Research Article

Resource based view in the Turkish construction sector and resource selection with ANP technique

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ARTICLE INFO	ABSTRACT

The competitive environment observed in the international construction sector has reflected in the Turkish construction sector through joint projects. In order to achieve competitive advantage in joint construction projects and to achieve success against national competitors, it is necessary to review resource selection strategies. In this context, the main purpose of this study is to look at the resource selection criteria of the construction companies in terms of International Resource-Based Theory. The 77 resources of the construction firms reviewed during this study were evaluated by taking into consideration their ability to be strategic resource and their competitive advantages. In this study, the Building Information Modelling (BIM) tools and technique, which has been spoken as a resource that will benefit competition in Turkey in recent years, was discussed as an objective and the research problem was whether BIM is a strategic resource or not. In the resource evaluation process, resources should be listed and evaluated by firm employees and managers. In the survey conducted for this purpose, construction firms were asked to select the resources they already had from the resource pool of the research and to score only 9 important resources. To establish vertical hierarchy and horizontal relationships, the obtained results of the evaluation were analyzed by using the Analytical Network Process (ANP) method. In the established hierarch, the objective was BIM and the selection criteria were VRIO criteria including Valuable, Rare, Inimitable and Organization, which are the resource selection criteria of the Resource-Based Theory. The scores obtained as a result of the survey study applied to the Turkish construction firms were reflected to the ANP technique. While the data processed with the Super Decisions software provides numerical and quantitative comparisons of resources in the construction sector, it also points to a selected set of resources that can work with BIM.

1. Introduction

BIM systems and tools used in the Turkish construction sector over the last decade have started to be among the resources used by the construction firms thanks to international projects. Given the development level of the firms, while some firms have a BIM system, the software programs that BIM offers take place as a tool in some other firms. At national or international level, BIM systems and its tools are among the firms' targets as a resource that makes a difference with its absence or presence, and even as a resource that some firms see in their competitors and feel the lack of it. Accordingly, even if they use terms such as administrative strategies, project management, human resources, innovation, vision and mission, Turkish construction firms have resources that they need support of them to their strategic resources, which they have chosen or created in line with their missing resources or the administrative strategies they have; however, they cannot put these resources into their place.

When firms are defined as organizational structures, resources and capabilities, we start to define them by looking at their internal structures. Moreover, the strategy applied by a construction firm in order to gain competitive advantage depends on everything involved in its internal structure.

In determining competition strategy by taking into account the economic-based literature, there are three different strategies that the firms applied in order to gain a

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competitive advantage; 1. Total cost strategy, 2. Differentiation strategy and 3. Focus strategy. Total cost leadership is defined as the making production of a firm at the lowest cost compared to its all competitors on the market. On the other side, in comparison to their competitors, the effort of firms to produce innovative and high-quality products is called differentiation strategy. Finally, the focus strategy can be defined as the attempt of firms to gain a competitive advantage in a specific product, a specific customer group or a specific market through narrowing down the target market in which they compete.

According to Michael Porter [6], who is pioneer of the concept of competitive strategy, a business must analyze the sector before developing a competitive strategy and determine a strategy that is appropriate for that sector. Thus, the firm will gain a position in which it will be able to protect itself against its competitors in the sector. The firms' acquisition of this opportunity is called position approach, industry-based approach and opportunity approach.

Contrary to Porter's opinion about strategies [6], a resource-based view explaining the situation in which firms aim to gain competitive advantage by focusing on their own internal structures and their own resources and capabilities rather than focusing on the sector has emerged [1].

The resource-based view aims firms to determine their own resources and capabilities. In this respect, when compared to the resources that are not in the hands of their competitors, the current situation will provide competitive advantage to the firms.

Looking at the opportunity-based approach, we face the fact that firms must first analyze the sector they are in and they must pay attention to it when determining their strategies in order to gain competitive advantage.

Among these two different approaches, in order to examine the Turkish construction firms in this study, the Resource-Based Theory (RBT) was preferred. In this context, while the resource-based theory was constituting the basis of the study, the BIM system and tools were selected as a resource for the Turkish construction firms and the firms were asked about their opinions on this resource.

The purposes of this study can be summarized in three items;

1. The fact that RBT is of great importance that can provide benefit for Turkish construction firms when the current strategies and resource selection criteria are examined

2. Listing the most important or strategically defined resources of the firms in line with the answers obtained from the interviews conducted with the construction firms. Matching the resources with the VRIO criteria and production

of the best resource alternatives or combinations with ANP technique.

3. Examination of whether the BIM system and its tools are a strategic source for Turkish construction firms or not.

The results obtained in line with these purposes will be beneficial in the future studies in terms of the key performance indicators and related measurements by listing the result of an original resource selection in construction firms.

2. Background

Edith Penrose (1950) and other researchers [4], [5], [6], [7], [11], have defended for years that in order for firms to grow and develop in an organizational sense, the current situation analysis should be done, industry analysis should be done and strategies should be focused on. Porter initially advised the opportunity-based approach that suggested focusing on market conditions and the environment [6]; later, by combining it with the firm's own structure, he has started to advocate SWOT analysis. While revealing the strengths and weaknesses of the firm, Porter has also foreseen to consider the opportunities and threats that the sectoral conditions, in which the firm is located, present. In addition, Porter evaluated the performance of the firms in terms of competitive insights by taking into account their product and sector structures and the market position they were in [6].

In the late 1980s, Jay Barney stated that the conditions required to gain firm performance and competitive advantage were associated with the firm resources and capabilities. If the resources are the building blocks of the firms, it is necessary to look at the internal structure of the firms in order to identify a resource [1]. By determining objectives for resources and capabilities such as being a valuable resource, being a rare resource, and not being imitated, this strategy, which is described as the resource-based view, has defined the firm as an organizational structure. On the other side, when the resource-based view was considered as a theory, a tool that evaluates the resources emerged. This tool, which is known as the acronym VRIO (V=Valuable, R=Rare, I=Inimitable, O=Organization), divides resources and capabilities into stages step-by-step in order to gain competitive advantage. If a resource meets all the criteria, it means that competitive advantage has been achieved. Sustainability of this depends on structure of the organization and its capability.

All the resources of a firm are more than its strategic resources [2],[3],[12]. Therefore, the protection of resources' strategic resource characteristics depends on the firm's efforts and organizational competence. Barney defines resources as "*everything, such as all assets, abilities, competencies, organizational processes, firm*

characteristics, knowledge, and know-how, that can be controlled by the firm and that provides efficacy and allows them to use strategies providing efficiency."[3] This opinion is a strategic solution that makes firms to gain a competitive advantage. Here, another issue to be known is that many of the strategic resources are specific to the firm and the firm must be able to establish communication with these resources at the highest level and keep the resources up to date according to the current circumstances and requirements of time. In order to do this, the firm needs to consider the official business processes and production functions together with their strategic resources. Protective measures are essential for the characteristics of the resources. These measures are provided by isolation mechanisms [3].

Considering the same resource selection criteria for construction firms, the resources and capabilities that the firm has in the current situation should be determined, and it should be understood which resources are defined as strategic resources.

3. Methodology

This study begins with a literature review explaining RBT and previous assumptions about competitive strategies. In the context of this research, a face to face interview study was held to determine the resources that might be possessed by Turkish construction firms, whether they had BIM system and tools or they might just aim to establish this system only for using BIM based software. During this research, the evaluation of the resources was done by applying Analytical Network Process (ANP) method in order to construct a logical hierarchy with the definition of the aim, criteria and alternatives. Again, the purpose of the research is connected to that hierarchy and it is questioning the best strategic resource or resource groups in connection with BIM.

It was decided that the best method for this evaluation was the ANP method because this study is a unique study combining ANP method with RBT in the perspective of the construction sector and its actual resources. Moreover, VRIO tool, which is related to RBT, will be a guide in providing competitive advantage by choosing the best resource alternatives specifically to each construction firm in line with the firm's strategy.

3.1 Decision-Making Process

Data for this research were collected through a survey study that lasted for two years. A total of 41 Turkish construction firms, which were listed in the top 250 contractors list of the ENR 2015 report, constituted the units of analysis of this study.

Comparing to all firms, it was seen that just 10 firms were using BIM system or at least its tools. In order to measure the resources as the number or type, 74 potential construction resources were chosen to ask the interviewees. This resource list included BIM and its tools. In addition, within the context of RBT, the VRIO tool that examined whether their resources were valuable, rare and inimitable or whether their organizational structure was capable to use them effectively was explained to the firms. After the collection of the appropriate data about the resources of the firms, a logical hierarchy leading to the decision-making process was able to emerge. Furthermore, if there are more than one alternatives in the decision making process, criteria, alternatives and the relations with the aim should be determined first on the way of competitive advantage. There are analytical decision-making methods used for this aim. These are Analytical Hierarchy Process (AHP) and Analytical Network Process (ANP). In AHP method, a relative measurement theory based on the pairwise comparison of the pre-defined criteria and alternatives is preferred. The logic of this method includes pairwise comparison matrices showing the resources as alternatives. In the AHP method, by preparing pairwise comparison matrices, ratios of dominance between the two alternatives are determined via an evaluation based on absolute numbers in the scales between 1 and 9. On the contrary, using the ANP method, not only a comparison between tangible resources is made but also a comparison between intangible resources can be made by depending on the opinions of knowledgeable and expert people [15].

In the decision-making process with ANP, the relationship between factors should also be considered. In other words, because the solution of the problem is not only in hierarchical order, but also in the relationship between the factors, the ANP method provides a more realistic analysis [8], [9], [10]. Also, the AHP structure is similar to a one-way communication system, but the ANP provides more detailed communication including vertical and horizontal connections.

Network structure provides opportunity to rate and grade the alternatives as ineffective, low-impact, high-impact, very high-impact [10]. So, before evaluating the resources, six main steps used for developing decision-making model by applying ANP approach should be defined. Each step of the ANP is described in detail below.

Step 1: Definition of the decision-making problem
Step 2: Identifying relationships
Step 3: Making pairwise comparisons between criteria and alternatives
Step 4: Calculating consistency
Step 5: Creating super-matrix
Step 6: Determining the best alternative

In this study, the use of ANP method was preferred because both the tangible resources and the intangible resources were subjected to pairwise comparisons. However, AHP builds a hierarchy, creates a one-way

model and when making the best decision, it uses priority order for effective factors. Good decision making process includes some steps such as thinking, planning and analysis. If the conditions required for gaining competitive advantage are also added when the evaluation criteria of resource-based theory are added to the resources selected with the firm strategy, determining the VRIO criteria as criteria in the ANP hierarchy is seen reasonable in terms of creating both the criteria and the matchup of the resources.

3.2 Resource Based Theory and ANP

As Barney pointed out, RBT aims to identify and examines resources in a firm as tangible or intangible terms. Since these resources are different from each other with their qualifications, quantities and importance levels, there is a need for an investigation about which resources will benefit from the competitive strategy that is chosen by the firm. [1], [2] [3].

ANP method was used during this research because it helps to investigate the selected resources in line with the survey questions. In order to do that, a total of 30 firms were visited within 2 years in which surveys were completed through face to face interviews. Firms were asked about their strategies and each firm was asked to make a strategic choice from 74 resources to identify their own 9 sources that they believed they are effective.

As it is known, the ANP method creates a network and a vertical hierarchy that are established at the beginning of the decision making process. Then, a horizontal logical link and relationship arrows are defined to show the relationships. Under these circumstances, it is necessary to use the criteria that ANP provides in order to combine it with RBT, while aiming to find the resource or resource groups that will provide competitive advantage.

VRIO, the criteria for the RBT, is a contributing tool at that phase; starting with the selected resources, the adjectives of VRIO (valuable, rare, inimitable) may be used to classify them. Furthermore, each resource may not be a strategic resource, but it may have a potential to transform into a strategic resource. VRIO, as it is mentioned before, evaluates the resources with yes-no question types. If the resource is valuable, its rarity will be questioned as a second step. After that, the potential of its inimitability is important. Finally the organizational effectiveness related to the usage of the resources will matter.

3.3 The ANP Model

First of all, as mentioned previously, determining the problem is the first step of the ANP method. The problem here is that whether BIM is a strategic resource selected during the decision-making process or not.

On the other side, the second step is to identify relationships. The relationships should be defined between clusters containing alternatives (resources), between criteria and clusters, and finally between clusters, aim and criteria. When the aim of the hierarchy is defined as BIM and if the VRIO criteria and alternatives are determined as resources, a network hierarchy will have been established by showing the relationships. VRIO is defined as criteria of our ANP model and alternatives are defined as resources of a construction firm.

A notable point in the ANP method is the importance of criteria. This importance does not affect the importance of the resources; however, it should not be forgotten that alternatives can affect the criteria [10]. In the context of this study, we can say that the VRIO criteria are a precondition because they are required to establish the hierarchy and network. Reason of this is that the alternative cluster comprised of 9 resources belonging to each criterion actually defines the quality level of resources that will contribute to the aimed competitive advantage. For example, in terms of the likelihood of transforming into a strategic resource and making BIM strategic resource, there are differences between pairing of a resource from a valuable resource list with BIM and pairing an inimitable resource with BIM.

The dependence between nodes (resources) in a cluster (criteria related to the resource list) is defined as an inner dependence and the dependence between two clusters is defined as an outer dependence. The feedback loop is another term for the ANP method and clusters containing nodes. The relationship of a cluster with itself creates a feedback loop. By the way, an ANP model that contains a feedback structure takes the name of the feedback model. Thus, clusters can question themselves in a complex problem [10].

Because the alternative cluster in the subsets (subclusters) also contains dependencies, they must depend on the highest level (that is the target level) from the lowest level. Thus, in the decision-making method of ANP, alternatives and resources can establish a pairwise comparison matrix. Pairwise comparisons are equal in terms of number and the scoring status was pre-determined by questionnaires. The purpose of this was to determine the level of dominance among alternatives. While the firms were asked which resources were valuable, rare and inimitable, they were also asked which resources they used organically and productively. The real and productive dominance also show the difference between all resources. Therefore, the resources listed between 1 and 9 by firms were evaluated by firms using scales between 1 and 9. The result of scoring showed the dominance of resources in pairwise comparisons from the sources that meet the dual criteria.
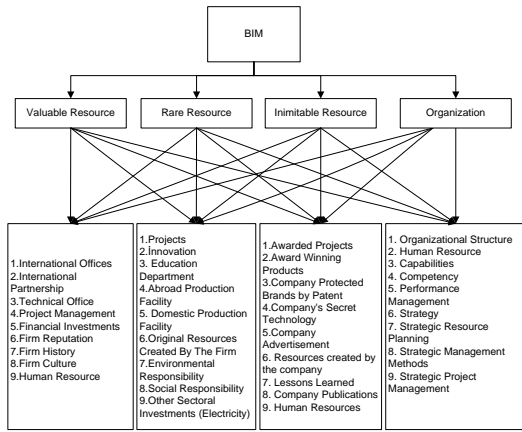
Figure 1. RBT related ANP model with resources.

On the ANP model, the second step is to define relationships. In the previous section, the relationships were defined by establishing links between BIM, criteria and alternatives (resources). On the other side, the third important step is the requirement to make comparisons by establishing links between the criteria and alternatives. The resource lists, which includes BIM system and tools, shown in Figure 1. were essentially chosen by the authors by the time Turkish construction firms tended to use them and these resource lists constitutes the clusters defined in the literature. Accordingly, these resources in each cluster are the nodes in terms of terminology. When defining relationships, it should be noted that the dependence between nodes in a cluster is defined as inner dependence. Moreover, the dependence between two clusters is considered as outer dependence.

Additionally, the feedback loop between the resources in clusters containing alternatives will also be identified by the relationship within them. If resources work together in the same cluster, a feedback is created for each cluster (Figure 1,2,3,4,5).

A simple pairwise comparison matrix is shown in Table 1. If it is assumed that A is a criterion, a comparison can be made between the resources defined as R1, R2, and R3.... In the list of references on the left column, R1 is scored between 1 and 9. This scoring can be done for all references. Thereby, this scoring is linked to creating a pairwise comparison matrix [9].

In addition, there is also a software that uses the ANP method. Super Decisions 2.6.0-RC1, which is one of those software, was chosen in order to make resource evaluation for this research. This software allows to create a resource priority list after completion of pairwise comparisons. The resource priority list that is created within this scope and that contains the BIM system and tools is shown in the Table 2.

Table 1. Adaptation of the simple pairwise comparison matrix to the resource selection. [9]

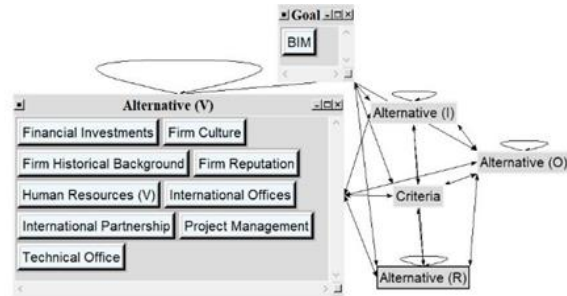| A	R1	R2	....	Rn
R1	1	4	....	9
R2	1/4	1	....	6
R3	1/9	1/6	....	1

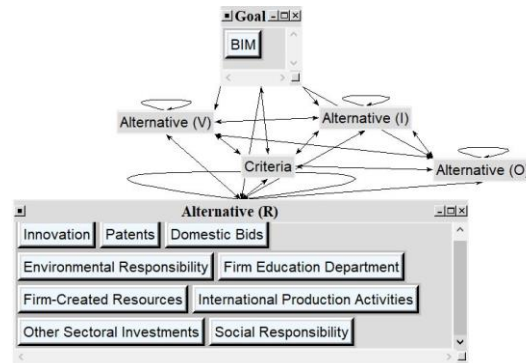Figure 2. The relation of valuable resources and other resources

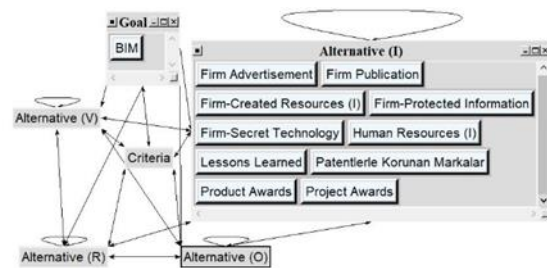Figure 3. The relation of rare resources and other resources

Figure 4. The relation of inimitable resources and other resources
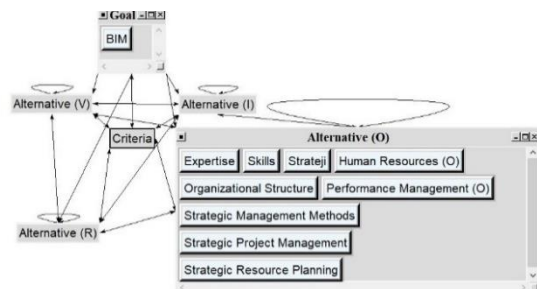

Figure 5. The relation of the organization and other resources

3.6 Calculation of the Consistency

When making comparisons and scoring are performed by using the AHP method, the evaluation of the matrices or written evaluation can be made. No matter what calculation tool is used, the consistency ratio must be included in this calculation [19]. In the context of this study, making the calculation, if "n" is accepted as the number of criteria, random index numbers should be defined. Thus, the eigenvalue is defined by λ. while the largest eigenvalue λmax in the created square matrix, the following equations are used.

Formula used in calculation of the consistency ratio (CR):

Consistency index (CI) = (λmax-n) / n-1

Consistency Ratio (CR) = Consistency Index (CI) / Random Index (RI)

In this calculation carried out with Super Decisions software, the consistency ratio was accepted as ≤ 0.1.

3.7 Creating a Super matrix

Creating a super matrix is one of the required steps used to prioritize the resources. Matrix tables divided into three groups (weighted, non-weighted and limit super matrix) are prepared [10]. Moreover, the weighted super matrix is the value that the sum of each column is equal to 1 in the prepared non-weighted super matrix table [8], [9].

The third and final step is to create a limit matrix by increasing the intensity of the weighted Super matrix until its lines change [9], [10]. As a result, for the aim of this study, basic super matrices and limit matrix tables were prepared by using Super Decisions 2.6.0-RC1 software.

4. Results and Discussion

The findings of this study indicates that the value of Turkish construction firm resources with strategically thinking from the view of RBT. Here, the firm resources including BIM were been asked to construction experts and with their comments, an evaluation was tried to be made. However, a resource and its real value will take years to understand in an organization, competitive advantage on the other hand may be gained by the construction firms which are regarded as the organizations here, that they should be capable of using their resources effectively. Moreover, during the time, the technological changes as innovation in construction industry will also affect the strategic value of the resources, so according to the RBT inimitable resources may become a common resource at some time if the firms do not protect their resources against the changes that time brings. Today, BIM system and tools are valuable resources for construction firms and the outputs that are produced by project teams, may help these firms to gain competitive advantage but its sustainability is related to the effort of the firms. So, construction experts' comments are important to protect the strategic position of the resources.

This study discussed and analyzed the potential of BIM system and tools to become a strategic resource for Turkish construction firms. In this study, the applied ANP technique and Super Decisions 2.6.0-RC1 software have been very effective in comparison of 36 firm resources used in Turkish construction sector. More importantly, the RBT, which presents a theoretical background for the research, and VRIO tool have been paired with the ANP technique in order to decide the complex resource selection problem. According to the research findings, examining the table of priorities, it is figured out that if it is strategically seen and associated with BIM, the most effective resource is human resources (in organizational management) with 41.09 % in the ranking. The other important resources are financial investments (31.02%), in-service training (30.91%), organizational structure (27.21%), firm advertisements (25.69%), firm recognition (17.93%), protected information (17.64%), created resources (16.75%), innovation (15.81), Project Management (12.59%), performance management (according to management) (11.17%), and firm's secret technology (10.87%), respectively, these results also show the relation with BIM, if the construction firm are able to match their strategic resources with it.

As a result, the relationship between BIM, strategic resources and percentage values strengthens the opinion that BIM is a strategic resource for Turkish construction firms. Moreover, further research about BIM and other resources may be considered as performance indicators for a construction firm.

5. Conclusion

This study is expected to be beneficial both for the construction industry and for the academia. The results of this research will facilitate to have the big picture of the resources evaluation phenomenon in the construction industry. This is vital since many construction firms had bankruptcy in 2015 during the research interviews were held and at that time strategical way of thinking and the guidance of researchers. Organizations such as construction firm on the other hand should better tailor their solutions for themselves with their strategies for resource choosing criteria. Also, this research will unearth any possibility of firm resources that may related with BIM system and tools are able to support the way to gain competitive advantage from the beginning phase of the resource selection in construction firms.

Until now, no study has attempted to investigate the RBT in construction industry with such comprehensiveness that connected with BIM. With this research, many researchers will be able to get information about construction expert ideas about the construction firm resources. In addition, the effect of RBT on resource selection might provide a good knowledge on the decision strategic resource selections.

Table 2. Priorities of Resources Calculated with Super Decisions 2.6.0-RC1

Priorities Table		
Resource Name	Normalized By Cluster	Limiting
Inimitable (criteria)	0.44570	0.111424
BIM	0.33333	0.083333
Human Resources (O)	0.41097	0.075482
Firm Advertisement	0.25693	0.057135
Firm Education Department	0.30910	0.053600
Financial Investments	0.31022	0.052908
Organizational Structure	0.27219	0.049992
Firm-Protected Information	0.17643	0.039234
Organizational (criteria)	0.13600	0.033999
Firm-Created Resources (I)	0.14702	0.032694
Firm Reputation	0.17931	0.030581
Firm-Created Resources	0.16758	0.029059
Innovation	0.15843	0.027473
Other Sectoral Investments	0.14667	0.025433
Firm-Secret Technology	0.10875	0.024183
Project Management	0.12595	0.021480
Performance Management (O)	0.11173	0.020522
Firm Historical Background	0.11687	0.019932
Firm Publication	0.08140	0.018102
Project Awards	0.06917	0.015381
Patents	0.08298	0.014389
Rare (criteria)	0.05392	0.013481
Lessons Learned	0.05966	0.013268
Technical Office	0.07511	0.012810
Strategy	0.06707	0.012318
Human Resources (I)	0.04821	0.010722
Product Awards	0.04552	0.010123
Firm Culture	0.05504	0.009387
Human Resource (V)	0.05271	0.008990
International Partnership	0.05110	0.008715
Valuable (criteria)	0.03105	0.007762
Strategic Resource Management	0.04207	0.007726
International Production Activities	0.04421	0.007667
Social Responsibility	0.04165	0.007223
International Offices	0.03369	0.005745
Expertise	0.03018	0.005543
Domestic Bids	0.02957	0.005127
Strategic Management Methods	0.02594	0.004765

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