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**CONTROLLING LOGISTICS IN THE
GERMAN AUTOMOTIVE INDUSTRY**

Von Sebastian Kummer*

Burgplatz 2

D-56179 Vallendar

Telefon (+261) 6509-0

Telefax (+261) 6509-111

e-mail WHU @ WHU-KOBLENZ.DE

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Abstract: We apply the ideas and instruments of Controlling to Logistics Management and have been developing techniques for: measuring logistics performance, cost accounting, logistics aspects of product calculation, controlling process chains in the field of logistics. This paper gives an overview of our work on Logistics Controlling. Examples for measuring logistics performance, cost accounting and controlling process chains from the German automotive industry will be shown.

* Dr. Sebastian Kummer, Assistant at The Koblenz School of Corporate Management (WHU) - Otto Beisheim Graduate School,
Correspondence should be send to: The Koblenz School of Corporate Management (WHU) - Otto Beisheim Graduate School, Burgplatz 2, 56179 Vallendar, Germany, Telefon: 0049-261-6509-182, Fax: 0049-261-6509-111
Internet: skummer@whu-koblenz.de
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1. General Aspects of Logistics Controlling

Many companies have adopted logistics management and got a reasonable profit from the efforts to rationalize. We often find logistics organizational units in these companies. Although it is quite obvious that controlling instruments for this new function are needed, there were no experiences in logistics controlling in 1982 when we started our research together with the German car manufacturer VW. The first activities we took were the classification of logistics costs and the problem of the cost allocation to cost centers. In the years 1988 and 1989 we developed a concept for logistics controlling for BMW. The system was implemented and supported by an information system called LOGIS which focussed on cost accounting and measuring logistics performance. Since then we developed many tools for logistics controlling and discussed them with logistics managers and implemented the instruments in many companies.

We divide logistics controlling in strategic logistics controlling and operative logistics controlling. Strategic controlling centers around the following issues

- define the strategic role of logistics for the company,
- make sure that strategic logistics aspects are involved in the strategic corporate planning,
- help the logistics management to develop a logistics strategy,
- assure that the logistics strategy can be realized in the operative logistics planning,
- set-up and manage the strategic logistics check

The elements of operative logistics controlling are:

- defining and measuring the goals of logistics,
- measuring of logistics performance,
- accounting logistics costs,
- create budgets for logistics,
- set-up an controlling system for process chains and
- benchmarking logistics performance

2. Measuring logistics performance

Logistics activities are scattered all over the companies and are executed in many cost centers. This leads to the fact that only few companies have systematic information about the performance of their logistic systems. This situation is very unsatisfying, not only for researcher, whose main task is it to develop measurement techniques, but also for the companies which need those information for the following management activities:

- Planning (e.g. logistics resource planning)
- Budgeting (e.g. zero based budgeting for logistics activities)
- Analysis (e.g. finding out fluctuations in the logistics performance or redesigning the logistics systems)
- Decisions (e.g. investing or process reengineering)
- Cost Accounting (e.g. for cost center reporting or product calculation)

Corporate logistics is a service function within the firm, so it is a good example for the problems one has in defining and measuring productivity in service firms. As the following example from BMW will show, there are two main problems measuring logistics performance:

1. The problem of defining indicators for the two components of productivity, namely input and output
2. The Problem of data collection and appropriate information systems

The following example from the receiving department of BMW gives an example of the output measurement process. The first step is to describe the variety of logistics functions such as handling, transportation, storing and repacking and their interaction (Figure 1).

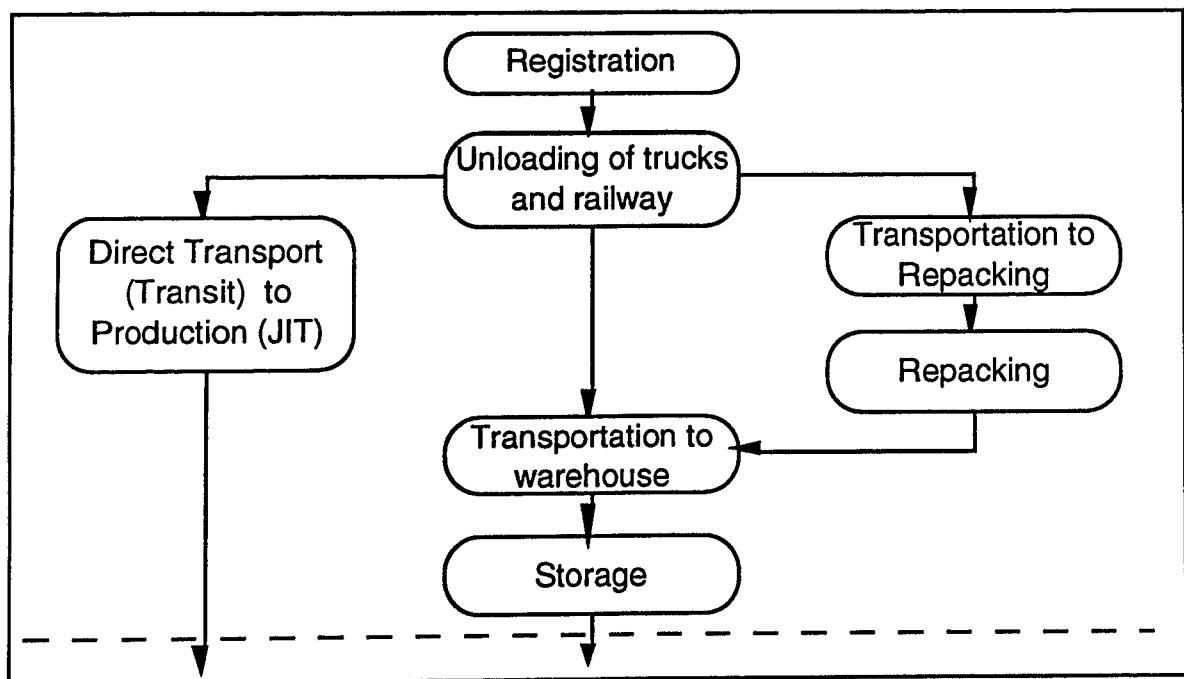


Figure 1: Process of receiving parts and materials at BMW, Dingolfing

In the second step we have to define the logistics output of each activity and the whole process and how it should be measured. In our example the output units could be: amount of shipments, volume or weight per shipment, number of redeliveries. To find performance indicators, we have to analyse the activities. For the activity "unloading" in the receiving process, we could find the output indicators:

- number of shipments,
- number of trucks,
- number of rail cars,
- number of loaded units (eg. differentiated in 5 types),
- unloaded weight (tons),
- number of damaged units/items,
- value of the damage and
- number of redeliveries

This list shows the variety and the resulting difficulties encountered in measuring the output and in choosing one of these indicators as a "Allocation Measure" for the cost accounting. Despite these difficulties, this step is broadly discussed in the activity based accounting literature and seemed to be the revolution the accountants were eagerly seeking for a long time. As accountants we also thought, that the activity based accounting and the process view in accounting would solve many of the questions. But the experience of the last seven years showed us, that it is very difficult to build up a permanent activity based accounting system. Because in the modern business many activities are interdependent, it is necessary to make the activity based accounting for all the processes and departments of a company. The problem is, that the accurate definition and measurement of "Allocation Measures" for such system is very costly and that non permanent analysis of single problems are as much effective and of course much more efficient.

We found the same problem of variety in determining input indicators, the second component of the performance measurement - serving as well as basis for process control and benchmarking studies we need input related indicators. For the activity "onloading" in the automotive industry we found the following possible input indicators:

- man-hours,
- hours of absent,
- overwork hours,
- facility-hours (e.g. if facilities are shared),
- availability of facilities (e.g. percentage of defects) and
- floor space.

The logistics cost center managers at BMW and in other companies are using both, the output and the input indicators to improve the performance of many activities and the whole processes.

Beside the rather theoretical problems of choosing the right indicators, companies face the also rather practical problem of collecting the relevant data. For building up a permanent information system the data collection must be automated. Permanent counting of material flows by employees usually leads to high costs with limited accuracy. We found out, that many of the information needed to measure the logistics

performance are already in different information systems. For the "logistics controlling system" developed for BMW we transferred information from five different information systems such as the storage information system, the transportation control system, the production planning system and the distribution system. If a special data collection for the measuring of the logistics performance is necessary, the costs of a permanent logistics information system are often very high and we found, that it is advisable to refrain from building up a permanent information system.

Whereas in the German automotive industry many performance measures are defined and measured, there is a lack between the importance and the adoption of key measures in most of the other industries. This showed a survey, we made in 1992. We asked 500 logistics managers about several key measures for "Logistics Controlling". The response rate was 18,4 % (92). The results for four key measures shows Figure 2. The survey showed, that the companies had installed many measures for the inventory controlling. But also more than 80 % of logistics managers answered that key measures like service of delivery, throughput time and (total) cost of logistics are important to measure, the adoption of these measures was little.

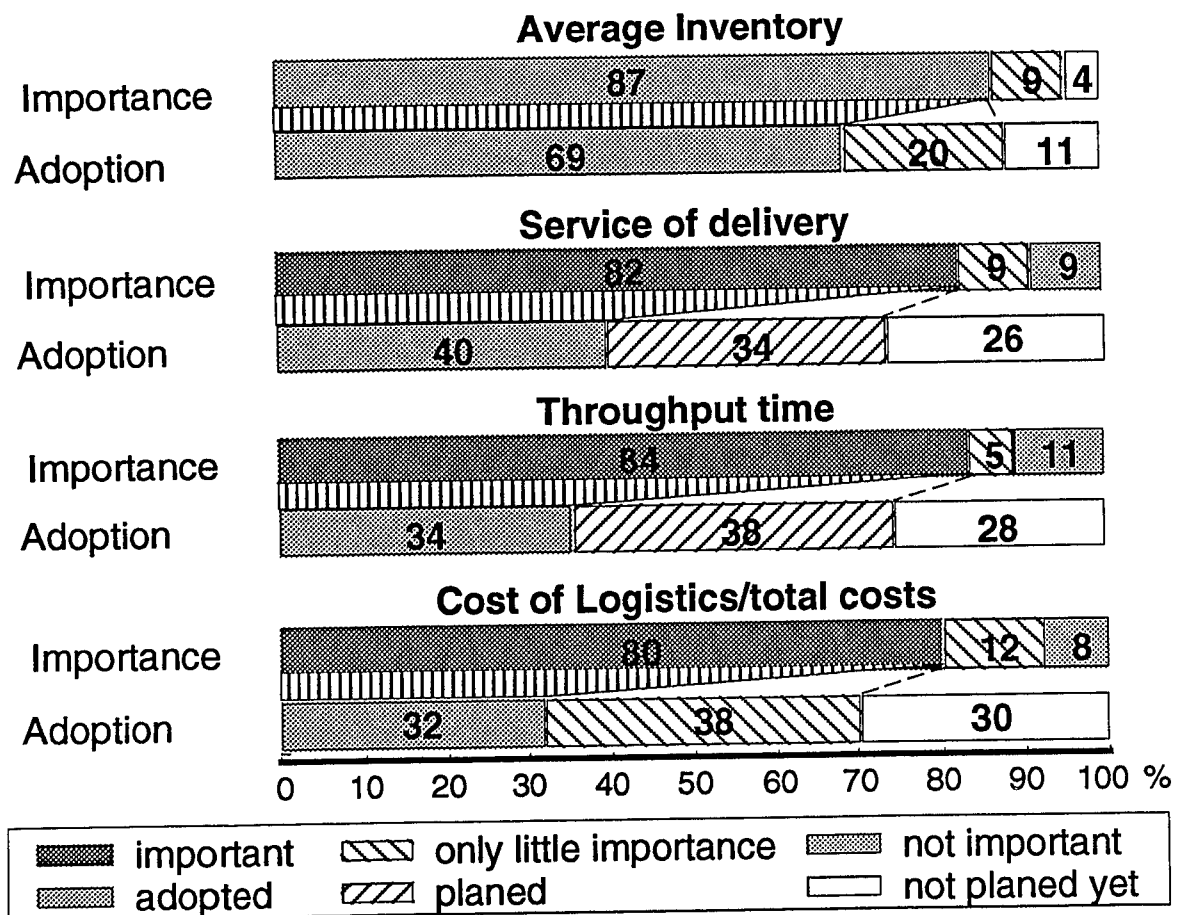


Figure 2: Empirical Study: Key Measures in Logistics Controlling

3. Logistics Cost Accounting

There have been articles and books about the rise and fall of cost accounting. The existing cost accounting systems are not adequate for the decisions that are to be taken because they are concentrating too much on the direct labour cost. Before the activity based costing idea occurred the defects of the traditional cost accounting systems for logistics were obvious. The cost accounting was focussed on the production and the direct labour. Only a few of the logistics costs were recorded separately. Logistics costs were not defined. Logistics costs in different cost centers were not collected together. Huge amounts of types of logistics costs like transportation costs were not differentiated. For the calculation of cost centers, for the calculation of regional costs, special customers and products not or only average logistics were used.

How can the cost accounting for logistics be improved? We see three main topics. First: Building cost categories in logistics. Second: formulation of logistic cost centers and third: calculation of product, customer, regional logistics costs. A first step to improve the cost accounting would be a detailed analysis of the most important types of logistics costs. (e.g. amount and structure of transportation costs). As an example we found in the automotive industry that although the amount of transportation costs were not rising significantly there was a tremendous increase in express freight cost. The analysis of this express rate showed that there were many transports by taxi from one factory to another factory located approximately 100 kilometers away. The question is: How differentiated should be the classification of logistics costs? We found out that many of these analyses should not be taken permanently - as an example every month - but should be done every one, two or three years.

Special cost centers for logistics should be established, because they show where logistics costs have their origin, demonstrate their importance and serve as an informational basis for company decisions like outsourcing. If logistics costs can be separated, the controlling is easier. Rationalization is supported, because the managers for the logistics cost centers feel more responsible for the logistic costs. Logistics cost centers also ensure that in product calculation process logistics costs are taken into account in a differentiated way.

The main problem of calculation is the allocation of overhead or indirect costs. To describe the problems of calculation and to show how the problems could be solved, we will focus on product calculation. Many of the logistics overhead costs and the indirect costs are allocated to the product with an average rate. To allocate indirect supply costs, many companies use an average rate and multiply the rate with the material costs of a product. The problem of this cost allocation is, that the costs of supplying as an example transportation or receiving are very often not correlated with the material costs. Therefore the product calculation doesn't correspond to the real costs of the logistics functions. We find similar problems in the logistics functions on the shop floor. Traditional cost accounting systems allocate the indirect labour costs in connection with the direct labour costs. The allocation of distribution costs shows the

same problem. Despite these problems, many of the automotive suppliers still apply this procedure, for reasons of easy Handling.

Because of the pressure the big automotive companies put on the suppliers, many suppliers had to reduce their prices and simultaneously reduce their logistics cost. As the cost accounting systems couldn't give the managers the right information, this was rather a tough job. In this situation VDO, a German supplier for instruments, realized that the traditional cost accounting and product calculation was not adequate to give the right information not only for rationalizing, but also for the price negotiations. More than 50 % of the costs were indirect or overhead costs. The board wanted an explanation for the high costs, the product calculation calculated. Especially the mass production of instruments for a very famous german small car was under pressure.

The first step of analysing the problem, was to select products where the difference between the product costs calculated with the traditional product calculation and the "real" product costs were significant. For the selection we found two characteristics: the material cost (high and low) and the amount of products produced daily (high and low). For each of the possible four combination we selected one product (Figure 3).

		Material Costs	
		low	high
Amount of products produced daily	low	Product B Material Costs: 1,35 US\$/prod. Amount of prod.: 30/day A-Parts: 5 B-Parts: 1 C-Parts: 7	Product A Material Costs: 61,- US\$/prod. Amount of prod.: 5/day A-Parts: 8 B-Parts: 26 C-Parts: 44
	high	Product C Material Costs: 2,46 US\$/prod. Amount of prod.: 2.500/day A-Parts: 8 B-Parts: 5	Product D Material Costs: 11,43 US\$/prod. Amount of prod.: 650/day A-Parts: 34 B-Parts: 20

Figure 3: Selected products for a product calculation analysis at VDO

Then we defined the process of producing the products and divided the process into activities. Each activity was analysed in the way described in chapter 2 and indicators for the activity output were defined. Out of these indicators one allocation measure for the cost allocation of the indirect logistics costs was chosen. We checked, that these allocation measures had a good correlation with the "real" logistics costs of the

products.

The next step was to develop a new calculation sheet. Figure 4 describes the old traditional product calculation and the new process oriented product calculation. The first idea of this calculation sheet was to allocate the logistics costs not as a rate but with an appropriate allocation measure. The second idea was to show the logistics costs separately, to sharpen the sense for the importance of logistics costs. The company wanted to divide the logistics costs in "logistics costs 1", which covered the indirect logistics supply costs and the logistics costs in the production process and "Logistics costs 2", which covered the logistics costs of the distribution process, because the costs of manufacturing 1 (as a sum over all products) and the total product costs (as a sum over all products) should be left unchanged.

Traditional calculation	Process oriented product calculation
direct material costs + indirect material costs (rate/percentage)	direct material costs + indirect material costs (rate) (without log. costs)
material costs direct production costs + indirect production costs (rate/percentage)	material costs direct production costs + indirect production costs (rate)(without l. c.)
production costs	production costs direct logistics costs + indirect logistics costs (allocation measure) logistics costs 1
Manufacturing costs 1	Manufacturing costs 1
+ R&D costs	+ R&D costs
Manufacturing costs 2	Manufacturing costs 2
+ distribution and administration costs (rate/percentage)	+ direct logistics distribution costs + indirect logistics distrib. co. (allocation measure) logistics costs 2 + distribution and administration costs (without l.c.)
total costs	total costs

Figure 4: Comparison of the traditional and the process oriented product calculation

For the selected products, the comparison of the traditional product calculation and the new process oriented product calculation shows significant differences (Figure 5). It also shows, that the characteristic "amount of products produced per day" is the one which has the highest impact on the difference between the traditional product calculation and the "real" costs. Other studies showed, that important cost drivers are "the number of product variations" and "the number of parts which are needed to produce a product".

	Costs evaluated by the traditional product calculation	Costs evaluated by the process oriented product calculation	Difference
Product A	272.00 US\$	367.71 US\$	+ 35.2 %
Product B	6.41 US\$	7.11 US\$	+ 10.9 %
Product C	5.72 US\$	5.42 US\$	- 5.2 %
Product D	30.00 US\$	32.96 US\$	- 3.0 %

Figure 5: Results of the comparison of product cost calculation for the selected products

4. Process chains and logistics controlling

The ideas of process orientation have a tremendous impact on the organizational structure of companies. During the last three years the German car manufacturers and their suppliers reorganised their corporations. After building up a logistics organization and logistics controlling tools, the German automotive companies set up and control process chains. As the controlling tools described above have their focus on logistics functions, the management of process chains is flow oriented. As the responsibility for logistics decisions are more and more decentralised and team concepts are implemented, new measures and performance indicators are hardly needed. Within the companies there is a strong demand for simple logistics controlling tools for the "self controlling" of groups and on the other hand the top management wants to have information to evaluate the productivity of the whole process. The old static and cost oriented controlling systems neither help the groups on the shop floor nor serve the demands of the top management. This lack between the organisational implementation of process chain management and the development of controlling is the real challenge faced by controllers today.

To describe the problems and to give a clue how these problems could be solved, let us take a look at BMW. In 1970 BMW had begun to implement logistics management as a service function. This function covered the supply management, the production management and the distribution. The goal was to build individualized cars for each customer. As a result, the logistics management rationalized and smoothed the production processes as well as the material flows by using a complex production planning and controlling system, that covered all functions.

As an answer to competition and to the increasing complexity of the business BMW implemented the idea of process chains into the logistics management. Four main

process chains:

- the process chain "car",
- the process chain "parts",
- process chain "transportation" and
- the process chain "spareparts"



were implemented. Process chains are defined as conglomerates of functions that have the same goal and go from (external or internal) customer to (external or internal) suppliers. For each process chain a goal system is defined. The main elements of this systems are service and productivity. The focus of activity based accounting and the tools mentioned above is on optimizing the process structure. The new challenge in process chain management is to optimize the "daily" decision making in the process chain. To show the importance of the idea of this new appearing controlling tool let's look at the process chain "car" (Figure 6). For each process chain key measures are defined and goals for: Service (response time, through put time, reliability), Flexibility and costs are set. Permanent improvement of the activities and the process have been done.

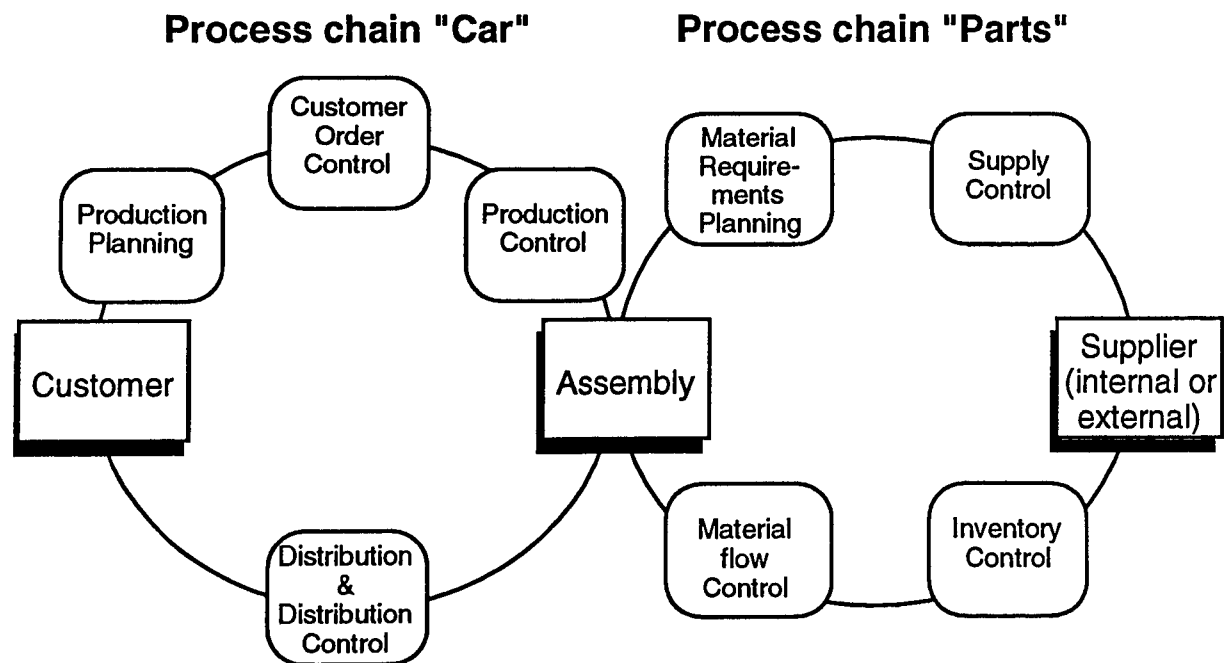


Figure 6: Process chains "car" and "parts" at BMW

As the customers demand more and more individual products and BMW is selling the products all over the world, very often decisions of volume, programme mix, country mix and special equipment are to be taken. The traditional cost accounting and the activity cost accounting offers no - or even worse the wrong - informational basis for these decisions. If there is a big fluctuation in the different markets the production planning very often has to make a decision like the following: Shall we cancel 300

cars which were planned for Italy and produce 250 cars for France instead. If we look at our goals and at the impact on the market, this has tremendous implications. The flexibility of the production and the flexibility of the sales have competing goals. To find the right decision we have to evaluate the cost impacts of the different goals of both, the sales and the production as well as on the whole value chain. As example: This decision, to cancel 300 Italian cars and produce therefore 250 French cars could have an impact on our suppliers and could produce additional costs for them. As the traditional cost accounting instruments are not adequate to calculate these costs and therefore are not suitable to support planning and controlling decisions Logistics Controlling has to develop new instruments. These instruments have to take different degrees of probability into account.

6. Conclusions

This short review should only show the importance and the direction the logistics controlling has taken. It also demonstrates the new questions occurring and the challenge for logistics controlling. Analysing the developments which are mainly driven by practical needs rises many questions. Although many logistics managers in Germany are very enthusiastic about the decentralisation and the promises of fast returns on investment, there is a significant danger, that this fragmentation leads to a lack of control over the logistics process as a whole and to suboptimized processes. Therefore a systematic "Logistics Controlling" which serves as an information base for logistics decisions and ensures, that techniques to optimize logistics processes are used is still badly needed.

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