Critical Issues across the ERP Life Cycle in Small-and-Medium-Sized Enterprises: Experiences from a Multiple Case Study

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Abstract

The paper reports on a multiple case study conducted in five Small-and-Medium-Sized Enterprises (SMEs). These companies have implemented ERP systems and the focus is on the critical issues, activities and key actors across different stages of the ERP life cycle in these enterprises. SMEs have less resources and competencies about complex ERP systems compared to larger companies. Thus ERP projects have proved to be risky and costly for SMEs. SMEs can easily be an easy prey for experienced vendors and consultants and end up with a system far from what they expected.

Keywords: ERP pre-implementation, ERP implementation, post-implementation, ERP life cycle, Small-and-Medium-Sized Enterprises, ERP critical success factors

1. Introduction

ERP systems are offered as standardized off-the-shelf packages, and have modules that support various business functions such as supply chain management, inventory control, purchase and sale processes,
manufacturing, accounting and finance, and human resources [1]. ERP systems usually involve the entire organization and provide opportunities for access to real-time data across the enterprise. ERP systems often lead to the phasing out of legacy systems and the replacement of incompatible silos of information systems (IS). Despite implementation challenges and high implementation costs, ERP systems have become popular, and both small and large companies implement this type of system to maintain competitiveness [2].

The cost of an unsuccessful implementation can be high, and especially in Small-and-Medium-Sized Enterprises (SMEs), poor outcomes of an ERP implementation may threaten the existence of a company [3]. Normally, SMEs have limited financial and IT resources to tackle an implementation on their own, and they are therefore highly dependent on external expertise [4]. SMEs also lack experience, and skills related to ERP implementation issues, and many of these companies find themselves getting less than expected out of their systems. There is a growing research interest on ERP implementation in SMEs [5], but there is still a scarcity on empirical research on this topic, and several questions are yet not answered.

Previous empirical studies on ERP implementation have focused on how organizations can manage implementation challenges, and a number of critical success factors have been identified [6]. Frameworks and lifecycle models have also been developed to understand and manage different stages of an ERP project in better and more efficient ways [7]. For instance, Somers & Nelson have identified several critical success factors which implementing companies should consider in an ERP project [8]. They also provide an overview of different primary activities and stakeholders and the significance of those (low, medium, high) across different stages in the ERP life cycle [6].

Most of the ERP research has been conducted in larger companies, and more research is needed to understand the ERP context of SMEs [9]. Therefore, this study reports on ERP projects from a multiple case study conducted in five SMEs. The focus in this research has been to identify critical issues in the pre-implementation, implementation and post-implementation stages of an ERP project. The following research questions have guided this study: (1) What are the critical issues that SMEs need to consider at different stages of an ERP system’s life cycle? (2) How can SMEs handle ERP projects to achieve a successful adoption and use of such systems?

In this paper, the work of Somers and Nelson [6] and Markus and Tanis [7] are utilized as a point of departure for presenting and discussing the results of this multiple case study.

The paper is organized as follows. Section 2 provides an overview of the different research sites and methods applied. Section 3 presents the empirical results of this research, followed by a discussion in Section 4. Finally, Section 5 provides some concluding remarks.

2. Research Sites and Methods

2.1. Research Sites

Five different SMEs provide the empirical base for this multiple case study. Table 1 provides an overview of the context of these enterprises including their core businesses and clients, their motivation for implementing an ERP system, and the modules they have implemented. The companies are from a wide-range of industries. This is strengthening for the results, since common trends across different business areas, indicates that the findings are relevant crosswise SMEs despite of industry.

2.2. Research methods

This multiple case study has mainly followed a qualitative research method. In total, forty-one open-ended and semi-structured interviews were conducted in these companies (Enterprise A: 2 interviews, Enterprise B:
2 interviews, Enterprise C: 12 interviews, Enterprise D: 12 interviews, Enterprise E: 13 interviews). The participants were CEOs, project managers, consultants, IT personnel, and end-users of ERP systems. In addition, field observations and document analysis were carried out. Observation data was collected in the pre-implementation phase of Enterprise C, and a survey (37 respondents) was conducted in the post-implementation phase of the same company.

Table 1. The SMEs involved in this study

| Enterprise   | Employees & locations | Industry                                                                 | Clients                                                                 | Motivation for ERP                                                                                      | Modules implemented                                                                 |
|--------------|----------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Enterprise A | 36 Co-located        | Health and hospital equipment, nationally leading for producing first aid and emergency treatment. High demand for innovativeness, need to develop products fast | Hospitals, offshore installations, national defense, voluntary organizations, veterinarians, public sector | Need a system that can handle scalability and continuous growth, supporting decision processes and use of historical data, provides financial control, fast customer response | Logistics, inventory & production man, sales & marketing (CRM)                        |
| Enterprise B | 130 2 locations      | Architecture competencies, entrepreneur, carpenters, planning and installation of industry buildings, delivers decoration packages | Different kinds of industry buildings                                    | Increase efficiency, replace legacy system in accounting and finance, and handle invoices.               | Accounting & finance, salary, time registration, electronic invoicing, document management system |
| Enterprise C | 50 6 locations        | Boat equipment retailer, selling accessories to boats, offering services for boat lay ups, boat maintenance, Web-shops and stores | Owners of leisure boats, sailors, companies using different kinds of boats in their business | Replace existing system with an efficient and integrated ERP solution enabling integration with existing Point-of-sale (POS) and CRM, integration towards financial institutions, improve e-commerce, logistics, document management repository | Logistics, accounting & finance, document management repository                      |
| Enterprise D | 90 3 locations        | Different kinds of office supplies. Web-shops and stores.                | A wide range of customer, all industries that use office supplies         | Replace the existing ERP system with a new system that is faster, more efficient and with higher scalability and better logistic functions | Logistics, accounting & finance                                                      |
| Enterprise E | 13 2 locations        | Publisher specialized in production of textbook for students in higher education. Also some text books for primary school | Mainly students at universities, teachers working in the primary school | Replace existing legacy systems with one ERP system supporting editors, royalty functionalities, employees in sales and marketing, management. | Accounting & finance, CRM, project management, royalty module                        |
In addition, secondary data from all the companies comprised project documents, requirement specifications, emails and intranet documents that provided important contextual information about the different research sites. The process of data collection and analysis proceeded in iterative cycles following norms of the hermeneutic circle [10]. When new and surprising themes emerged, these were further explored and analyzed. Hence, the interview guides became more narrowly focused over time. All the interviews and observation data were digitally recorded and fully transcribed. The empirical material was further systemized, reduced, and categorized [11]. Finally, the themes were interpreted by utilizing existing theoretical concepts within the literature. For instance, we employed the concepts of ERP (critical issues across stages in the ERP life cycle) in combination with our empirical findings in order to obtain a broader understanding of the challenges these companies met during their implementation of an ERP system.

3. Results

The ERP life cycle is applied to systemize the empirical findings of the five SMEs under study. We focus on key activities, critical issues and key players across the stages of pre-implementation, implementation and post-implementation. As mentioned above, the empirical data is more comprehensive for enterprise C, D and E and therefore richer descriptions from those case studies.

3.1. Pre-implementation

Enterprise A. The project manager and one of the IT professionals selected the system. The IT professional played an important role since he knew the business processes of the company, was strongly committed to the project and took hand of the requirement specification. They had experiences from former ERP projects in addition to general IT competencies and business understanding. The enterprise had an old ERP system handling logistics, production and inventory management. A project team was set up, and infrastructural issues and the hardware situation were reviewed and upgraded to prepare for a new ERP-system. In parallel with these activities, they mapped the business processes in the company and developed a requirement specification. Three different ERP-systems were evaluated before they made a decision. The company put weight on a number of selection criteria. They wanted an ERP system with a well-known reputation offered from a local vendor, providing continuous support. Moreover, the new system should be easy to install on existing infrastructure and hardware, easy to use, and support existing business processes. They wanted to keep the most of their processes without changes. This was mainly to avoid resistance in the organization. They looked for a system supporting logistics, production management, sales and marketing, and with decision support functionality. The cost of the system did also matter. The company chose the system and the vendor that conform best to the selection criteria and was able to respond to the requirement specification in a competent way.

Enterprise B. The project leader of the ERP project had broad experience from different IT systems. He was responsible for most of the decisions during the overall project. Since Enterprise B is a small company and ERP systems are standardized software packages, he decided to not make a requirement specification. Four different systems were evaluated. Important criteria were that the system was supported by a local vendor, and a system particularly made for small enterprises. They wanted to implement modules supporting finance, salary, time registration, and document management. Two different supplier of the same system were considered, and only one of them was able to demonstrate the system in an acceptable way. The project manager emphasized that personal qualities of the consultant demonstrating the system, was important for the decision of supplier. In addition, they checked references for both of the suppliers.
Enterprise C. The CEO was strongly committed to the project, and had previous experience with ERP implementation projects and knew that these had many problems. In addition, vendors and resellers did not always deliver what they promised. The CEO was quite skeptical to the promises from the resellers’ sales people. Also, from his experience from other SMEs, he conjectured that they focus too little on the track records of the resellers and the implementation consultants. He found that most SMEs lack the skills necessary to select the most appropriate vendor and proficient resellers and consultants. Therefore he wanted to prepare before acquiring an ERP system. The project team, consisting of the CEO and the CIO, was appointed by the company board. It was decided that these two people would be the most competent and skilled to carry out a successful ERP acquisition and implementation project. The CEO had contacts with other SMEs implementing ERP systems, and found out that several of the SMEs had acquired systems that did not fit the company requirements. For example, the resellers would send sales people who were more proficient in making sales than in the systems specifications. Often the sales people would promise more than they could hold, and they would underestimate the technical challenges. Another problem was related to the resellers’ consultants. They would usually send junior consultants, and only brought in the senior consultants when the implementation got into trouble. This could therefore be quite expensive for the customer. The resellers’ junior consultants would get their hands-on training through such projects, billing the customer. Therefore, the CEO did not trust sales representatives.

Six ERP systems were invited for further assessment. The company conducted auditions with resellers and their consultants. The project team had gone thoroughly through the ERP packages, and they created assignments that the consultants were asked to solve. The company was only interested in signing contracts with consultants who could solve the assignments during the meeting. Two of the resellers performed well at the auditions. One of the consultants excelled particularly, and demonstrated impressive skills. The project team decided to hire that consultant and his company as the reseller. The company was offered a standard contract by the reseller. This contract was difficult to comprehend, and the CEO conjectured that it would be difficult to abide by the contract. The company would rather have a contract that they could abide by. They also revealed that the standard contract had provisions that made it possible for the reseller to renegotiate various issues at a later stage. Therefore, the company insisted that the contract should be revised. The project team pressed on for a comprehensive pre-project that would solve all issues, but the consultant refused to provide that much level of detail in the pre-project. He argued that it would make it easier to replace him in the main project. The project team accepted these concerns and accepted a shallower pre-project.

Enterprise D. The project commenced when the company realized that it had out-grown its previous ERP system and decided to look for a new ERP system. The flow of goods had increased significantly, and they needed to become more efficient. They evaluated four vendors and systems and selected the system and vendor six months later. The company did not have enough competence internally to implement the system and looked for a consultancy company to lead the project. They decided to employ the skills of a large consultancy company, which was experienced in the chosen ERP system. The size of the consultancy company was deemed to be important to secure long-term access to the ERP competence. The consultancy company stated that it was very proficient on project management and would lead the process the whole way, and they got the job. The consultancy company recommended a pre-project, and this was run shortly after. A group of consultants and department managers from Enterprise D ran the pre-project. They studied the business processes in the company and made a requirement analysis. One of the consultants (CFO) was then assigned the main responsibility for the pre-implementation project and was located in Enterprise D during the implementation project. The CFO became the internal project leader and the spokesperson for the employees at the accounting department. The head of the logistics would take part and also represent the employees in the logistics department. The CEO then withdrew from the process. He received the pre-project report and found that it addressed the needs of the various departments appropriately. Shortly after the pre-
project, Enterprise D told the consultants to go ahead with the project. Enterprise D decided that the go-live date would be just before the summer holiday in June, and they asserted that the system would be well in operations by August, when the busy season starts.

The employees were more critical because only the managers were involved in the pre-implementation process, and thus their voices were not heard. Many of the respondents were more critical of the go-live date, especially end users. Several end users believed that the holiday would interfere with user training and had requested that the go-live date should be moved forward. Many employees went on holiday around the go-live date and were not proficient enough in using the ERP system when they returned from holiday.

Enterprise E. Until May 2007, this company, which was a publisher, used a combination of several systems. This was a disadvantage, and they wanted to acquire a common system. Such a need was not shared by all employees at the publishing house. Until the implementation of the SBO, the company had used FileMaker and Maconomy. The organization formerly had a graphical department, and they preferred to use a Mac-based software solution that provides functionality to support graphical work. FileMaker is a tailored system for Macs and was adapted to the editors’ needs. In this system, editors could create new projects and store related data. In addition, it was possible to perform tasks related to the design and layout of the books. Thus, this former system supported the needs of many of the staff, especially the editors. The administration and marketing department used Maconomy’s financial system. Maconomy is adapted to the Mac operating system. In addition, Maconomy had a function that calculated royalties (a calculation model for the royalties of authors). Despite the customized systems in the company, there was a need to acquire a single system supporting all functions within the company. The new system needed to meet certain criteria. An important criterion was that it needed module for calculating royalties for each book sold. Such criteria led to the exclusion of several ERP systems.

The publisher had the opportunity to upgrade its existing Maconomy system. This system had a working royalty function, though not an optimal one. However, an upgrade proved to be very expensive and was therefore irrelevant. Schilling Data was another system that was considered because several major publishers use this system. The system corresponded to expectations, but was found to be too expensive for the publisher. The publisher then got in touch with the vendor of SAP selling SBO. SBO is an ERP system suitable for smaller organizations with up to one hundred employees. SBO was chosen because of the royalty function. The consultants selling SBO undertook the responsibility of developing such a solution which was not present in the standard solution.

3.2. Implementation and Post-implementation

Enterprise A. Both the local supplier and consultants were actively involved during the implementation process. The consultant from the vendor was actively involved before, during and after the implementation process. The users were satisfied with the consultant since he had personal qualities such as being a good listener to users’ problems, and he also put effort into understanding the company’s processes. The company attempted to clean the data properly before transferring them to the new system. They implemented the system through a big-bang approach after a period of testing and training. It was challenging to test the system since the users did not have much knowledge about the system. They decided to test the most important processes, and the consultant was responsible of all data transfers. They chose to adapt the system to the business processes, and not the other way around. The primary reason for this was that the users did not want to change their routines. Process changes would have been better, however, the company decided to postpone process improvements to later on.

The interviewees emphasized the importance of creating a knowledge network of both internal employees and external consultants after the implementation. In addition, they have dedicated super users across the
organization. After the implementation, the primary consultant stayed two weeks on site to follow up and support the users. The company has gradually built internal competencies on the system, and has become more and more independent of external competencies. They have several super users which make the organization less vulnerable for loosing competencies if some employees leave. Still they need external consultants for further development of the system.

Enterprise B. Enterprise B used a big-bang implementation approach. The new system was customized to fit with existing processes which was the reason for many of the problems. The project went far over budget because of extra time resources. Most of the implementation process was taken care of by the vendor. However, the vendor did not meet up to the expectations and spent a lot more time than they had promised. The SME was not able to use the system according to the plan, and all the modules were not implemented. The consultant was a junior, and lacked experiences with this kind of system implementation. This phase turned out to be a nightmare for the company, and they decided to break the contract with the vendor. After a long period with much hassle, they assigned a contract with a more competent vendor which they still use for support.

The company put much effort into training of the users. Firstly, the project leader and employees from accounting got training both through common sessions and individually. The other users participated at common training sessions for only one hour. The company transferred some of their old data through the new system. This was a cumbersome process since they did it partly manually through punching or by transporting excel sheets. They did not transfer the accounting data. They had nearly 1000 projects to complete before the transition to the new system. Thus it was a challenge to avoid data redundancy since there was duplication of the data between the old and new system.

The implementing organization was dependent upon external consultants after the implementation. They have support from a local vendor and get help quickly when needed. The vendor upgrades the system on a remote basis. The company emphasized the importance of having a consultant they can trust and who is available on request. They are satisfied with the support they get from this vendor. The training of the users continued in this phase. Many users can work more independently than before since the system provide them with important status reports on different projects.

Enterprise C. The project team was aware that challenges could arise during the ERP implementation; however, they were not prepared of additional issues arising in the post-implementation phase. The most serious problems were security issues due to incorrect configuration of the system, problems with extracting transaction data to get sales reports, difficulties with sending invoices, inaccurate inventory due to point-of-sales workarounds, and lack of satisfactory ERP competence among the users due to insufficient training arrangement. The technical configuration of the system was tackled by hiring the consultant for one day per week after the system went live. Several of the participants stated that the employees tried to avoid the system when they met problems, thus “workarounds” were quite common. The CEO pointed out that such error early in the process probably had led to many errors in the database. He further added that they will have to count all the items in the warehouse, and correct the database manually. Managers of the retail shops were quite frustrated with this situation. They established a help desk service, manned by an external consultant, to assist the employees in using the system. The employee survey indicates that the situation improved significantly during the first year. The CEO had determined that the training offered by the vendor would not be appropriate. He was very critical to the training quality, and believed that they could provide a more adequate program by themselves. The company therefore decided to decline the vendor’s offer for user training courses. The poor training quality was corroborated by the survey responses from the employees, and most of them seemed to be quite critical to the training. The CEO had produced manuals and training videos to improve and support the employees’ learning processes. Another action was that super users, who mainly were located at the main office, would visit the retail shops and give training seminars there.
Enterprise D. Most of the participants noted that the project management was poor and was a major reason for the problems that occurred in the project. The SME had given the consultancy company the responsibility for the project management. It was also evident from the interviews that they lacked a strong leader during the process. Both the CEO and several of the employees noted that the CEO should have taken charge. Several of the respondents commented that the appointed internal project leader was not up to the task. The consultancy company has admitted that their project management was not good enough, but they claim that the implementing company also is to blame. Many of the employees commented that the communication with and between the consultants was not working properly. The SME addressed these problems several times, and was promised that it would be better. According to the respondents it did not improve. The consultancy company on their part felt that the customer company had problems with their communication and project organization. The CEO had decided that there would be minimal customization. The assigned consultant did still get many requests for customization of various parts of the ERP system, which were executed. Many of the adjustments were not necessary, for example minor customizations of the screen images. It was noted that neither the consultant nor the SME was firm enough when employees requested adjustments.

Another problem was that many promises and messages were only given orally. This made it difficult to keep an overview of what had been said and done. Both parties admitted that they should have documented things better.

The user training in itself was perceived as fairly good among employees and managers, but evidently there were some problems. One issue was that there were done adjustments to the system on the day of the course. The two consultants were located in different places, and did not communicate very well. This led to problems for several of the employees. Another problem was the timing of the user training. It was right before most of the employees had their summer holiday. The CEO noted that the training was not sufficient, and they ran a new round of courses after the go-live. Some employees commented that the training had little focus on helping the users to understand the system. They had little overview beyond their role, and therefore limited understanding of how their processes interacted with those of other employees. The users were therefore waiting for help, and did often resort to workarounds.

Several of the managers noted that the dissatisfaction and resentment grew among users in this phase. There were plans for arranging super user training for two of the managers, but that was never done. Thus, the user support was very weak. The CFO left the company one year after the system went live, and the CEO took the charge of the ERP project. He soon discovered that there were serious problems with the accounting data. There were errors up 200,000. Work routines were also not performed correctly, which led to more errors in the transaction and accounting data. As a result, the annual statements for 2009 were incorrectly posted. The CEO and the consulting company then took control of the situation, brought in new and more competent consultants. The new consultants were able to fix the errors in reasonable time.

Enterprise E. The staff at the publishing house had different attitudes toward the new system. Some spoke positively about the SBO, while others were skeptical. The publisher has different departments, each with its own needs and requirements for functionality. It is therefore not surprising that there was variation in how well each of the employees was satisfied with SBO. The publisher appointed a super-user that developed solutions for the employees’ various problems. These solutions include the creation of screenshots showing step by step descriptions of the various operations. This was seen as positive for the employees. The editorial staff did not have the same need for a new system as the department of marketing and sales. FileMaker was well liked by most editors because it was customized to the organization and especially to the editors. According to the editors, SBO was not well suited to their knowledge-intensive tasks. The editors needed a good project tool, which according to the editors were not supported in SBO. The SBO had over 90% redundant functionality, which was not appropriate for supporting daily work routines. However, some of the editors thought of the new system as a new opportunity. They perceived FileMaker as a registration system,
and its use was locally linked to each editor that had information and data stored on their local PC, which were inaccessible to others. The implementation of SBO in this kind of situation would provide common information and a common view for all employees working on a given project. The department of marketing and management used Maconomy before they were introduced to SBO. The staff was pleased with the new system as it supported the finance functions in an appropriate manner. In addition, the system was highlighted as structured and orderly, as it gave easy access to necessary information on production, sales, and internal and external costs. This overview was important for management in their daily tasks.

The SBO was perceived as cumbersome to use, and this led to low or wrong usage of the system, and alternative solutions were chosen. Alternative ways of performing these tasks included using other applications, such as Word and Excel. These tools were, in some cases, better suited to the editors' needs. Beyond these applications the former system FileMaker is still in use. Phasing out FileMaker was planned in relation to the roll-out of SBO. Due to the lack of adequate solutions in SBO, employees in the marketing department still needed certain features in FileMaker. An important challenge for the publisher was the calculations of royalties for the authors who have published books by the publisher. The development of this module proved to be difficult, and the external consultants underestimated the complexity of the module which they had to make from scratch. The fact that the calculation is yearly, however, was a problem because it took too long before the problem was detected. The module is still not functioning properly.

4. Discussion

In the pre-implementation phase we found that selection of project leader and project team, development of requirement specification, reviewing the market, evaluating different systems, vendors, resellers and consultants, and making a contract with the vendor, were the most central activities. Important activities during the implementation phase were project management, user training, cleaning and conversion of data, testing of the system, customization of the system. In the post-implementation process, the training of users continued, and the companies were dependent upon support from the vendor. Some of SMEs experienced workarounds due to insufficient training, and thus less use of the systems. One of the companies emphasized strongly the importance of creating a knowledge network of internal employees and external consultants to increase system competencies.

The selection of the most appropriate system was a critical issue, and Enterprise E ended up with a non-suitable system, which was not designed for publishing houses. This small company had limited financial resources, and therefore, they were forced to choose a non-optimal system. However, the selected system may prove to be far more expensive because of a lack of fit to the work practices of the editors, and the new system caused extra work. In Somers and Nelson [8], "Careful selection of package" is the third most important critical success factor in the initiation stage, and an ERP system may not be the right choice at all.

The key players in this study consisted of both external and internal actors that were important for the outcome of the project. In the pre-implementation phase, the selection of vendor, reseller and consultant was critical for the companies. This was especially discernible for Enterprise C which organized auditions for selecting the best qualified actors. We assume that this company had a better starting position than most SMEs. The CEO knew that there were many pitfalls that could make the project go wrong. The company therefore took steps to build the internal ERP competence on ERP acquisition and implementation. We should expect that the typical SME will be in a worse position, and may easily end up with the wrong system and paying a larger bill than necessary. These are the findings in several other studies [4, 12]. Companies acquiring ERP systems will usually enter into a long term relationship with the reseller and the implementation consultants. They may, however, be motivated by different agendas, such as maximizing their income from the project. The crucial part for a reseller is to complete a contract. Once the contract is signed,
junior consultants could be assigned to the rest of the project. This corroborates Skok and Legge [13], who found that some consultants would lack experience from ERP implementation projects. The consultants would not always be honest about their skill levels [14]. Commitment from the CEO is important, and this was one of the reasons why the ERP project failed for Enterprise D. The project manager was not experienced and the pre-project was not preparing well enough and the failure circle started already in the pre-implementation process, and problems became visible at a later stage when unnecessary customizations and wrong numbers in the system came to the surface. This pitfall does Markus and Tanis in particular call attention to; wrong decisions and errors in former phases became visible later in the life cycle [7].

5. Conclusion

This multiple case study has identified key players, activities and critical issues across the ERP life cycle in five different SMEs. SMEs may have some challenges that are different than larger companies. SMEs have less resources and competencies about complex system, thus they are more dependent of external support and selection of an appropriate system. The SMEs wanted support from a local vendor. A good partnership between the implementing company and the vendor or consultant through the whole life cycle was pointed to as important from all the SMEs under study. This might be an issue which is less critical for larger companies which have their own IT department and more resources to build up their own competencies.

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