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HOW TO DETERMINE A COMPANY'S OPEN INNOVATION SITUATION?

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1. Introduction

Open Innovation (OI) describes the opening of a company's innovation process to external actors (e.g. suppliers, customers, consumers, etc.) and the resulting collaboration [Chesbrough et al. 2006], [Lichtenthaler 2009]. Depending on the flow of knowledge three types of innovation can be distinguished [Gassmann and Enkel 2004]: (1) **outside-in**: transferring external knowledge into the company; (2) **inside-out**: giving internal knowledge into the environment to enable innovations; and (3) **coupled**: a combination of the previous types. OI offers a variety of advantages, such as improved market orientation, integration of external expertise and exploitation of new markets [Enkel et al. 2005], [Braun 2012]. However, within an explorative interview study in 2012, we found that conducting OI still bears challenges for companies, such as the selection of appropriate actors for OI and the selection of efficient OI-methods [Gürtler 2013]. Often this was due to an insufficient planning in the beginning, considering the specific goals and boundary conditions. In order so solve this needs, we developed the methodical procedure model "Situative Open Innovation" (SOI) [Gürtler and Lindemann 2013]. This model supports companies by planning an OI-project. It allows a systematic selection of appropriate OI-actors and OI-methods fitting to the specific internal and external situation and issue of a company.

At this, a company's situation is a set of context-factors and boundary conditions which constrain an OI-project. For instance, company-internal aspects of a situation might be experience with OI, culture, organization or barriers; while external factors might be market dynamics or competitors.

Hence, a central element of Situative Open Innovation is the analysis of a company's situation. The analysis requires suitable attributes which allow the description and determination of a situation, as exemplary described before. In order to develop a small set of key-attributes, our research approach starts by identifying all potential attributes for a situation and reducing this pool to key-attributes by evaluation in industrial projects.

This publication sets the basis for an efficient determination of a situation by presenting a first set of attributes we gained by literature review and evaluated by an initial academic and industrial application. This allows a first estimation of benefit and effort of each attribute. The short-term benefit for academia is a pool of potential attributes for describing a situation and can be used in various fields of research. So far, such a pool does not exist, i.e. each researcher or researcher team usually start a new literature research to define appropriate attributes. At this, a pool of possible and for specific applications evaluated attributes can provide a great value gain in terms of saved time for literature research and of evaluated validity of attributes. For Situative Open Innovation, this initial pool of attributes represents a basis as all its subsequent steps build on the results of the situation analysis.

The following paper starts with an introduction into the methodical model of Situative Open Innovation in chapter 2. Chapter 3 describes our research method. Chapter 4 presents the consolidated

lists of attributes. The particular results of the literature- and industry-based evaluation are discussed in chapter 5. Chapter 6 summarizes our findings, addresses limitations and gives an outlook about following steps.

2. Situative Open Innovation

In the following we explain the context of this publication. Situative Open Innovation is a methodical procedure model for planning an Open Innovation (OI) project [Gürtler and Lindemann 2013]. It was developed to solve needs identified within an OI interview study in 2012 such as missing support by introducing OI and challenges by selecting appropriate OI-actors and OI-methods [Gürtler 2013]. In one exemplary case of the study, a manufacturer of semi-finished products intended to conduct an idea competition to identify additional fields of application for a new material. Besides a missing evaluation of the suitability of an idea competition as OI-method, the primary technical issue was formulated as design issue due to „sounding much cooler". In the end a large pool of potentially good design ideas were gained. However, these design ideas were of limited use for the primary technical issue. In the retrospective reflection during the study, these mistakes might seem obvious but in daily business this is a common challenge. The particular issues for OI are often analyzed insufficiently as well as internal and external boundary conditions and constraints of a company.

Thus, the goal of Situative Open Innovation is to support companies and academia by a methodical procedure model which can be conducted autonomously. Situative Open Innovation focuses on the planning stage of an outside-in OI-project. It is located between the strategic management decision for OI and the subsequent conduction of the OI-project itself.

Ponn [2007] referring to [Brockhaus 1996], [Band 20, p. 274], defines a situation generally *as state or entirety of current circumstances and relationships*, based on the Latin word „*situs*": position, condition. It is closely linked to the term „*context*" (Latin: *contextere*: to closely link) which is defined as coherence, background and periphery [Brockhaus 1996], [Band 12, p. 328].

Based on this, we define:

> *In terms of SOI a company's situation is a set of internal and external context-factors, boundary conditions and OI-issues which set the specific and dynamic constraints for an Open Innovation project.*

Situative Open Innovation (SOI) consists of five steps, illustrated in Figure 1. The steps can be performed sequentially but the procedure model also allows iterations when new information are available or boundary conditions change over time [Gürtler and Lindemann 2013].

1. **SOI – 1: Analysis of OI-situation and OI-objectives**
   In the beginning the goal and object of the OI-project is analyzed, e.g. what shall be considered: a product, process, service, etc.? Shall it be improved or radically renewed; etc.? In parallel the internal and external situation is analyzed. Their determination is addressed within this publication.
2. **SOI – 2: Selection of OI-actors**
   In this step, a pool of potential OI-actors is identified and assessed regarding their potential contribution regarding the OI-project and their strategic impact. Based on this assessment, they are prioritized and relevant actors selected by using concepts from stakeholder analysis [Freeman 2010] and Lead-User identification [von Hippel 1986]. The situation attributes of step 1 serve as boundary conditions and constraint, e.g. necessary expertise of actors, know-how protection aspects and resources limiting the number of actors.
   At this, an OI-actors is defined as *any (internal and external) individual, group or organization which is involved in the Open Innovation project* [Guertler et al. 2013].
3. **SOI – 3: Definition of OI-collaboration**
   This step defines the boundary conditions for the OI-collaboration, including the degree of participation: shall the OI-actors contribute by e.g. supplying ideas, technical drawing, prototypes or just approval. Also aspects as incentives and know-how protection are addressed. The situation-attributes define e.g. the degree of participation and know-how protection aspects.
4. **SOI – 4: Selection and adaption of OI-methods**

Based on the analyses in the previous steps, appropriate OI-methods are selected and necessary adaptions are derived. The situation-attributes of step 1 define the collaboration constraints in terms of available resources, time, suitable OI-methods fitting to the OI-issue and also influence the necessary adaptions of the OI-methods.

5. **SOI – 5: Planning of OI-controlling**
   In order to measure the success of the OI-project and actively control it, specific key-performance-indicators (KPI) as well as controlling measures are selected according the chosen OI-methods, actors and boundary conditions. Based on the situation-attributes and the other previous steps, appropriate KPI are selected. This step also includes a process assessment of SOI itself. In each step it is analyzed if the required data and results are sufficient and consistent (e.g. consistency between selected OI-actors and required expertise of an OI-method). Otherwise an iteration of previous steps is performed.

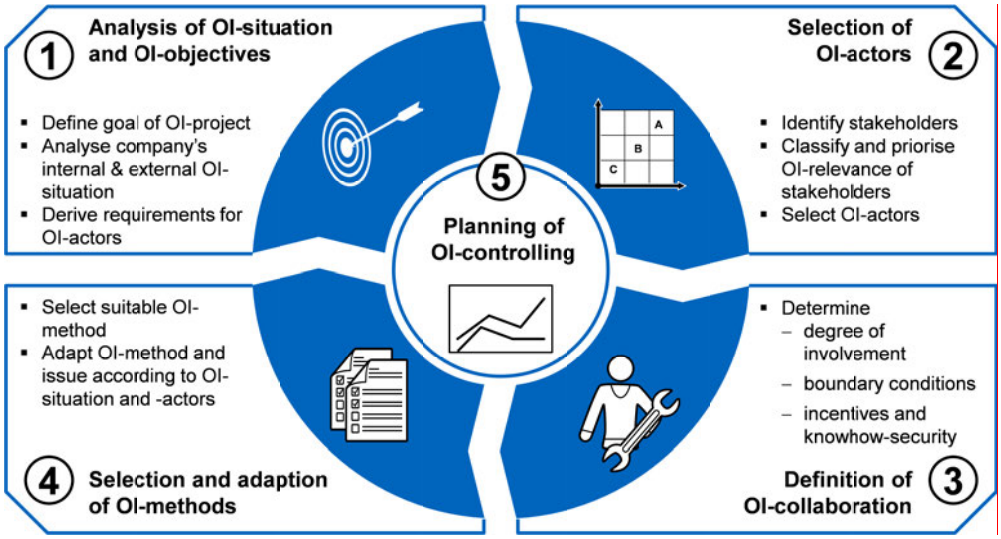

Figure 1. Model of Situative Open Innovation [Gürtler and Lindemann 2013]

3. Research method

Based on a literature review, a pool of potential attributes for characterizing an OI-situation was collected. In an iterative process four generic categories were identified and the attributes allocated to them. This first set of attributes was then evaluated by a retrospective characterization of OI case studies described in literature. We selected this approach as a kind of pre-test due to the accessibility of case studies in literature. This gave a first indication about suitability and approximate effort. To ensure industrial applicability, additionally the list of attributes was evaluated in the context of three OI-projects with industry. We selected the companies due to their different OI-project issues in order to avoid issue-specific feedback only. The issues were (1) a technical improvement of a product, (2) a process improvement and (3) development of new services. At this, the particular situations were characterized using the list of attributes, the specific meaningfulness and effort of each attribute determined as well as missing attributes added.

4. Describing a company's situation

As mentioned in the previous chapter, different attributes for describing an OI-situation were identified and iteratively four categories derived, based on a literature review. The particular literature is listed for each attribute. Figure 2 illustrates the four categories.

In the following all attributes are presented accordingly to their categories and briefly explained. In some cases suggestions for potential values are given. The identification of underlying numerical limits for scales (such as "low, medium, high") is part of future research. Each attribute is marked by an ID, e.g. "C2". An additional asterisk marks attributes added by industry.

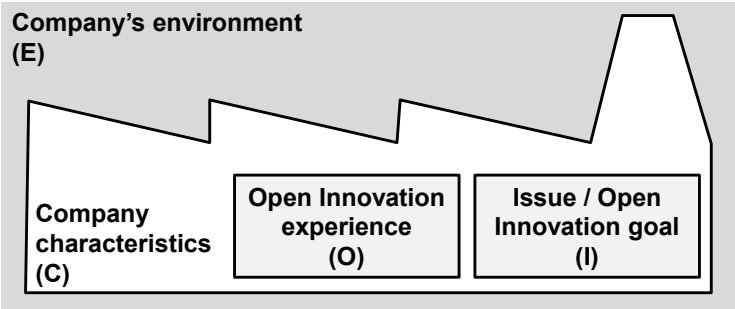

Figure 2. Situation attribute categories

4.1 Company characteristics

Company characteristics describe the internal state and conditions of a company at strategic, operational, organizational and cultural level. Some attributes are closely linked to environmental attributes but considered more company-related.

Table 1. Company characteristic's attributes

No.	Attribute	Description/benefit and references
C1	Company name	Useful to sort attribute lists of multiple companies, based on: [Chiaroni et al. 2011].
C2	Enterprise size	Type of enterprise; according to Gassmann et al. [2010] OI focuses mainly on large-scale enterprises. This attribute considers a potential inter-dependency. Exemplary values: small, medium, large.
C3	Annual revenue	Influences the available resources for OI, but can also serve as an indicator of a company – dynamics might indicate effects of OI, based on: [Chiaroni, et al. 2011].
C4	Degree of globalization	Indicates inter-organizational influence of different cultures; indirect environmental influences, distributed development, etc. Exemplary values: national, Europe, global.
C5	Number of active countries	Closely linked to degree-of-globalization but more specific; company's allocation on different countries might affect development process and OI-project, based on: [Gassmann, et al. 2010].
C6	Number of employees	Possible influence on absorptive capacity; employees as pool for „internal OI" [Chiaroni, et al. 2011].
C7	Annual expenses for R&D	Expenses for R&D affects their effectiveness [Sofka and Grimpe 2010]. This also affects a company's absorptive capacity [Cohen and Levinthal 1990].
C8	Number of R&D employees	The effectiveness of R&D is influenced by the number of R&D employees [Keupp and Gassmann 2009] and in consequence might also affect a company's absorptive capacity.
C9	Number of patents	Indicator of a company's development performance; annual increase might serve as indicator for the influence of OI.
C10*	Size of OI-team	Influences the capacities and effort which can be invested into an OI-project
C11*	Size of responsible department	Number of employees working in the department which is responsible for the issue of the OI-project. Potentially relevant especially for internal OI-projects.
C12*	Company's overall strategy	Influences an OI-project by setting the overall frame for all activities within a company. *Exemplary values: cost leadership, technological leadership, etc.*
C13*	Innovation culture	What is the overall innovation culture within the company? For instance, is the focus on incremental or radical innovations? Is the focus on in-house development only, or are development cooperations common?
C14*	Fluctuation of employees	This might have an effect in terms of employees' expertise and OI-experience as well as their attitude towards new employees, ideas or knowledge.

4.2 Open Innovation experience

These attributes characterize a company's experience regarding Open Innovation (OI). This is considered a crucial aspect directly influencing a new OI-project. Thus, it is considered separately besides overall company's attributes. For instance, if a company has already made positive experience with OI this can be used to motivate employees for additional OI-methods. In the case of bad former experience, this needs to be considered and accordingly addressed while involving employees to avoid opposition [Stolzenberg and Heberle 2009].

Table 2. Open Innovation experience's attributes

No.	Attribute	Description/benefit and references
O1	Number of performed OI-projects in the past	How many OI-projects were performed in the past? Was it a single experience or more frequent?
O2	Frequency of interaction	In the case of a multitude of OI-projects: were they performed regularly, and with which temporal distance?
O3	Duration of interaction	What was the average duration of the OI-projects?
O4	Used OI-methods	Which OI-methods were used? Is there a specific OI-method or tool which is well-known in the company?
O5	General results of project	How were the results of the OI-projects perceived by employees?
O6	Employees general attitude towards externals	How is the overall attitude of employees? This includes aspects such as Not-Invented-Here-Syndrome which needs to be considered accordingly [Katz and Allen 1982].

4.3 Issue / Open Innovation goal

This category contains attributes describing the goal and resulting objectives of the OI-project. It specifies the object of interest, its desired change.

Table 3. Issue/Open Innovation goal's attributes

No.	Attribute	Description/benefit and references
I1	Project issue	What is the overall goal of the OI-project? For instance, insights in product's application, solving technical problems, social and environmental issues, etc. [Gürtler et al. 2013].
I2	Object of interest	What object is considered within the project? Exemplary values: product, service, process, business case.
I3	Product type	Is it a product for industrial customers which might is further processes or is it for consumers? *Exemplary values: B2C, B2B final product, B2B semi-finished product*
I4	Product-Life-Cycle stage	Due to product-life-stages influencing the boundary conditions for an OI-project, they need to be considered [Gürtler, et al. 2013]. For instance, does the project focus on the development of a new product or improvements of maintenance processes of a product in the utilization stage? Each stage can be further subdivided in sub-steps, if necessary: e.g. the development stage: idea generation, idea assessment, concept design, development, etc., [Gruner 1997], [Verworn and Herstatt 2007].
I5	Type of Innovation	Is the project's goal the improvement/"incremental" innovation of an existing object of interest or the radical change/redevelopment? [Green et al. 1995], [Linton 2009], [Inauen and Schenker-Wicki 2012].
I6*	Complexity of issue	A first evaluation of the goal's complexity.
I7*	Time frame	Is there a deadline constraining the duration of the OI-project, e.g. due to a surrounding bigger project?
I8*	Available resources	Which resources are allocated to the project?

I9*	Production factors	Are specific production resources needed or available such as tasks, machines, material, etc.?
I10*	Level of strategic support	Which management level is supporting the OI-project?
I11*	Budget conditions	Until which financial amount can the OI-team decide independently without requiring the permission of next-level's management?
I12*	Dependencies on other departments	Are there any organizational, processual, monetary, etc. dependencies to other departments within the company which might affect the OI-project?
I13*	Lack of clarity in IP rights	Might patent applications be affected by the OI-project? Do inventions exist which are not patented?

4.4 Company's environment

This category considers environmental aspects which might affect both the OI-project and the company itself. This includes market aspects, competitors' situation, etc.

Table 4. Company's environment's attributes

No.	Attribute	Description/benefit and references
E1	Industry/branch	According to Gassmann, et al. [2010] some industries are ahead of others in terms of OI application. Thus, a potential effect is considered by this attribute.
E2	Existence of price regulations	Price regulations might constrain the solution space for the OI-project and the company itself by causing cost pressure. *Exemplary values: none, low, medium, strong, very strong*
E3	Need for certification	Does the object of interest or parts need to be certified, e.g. in terms of electrical safety? This might cause effort and additional costs and can e.g. influence the type of suitable external knowledge. *Exemplary values: very low, low, medium, high, very high*
E4	Existence of entry barriers into market	Are their barriers which hinder potential new competitors to enter the market (based on [Porter 2004])? This might affect the amount of internal knowledge which can be published within an OI-project. But it is also relevant if the company itself considers entering a new market. *Exemplary values: very low, low, medium, high, very high*
E5	Number of suppliers	Is it a single- or multi-source market (based on [Porter 2004])? Exemplary values: very low, low, medium, high, very high
E6	Degree of dependence of suppliers	Can the supply parts also be ordered by another supplier or only by one/a few suppliers – maybe due to a co-development (based on [Porter 2004])? *Exemplary values: very low, low, medium, high, very high*
E7	Type of competition	Which type of competitions does exist in the market of interest (adapted from [Porter 2004])? This might affect the amount of internal knowledge which can be published within an OI-project. Drechsler and Natter [2012] also state the relevance of a company's competitive environment. *Exemplary values: monopoly, oligopoly, polypoly*
E8	Degree of competition	How strong is the competition in the market of interest? Does everyone compete for the same market parts, or does each company have its „own" sub-market (adapted from [Porter 2004])? This might affect the amount of internal knowledge which can be published within an OI-project. *Exemplary values: none, low, medium, strong, very strong*
E9	Type of customers	For which type of customers is the object of interest? *Exemplary values: B2C, B2B*
E10	Contact to end customers	How is the contact to the final customers of the product? In the case of B2C products: is there a direct contact and exchange? *Exemplary values: direct, indirect*

E11*	Diversity of customer groups	For how many customer groups is the object of interest? This might affect the success of the OI-project, the variety of demands to focus on and potential OI-actors. *Exemplary values: very low, low, medium, high, very high*
E12	Branch-specific innovation cycles	Are their branch-specific innovation cycles, and how do they look like? This might be of relevance e.g. in terms of cross-industry innovations (based on [Gassmann, et al. 2010])

5. Evaluation and discussion

The list of attributes was evaluated in a two-step approach. It was chosen due to its scalable effort and its retrospective and prospective character. Using the literature review, published case studies were analyzed retrospectively by utilizing data given in the regarding publication and complemented by company's details on their websites on the internet. The case studies considered were: [Dodgson et al. 2006], [Franke and Piller 2004], [Franke et al. 2008], [Gassmann and Enkel 2006], [Lang 2006], [Lang and Reich 2008], [Perkmann and Salter 2012], [Piller et al. 2010].
Due to partly limited accessibilities of information and to evaluate the prospective applicability, three industrial projects were characterized by the attribute list. At this different types of companies and project issues were considered to assure a broad evaluation basis: (1) a medium-size manufacturer of fun rides looking for new technical solutions for the improvement of his products; (2) a large-scale supplier for railways and utility vehicles aiming at a process optimization of a maintenance process; and (3) a large-scale transportation company developing new services and according business models. The overall goal was to ensure the general applicability.

5.1 Literature-based evaluation

The case study evaluation revealed three attributes which could not be assessed due to missing accessibility to the related information (especially E5 and E6).

- C5: Number of active countries
- E5: Number of suppliers
- E6: Degree of dependence of suppliers

The following three attributes could be assessed only for a part of case studies:

- C7: Annual expenses for R&D
- C8: Number of R&D employees
- C9: Number of patents

Also for these attributes the accessibility was the main limiting factor. Some companies provided more and others less information on their websites. Secondary sources such as economic newspaper websites were used conservatively due to uncertain reliability.

5.2 First industrial evaluation

As the literature-based evaluation showed, the access to and acquisition of specific information are crucial factors for assessing attributes as well as the regarding situation of a company. While the literature-based evaluation was from a company-external perspective, the industrial evaluation had the advantage of being inside the company and having access to internal data sources, such as intranets or managers. Besides, this type of data sourcing is closer to the future utilization of the attribute list, since it is intended to be autonomously applied by developers and managers within a company.
The leading questions of the evaluations were:

- Which attributes are useful from the company's point of view?
- Which attributes cause a relatively high effort for data acquisition?
- Which attributes might bear a low benefit from the company's point of view?
- Which attributes should be add to the existing list?

In accordance to the literature-based evaluation also the industry evaluation indicated difficulties in acquiring data for assessing the annual expenses for R&D (C7), the number of employees in R&D

(C8), the number of patents (C9) as well as the number of suppliers (E5) and the regarding level of dependency (E6).
The feedback of the railway and commercial vehicle supplier additionally evaluated the assessment of the number of active countries (C5), frequency of former OI-projects (O2) and their duration (O3), branch-specific innovation cycles (E12) and the existence of entry barriers to the market (E4) as difficult. But it suggested the enhancement by additional attributes such as size of department responsible for the OI-project (C11), the size of the particular OI-team (C10), production factors (I9), level of strategic support (I10), etc. The feedback of the fun ride manufacturer included new attributes such as lack of clarity in IP rights (I13) and complexity of the OI-issue (I6).

5.3 Discussion and limitations

Both the literature-based and the industrial evaluation attest the general applicability of the attribute list. At this, the data acquisition for R&D employees (C8) and expenses (C7) as well as number of patents (C9) was assessed as difficult in all cases. Despite this, we consider them as relevant for evaluating a company's OI-situation. For instance, the number (E5) and dependency level (E6) on suppliers might give evidence for a company's strategically external situation. Also the expenses and involved employees in R&D support the analysis of a company's absorptive capacity. However, a refinement of those attributes is necessary to support the corresponding data acquisition.
The industrial evaluation yielded a number of promising, additional attributes which are marked with an asterisk in the previous tables.
Differences between the feedbacks of the three companies might be due to the differing company situations. The market environment of the fun rides manufacturer is strongly competitive which might affected their emphasis of IP related attributes. In the case of the supplier, the OI-project is strategically located within the maintenance department in the neighborhood of several other departments. In contrary to the other industrial cases, this project does not have top-level management support and is focusing on internal OI in cooperation with other departments and production sites. This might be a reason for the feedback emphasizing attributes related to management support, the level of economic and operative degree of freedom, available resources, etc. The new service and business case development of the transportation company is located in an early stage of the development process at the top management level. This might be a reason why the feedback was more abstract than in the case of the other industrial cases.
However, despite the basically positive evaluation results, there are some limitations. Besides the low number of evaluating companies, the evaluation was primarily conducted by students supervised by the industrial partners. Though they had access to internal databases and experts this limits the quality of the feedback. Additionally, the feedback is relatively subjective due to the low number of discussion partners involved. In general the industrial evaluation focused on the assessment of usefulness and acquisition effort as well as the addition of missing attributes. An analysis regarding the specific OI-suitability is part of future research based on a broad interview study retrospectively analyzing OI-projects in industry as well as the application of the enhanced attribute list in the context of further OI-projects.

6. Conclusion

This publication presents an initial list containing 45 attributes, clustered in four categories, for characterizing a company's situation. These attributes primarily focus on OI-situations which set the frame and constraints for an OI-project. However, also researchers from other fields can utilize the attribute list when they need to describe a situation. Though the list is still growing, it can reduce the effort for intensive literature reviews of each new researcher by providing suitable attributes as well as giving inspiration for additional case-specific attributes. In the context of Situative Open Innovation, in the medium-term the presented attributes build the basis for a systematical determination of an OI-situation and derivation of appropriate OI-actors and OI-methods. In the long-term this will allow academia as well as industry to plan OI-projects more efficiently and reduce risks linked to the choice of insufficient OI-actors or OI-methods.

Based on the results of the first evaluation, the list of attributes will be further enhanced and detailed. The main aspects are (1) a more detailed analysis of the object of interest, regarding placement in product portfolio, core competencies, modularity and system's architecture; (2) refinement of product-life-cycle phases; (3) differentiation in primary and secondary attributes, e.g. the type of the object of interest influences the use of other attributes such as production factors, etc.
In the subsequent step, the attributes will be evaluated more detailed, especially their relevance regarding OI. At this, data gained by a retrospective analysis of OI-projects in industry will provide indications. To enable a profound assessment of the data acquisition effort quantitative measures will be applied, e.g. minutes for researching an attribute.

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