge would still stay tacit for the receptors. Briefly, the mediator should know how to approach colleagues who are *"knowledge keepers".*

According to the interviewee, another role of the mediator was compiling all the details in a product development process. Knowledge and resources that spread around should carefully be examined and gathered into one process. While his colleagues behaved individually and used their knowledge and resources according to their styles, coordination of the created knowledge or product has always been the main task of the mediator and such a task is so essential that loss or misuse of resources would be his responsibility according to his ordinates. The mediator stressed on the *"zero-hierarchy"* concept of his working environment, which meant that colleagues were considered to be at equal levels including the mediator who, however, had to control the knowledge flow and the product development process for its efficacy and efficiency. This was referred to the mediator as a natural leader of a zero-hierarchy team. Thus, interpersonal relationship were mentioned to play an important role in such teams, which require high level of communication skills that members had different types of personality each and the mediator happened to be in the middle of this complex

communication network, particularly in meetings. Moreover, retaining the employees was mentioned to be another task of the mediator and the interviewee gave such an example to this case as he even had to think about the dissatisfaction of his colleague for his salary and had to speak with top managers about this matter as his colleague was a very valuable employee for the company. Besides, technology was defined as the basic driving force of the company, particularly for the electronic goods and the mediator used his technical skills in order to maintain the technological capability of his company in accordance with outer developments. Therefore, focusing on issues and problems were necessary in several circumstances. The interviewee mentioned that he, as a true researcher, had to follow every little innovation in the technological environment that his company would supply benefits in terms of customer satisfaction and costs. In addition, he mentioned that the approval of the independent quality department of the company as well as the R&D and production departments in order to bring these innovations in the company's product development projects. Here our interviewee mediator pointed out the importance of dynamism, as, perhaps, a key factor that holds the company dynamic while responding to its fast changing market environment. If the mediator acted slow in making research for more economic and more efficient technological solutions, this would have kept the company behind its competitors.

In order to examine the above mentioned interview through our theoretical framework for the model we have developed, the below table can be proposed to monitor the theoretical concepts (Table 1).

5 Conclusion

The mediator in this sense, as a team member who is on the same hierarchical position with other team members but who uses the managerial skills with the combination of his/her technical background is the main force of creating knowledge in an innovative environment where other people mostly use their capabilities on technical level. In any social context, especially the value added influence of tacit knowledge sharing and use among the team members needs to be coordinated by a member whose managerial capabilites are acceptable for this position. In the example we have shown above, the mediator with his degree in engineering and management, with his experience in project management proves to fulfill his/her technical capabilities. His intellectual, social and characteristic capabilities, which enable him/her to communicate properly within the team and organization is the most important factor for continous knowledge flow

that not only ends up in knowledge creation but is also a vital feedback for corporate culture and existence. It is expected that the above mentioned model and the study on the role of the mediator provides oppurtunities for further studies and research.

Table 1. Use of managerial capabilities throughout the knowledge flow

	Intellectual Capabilities	**Social Capabilities**	**Technical Capabilities**	**Characteristic Capabilities**
Corporate Culture	The mediator is in position to establish an introductory point with shared values, norms and beliefs.	The mediator is in position to continue the practice of commonly recognized parts of the corporate culture.	A mediator with broader experience in project management would bring the reflection of corporate culture easily to the team.	The mediator is in position to adjust the different perceptions of team members concerning corporate culture.
Knowledge Sharing	The mediator enables knowledge creation through clear definitions and assumptions.	The mediator is in position to use different ways in order to share the acquired knowledge with different team members.	The mediator with a technical background is able to communicate with members in technical terminology.	The mediator is able remember the crucial details concerning the total of the work.
Building a Team Culture	The mediator with a strong intuition is able to establish the vital group dynamics.	The mediator is in position to convince team members for the common aims.	Previous experience on group thinking and team development is a strong asset for dealing with problems within the group.	The mediator proved to be trustworthy for common aims.
Creating Concepts and Methodology	The mediator with his/her general knowledge and true interpretation is able to establish the common terminology.	The mediator and his/her set of values are respected among the team members.	The mediator is able to communicate with members from different backgrounds.	The mediator with his/her standard behavior pattern is easy to communicate with and understand in case of a change in the group.
Innovation	The mediator has not only an analytical but also an imaginative approach.	The mediator is able to create a synergy among team members.	The mediator is able to make personal judgments or recommendations on technical issues.	The mediator is very dynamic and aware of simultaneously ongoing efforts.
Knowledge Creation	The mediator with his/her analytical	The mediator knows the team members so well	The mediator is technically in position to	The mediator is in position to store the acquired

	approach is a true help in the knowledge creating process	that s/he is in position to guide them in knowledge creating process.	understand and interpret newly created knowledge for further investigation.	knowledge.

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