EXPLORING THE RELATIONSHIPS BETWEEN MISFITS, CUSTOMIZATION, PROCESS REENGINEERING IN ERP IMPLEMENTATION: FINDINGS FROM A TAIWANESE TEXTILE SME

ABSTRACT

The study aims to provide insight into the relationships between misfits, customization, business process reengineering (BPR) in ERP implementation. The analysis of an ongoing ERP project of a Taiwanese textile SME is conducted. We propose a casual schema for these three constructs, together with a misfit typology. Based on our findings, customization and BPR are taken as complementary solutions for ERP misfit problems. How customization impacts the ERP implementation success relies not on the percentage of customized modules, but is determined by how useful customization is in meeting context specific requirements, and how it influences embedded ERP procedures. ERP-enabled BPR forces a company to adjust its current processes to fit with ERP practices by standardizing operations and adjusting the business infrastructure. However, this improvement doesn't guarantee the rationality of the process, unless an operation is unified, simplified, and is consistent within a site.

Keywords: Enterprise Resource Planning (ERP) Implementation, Customization, Business Process Reengineering (BPR), Misfits, Case Study.

1. INTRODUCTION

Owing to pressures from dramatic business environment changes and global competition, companies have to shape new business strategies proactively. An effective business strategy, which is the key to survival, relies more heavily on information technology (IT) nowadays [Nah, Lau & Kuang, 2001]. Therefore, when the enterprise resource planning (ERP) system emerged in the 1990s, companies around the world were eager to introduce this application in order to exploit the potential of this new information system (IS).

An ERP system, in short, is a commercial software package that promises the seamless integration of all information flowing throughout the company [Yen, Chou & Chang, 2002]. This system supports a process-oriented view of business operations, and is embedded with standardized business processes and best practices [Nah, Lau & Kuang, 2001]. However, the difficulties of ERP implementation have resulted in a high

failure rate in the past decade [Nah, Lau & Kuang, 2001; Hong & Kim, 2002]. Numerous studies recognized this phenomenon, and investigated ERP implementation projects in depth. Generally speaking, those studies can be divided into two main categories: studies of critical success factors (CSFs), and studies of misfit problems resulting from context specific requirements.

With regard to the CSFs of ERP implementation, those studies jointly provide a basis for identifying and mapping CSFs with ERP project phases. Bingi, Sharma & Godla (1999), Sumner (2000), Nah, Lau & Kuang (2001), Wan, Ling & Huang (2001), Tan & McLaurin (2002), Hong & Kim (2002), Serene, Vathanophas & Ling (2002), and Zhang et al. (2003) have all contributed to this field. Accordingly, some CSFs are important during the whole ERP project (e.g., ERP teamwork, top management support, and project management); some CSFs become important after the implementation phase (e.g., BPR, minimum customization, and change management); while some CSFs are important merely for the project maintenance phase (e.g., performance evaluation).

On the other hand, Soh, Kien & Tay-yap (2000) initiated their research based on the misfit problems caused by the incompatibility between contextual requirements and western ERP logic. They suggest that, national, industrial, and company specific requirements might all affect the ERP implementation success. Regarding the effects of the specific requirements of national or regional cultures, Van Everdingen, Van Hillegersberg & Waarts (2000) and Zhang et al. (2003) provide some supportive evidence. For the industrial layer, Wu & Wang (2003) highlight how industrial features influence the tendencies and the evolution paths of ERP adoption and implementation. Finally, company-specific factors, such as firm size [Adam & O'Doherty, 2000], ERP project duration [Adam & O'Doherty, 2000], and organizational or task-technology fit [Smyth, 2001; Hong & Kim, 2002; Tan & McLaurin, 2002], are all reported to have impacts on ERP implementation success.

Amongst all the studies listed above, customization and BPR can be regarded as the CSFs that are most relevant to the misfit problem of ERP implementation. Although far beyond discussion, both research streams tend to regard more customization and BPR as contradictory solutions. However, owing to the features of IS packages (see Gattiker (2002), for instance), we do believe that companies can exploit and maximize the power of both customization and BPR concurrently, thereby easing misfit challenges and leading to smoother ERP implementation. Also, studies on successful ERP implementation only provide limited knowledge on the meaning and the value of BPR. This raises our research question: "Are there any implicit relationships between misfit problems, customization, BPR in ERP implementation?" More specifically, our research questions can be shaped as: (1) Are customization and

BPR really contradictory, rather than complementary? (2) How does a company exploit customization and BPR to ease misfit problems? And (3) Is fully applying the ERP logic equal to successful BPR?

2. RESEARCH METHOD

The ERP implementation project is complex, in particular when taking into account the specific requirements within and beyond the company. The difficulty of separating out aspects from contexts suggests that a detailed case study approach is the most suitable research strategy [Holland, 1995]. This paper gives an in-depth analysis of an ongoing ERP implementation project within a company. In order to highlight the misfit problems on ERP implementation, we select a Taiwanese textile SME that applies a western ERP package. It is a representative case because it covers rich contextual specific requirements, which includes company (SMEs with less bargaining power with partners, and with more concerns on costs of IT investment), industrial (textile), and national (Asian culture) aspects. To protect company privacy, we use the fictitious name (D&A) for this case company.

Interviews with the CEO, the general manager (GM) and ERP team members in the company are conducted throughout 2003 and 2004. Besides, as part of the study, one of the authors participated this ERP project for a period of four months in 2003, playing as the role of a member within the ERP project team.

3. CASE INFORMATION

Company Background and Motivations of Implementing the ERP

D&A is a Taiwanese textile company formed in the 1970s. It started its overseas expansion and built plants in the 1980s, aiming at utilizing the competitive advantages worldwide. It produces fashion knitwear products for U.S. wholesalers, serving as an OEM. Relative to its competitors, D&A invests intensively on its R&D capability, which helps itself more sensitive to the fashion trends and quicker response to customers' new tastes. The outstanding product quality and stable order fulfillment makes D&A being recognized and awarded by its key customers. Such a success also made D&A continuing its growth in annual sales. Although with its success in performance, the CEO was not satisfied with its current management and control structure. In 2000, the CEO started an improvement plan for internal adjustment and transformation on both IT and business sides. The major goals that D&A desired to

achieve include the following five, namely: (1) better management and operation processes to make cost down; (2) better administration, authority, and control mechanism; (3) a new, integrated IS infrastructure to replace its legacy, separated ISs; (4) synchronization of information, physical and financial flows, with timely information available; and (5) fitting with key customers' requirements on both IT and business sides. In 2002, when the GM found the potential and the price of ERP solution satisfied with D&A's requirements, the GM started the feasibility study about initiating an ERP project inside D&A.

Stage 1: Plan Phase of ERP Implementation

After thoroughly evaluation, the CEO, the GM, together with the CIO decided to implement the Oracle ERP. Worrying about the inability of her staffs, the GM reached a consultant company through Oracle's help. The consultant company, a partner of Oracle, had experience in implementing ERP for textile companies. After meeting with staffs of Oracle and the consultant company for several times, the GM signed contacts with Oracle, and a one-year-long customization and implementation contract with the consultant company in mid 2002.

For D&A, key ERP modules being purchased include: (1) accounting modules, such as AP / AR, and general ledger (GL); (2) asset management modules, such as fix asset management; (3) distribution management modules, such as OM, shipping, and inventory management; and PR / PO; (4) manufacturing modules, such as forecasting, MDS, MPS, MRP, capacity planning, WIP management, and cost management. One fact worth mentioning here is that D&A purchased more EPR modules than that being reported in this paper. The primary reason of not reporting the remaining part is because those modules either serve for non-core business functions or have less interference with other modules.

To ensure the ERP project running smoothly, the GM made extra efforts on the following issues, when the ERP project initiated. First of all, the GM and the CEO promised to participate most ERP meetings. Secondly, the CIO and one functional manager were assigned as co-project managers and champions, to minimize the gap between IT and business domains. Finally, an ERP project team was formed; two experienced staffs with IS background were hired for bridging and training tasks.

Stage 2: Project Phase of ERP Implementation

D&A took the consultant company's suggestion, initiating four tasks in parallel since the project started: ERP module introduction, functional system requirement interviews, current operation processes documentation, and settings of trading models. The ERP module introduction helped D&A staffs having clearer ideas about whether

system modules match their business needs. Functional system requirement interviews led consultants having in-depth understanding on D&A's current operations and future needs (e.g., providing feasible business and system matching solutions, and identifying required customization modules). The current operation processes diagnosing helped D&A's management clarify links across functions, to identify inconsistent operation procedures, and to highlight gray areas of responsibilities. Finally, trading models helped to build the blueprint of how D&A perceives the interrelations within its multi-nations, multi-sites operations in the near future. It was the key reference or the foundation of settings of ERP modules. Because D&A lacked of such experience, and because there were numerous tradeoff concerns or arguments between its current practices (e.g., cost concerns and internal auditing) and the ideal settings (e.g., the quantity and complexity of inter-organizational transactions), a compromised version was built. To sum up, during this step, although with some complaints and arguments inside D&A, the outcomes of these tasks served as the key reference for future design, including building up its standard operation procedures.

Four parallel but interrelated functional implementation sections came after the above tasks. The first section is accounting. In this aspect, most efforts were put on three topics: choosing appropriate principles amongst the embedded alternatives of ERP, determining how to deal with (internally) inter-organizational transactions, and deciding how to match practical requirements with ERP modules. Owing to the complexity of inter-organizational transactions, and the unwillingness of changing case-based payment practices, the GM decided adopting multiple ERP methods in parallel to fit with current operations.

Fixed asset management forms another section. It was the section with fewer arguments, except for the category setting, responsibility design, and the GM's insisting on the authority and control hierarchy of procurement.

The order management section was the most complex one. Reasons making this section difficult to deal with include: (1) Original ERP does not provide supports for core business functions, such as lab dips management (recording required color yarns information), and country-dependent shipping documents. (2) The ERP sample management module is R&D oriented, which does not satisfy the features of textile sample management. (3) The order formats and information is customer-dependent, which makes D&A hard to identify and to record through standard ERP modules. And (4) An order spec covers some physical information (e.g., quality information of panels), which is hard to digitalize all the information. Therefore, the consultant company and D&A staffs spent lots of time customizing modules for pre-order / order management, and designing interfaces bundling those customizing data with existing ERP modules (e.g., PO, OM, BOM, and AP/AR), either explicitly or implicitly.

Finally, in manufacturing section, ERP were useful for identifying better, unified operation procedures, and restructuring (e.g., changing the responsibility hierarchy, organizational structure and job arrangement). However, it was still tough to fit D&A's operations directly with ERP modules. One major reason is that the inflexible manufacturing time (i.e., customers do not release finalized order specs and quantities until the last minute), together with a peak demand pattern (knitwear is sold mainly in fall and winter). Besides, challenges of regulation constraints (e.g., quota limitation), embedded heuristic scheduling practices, and D&A's existing multiple manufacturing sites transferring designs, all make MRP functions hard to apply smoothly. Moreover, yarns, the major material of knitwear products, are difficult to manage, because of both quantity management (e.g., the humidity seriously affects yarn weights) and quality management (the color of yarns varies from lot to lot). Moreover, unlike the simple, direct relation between order spec and BOM in electronics industry, the order of a textile product covers many styles and items, owing to different sizes (e.g., small, medium, and large), different color combination, and different packing requirements. This feature makes issues such as scheduling, MPR, and building up BOM far more difficult and complex. Beyond that, there is a common phenomenon in the textile industry. The information of orders, products, and materials are seldom reused because of the features of fashion products (seldom re-produced in the next year) and the lot-dependent quality (because the color of yarns is determined by lot and is impossible to reproduced).

The last step of this phase was cross-functional scenario testing. It was composed of logical testing and run-time testing. During this step, problems such as mismatches, system bugs, settings of authorization hierarchy and non-required / non-value-added operations were again filtered, identified and solved. However, some problems caused by practical concerns (e.g., regulations, and multiple but inconsistent operations within a module) were still pending without any changes.

Stage 3: Project Outcome and The Status So Far

Although half year behind the schedule, the ERP project entered the pilot phase in early 2004. Most department users are required to adopt the parallel run approach (using both legacy ISs and ERP) for the first half year of 2004, in order to ensure data accuracy and to stabilize ERP operations. As well, the ERP usage training for overseas plants is still in progress. At the same time, to tightly link with D&A's manufacturing systems at overseas plants, and to develop a shipping management system based upon the ERP platform, relevant departmental members and the CEO are now defining new system requirements, figuring out possible alternatives of module and data integration with ERP tightly through Oracle ERP's open interfaces.

Although this project hasn't achieved the expected goals so far, D&A's management (especially the CEO and the GM) are satisfied with the direct and indirect influences of this project inside D&A.

4. ANALYSIS AND IMPLICATIONS

Misfits and Corresponding Solutions: An Analysis

We categorize key misfits being found in the case by adopting Soh, Kien & Tay-yap's (2000) framework, as shown in Table 1. Each misfit (together with its solution in this case) is classified by two dimensions: the source of specific requirements (company, industry, or nation) and the software-based perspective of misfit clustering (data, function, or output). This table, in fact, not only helps to highlights the number of misfits, but also helps to clear identify the relationships between different types of misfits and their corresponding solutions.

From the table, customization and BPR are both taken as solutions in this case. For functional misfits, most problems rising from industrial requirements are satisfied by customization, while smaller portion is solved by BPR-based approach. On the contrary, for data and output misfits, D&A prefers solving by customization. These phenomena reveals that customization is appropriate for misfits having fewer impacts on ERP practice, whereas BPR is suitable for misfits being damaged to embedded ERP practice. Therefore, we here propose the first misfit-classification dimension of "possible changes with / without affecting embedded ERP practices."

If further analysis is taken on company specific requirements, it is found that some of them are not truly caused by the company itself. Instead, the misfits might result from the numerous requirements of different key supply chain partners. For instance, different customers and suppliers force D&A to follow their own order or payment formats and methods. Those incompatible requirements from partners are hard to unify by simply revising D&A's internal processes. Although such misfit or phenomenon is not yet highlighted by previous studies, it is, in fact, a typical scenario or challenge a SME might suffer when working with supply chain partners. Thus, by considering this new source of misfits, we identify the second dimension for misfit classification: "misfit processes can/cannot be solved solely within the organization."

Combining this two classification dimensions, we refine four misfit types from the solution-oriented perspective: (1) Type I: able to be solved within the company and need not affect embedded ERP practice (e.g., extra output report, suitable data input interfaces, and industrial specific modules); (2) Type II: able to be solved within the company but might affect embedded ERP practices (e.g., multiple payment /

material-receiving matching approaches); (3) Type III: unable to change current practice but might be solved without changing embedded ERP practice (e.g., providing unique order input interfaces for fulfilling numerous customer-dependent order formats); and (4) Type IV: able to be solved by cooperating with partners and might result in changes of embedded ERP practice.

We now explore the meaning of customization and BPR, as well as how both approaches are taken during ERP implementation. Customization is applied for solving different types of misfits. In fact, it is not an uni-dimensional construct. Therefore, contrary to previous studies such as Nah, Lau & Kuang (2001), we argue that the value of customization should not be determined merely by the percentage of customized modules. Instead, how customization contributes to ERP implementation success should be determined by another two criteria: "customization with / without affecting embedded ERP practices" and "how well it solves the challenges of contextual specific requirements."

Secondly, when reviewing the contributions of BPR in this case, we find that the scope of BPR in ERP implementation is much more narrowed than what is quoted by Davenport in the early 1990s. Here, BPR can be interpreted as actions of standardizing current operations to fit with the best practices of the ERP. We prefer calling it ERP-based BPR. More specifically, a truly ERP-based BPR is achieved only when the organization adjusts its process with ERP practices, aligns the process better with the changed business infrastructure (including organizational structure, authority hierarchy, and control mechanism), and unifies it as a single operation with only one practice (without more choices or exceptions). Otherwise, it might become a puzzled process refinement. One typical example in this case is that D&A keeps multiple practices for matching payment and inventory receiving at one plant, which is expected to cause extra problems in the foreseeable future. Another example is that the multi-site-based inter-organization interactions become quite complex owing to the compromised setting of the trading model. Therefore, from its very nature, finding on the CSF namely BPR also slightly contrasts to the claim made by previous studies (i.e., fully adopting ERP logic equals to business improvement and achieving BPR).

Relationships between Misfits, Customization and BPR

Figure 1 illustrated the casual schema for misfits, customization, BPR in ERP implementation, according to the above discussion. This casual schema is particularly useful for companies applying ERP and BPR in parallel. As depicted in the figure, from the very beginning, there are two sources causing inconsistencies between current practices of a firm and the embedded ERP logic: contextual specific misfits, and organizational inefficiencies of current operations. For Type I and Type III misfits,

which have limited impacts on the ERP, customization is the best route for easing misfits, and leads to positive effects on ERP implementation. For Type II misfits, Type IV misfits, and organizational inefficiencies, which result in conflicts with embedded ERP logic, process or infrastructure changes are needed in dealing with inconsistencies. However, whether the processes changes really contribute to successful ERP implementation depend on if they are truly ERP-based BPR; otherwise, they become puzzled or misunderstood ERP-based BPR, and will cause new inconsistencies in the foreseeable future. Furthermore, the emergence of misunderstood ERP-based BPR not only implies the possibility of the appearing of unclear responsibility, it can be also regarded as a signal that the management who tries to benefit from ERP logic fears the failure of dramatically, truly BPR.

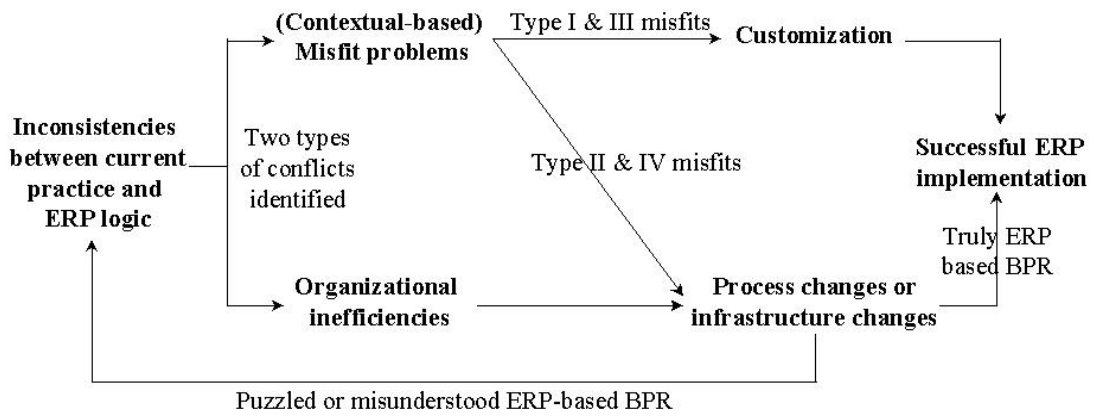

Figure 1 A casual schema of misfits, customization and BPR in an ERP project

Other Interesting Findings

In this case, although the ERP implementation hasn't achieved expected goals so far, this project truly provides D&A a great opportunity reviewing its current business and IT infrastructure, and a way of forming clearer business visions by iterative sense and response manner. This iterative learning-by-doing loop is appreciated by the management of D&A. Therefore, consistent with Gattiker's (2002) and Hong & Kim's (2002) claim, an ERP project is not merely a IT project; rather, it is a business project, embedded with the nature of organizational learning inside.

5. CONCLUSION

Business now relies more heavily on IT usage than that in the past. Consequently, when ERP systems emerged in the 1990s, companies were eager to introduce this application in order to exploit the potential of this new IS.

This study aims to provide insight into possible sources of misfits, the meaning of

two CSFs of ERP implementation: customization and BPR, as well as the implicit relationships between these three constructs. The analysis of an ongoing ERP implementation project of a Taiwanese textile SME is conducted. It is a representative case because it includes rich context specific requirements in terms of ERP implementation. We believe that the findings from our research not only help scholars to verify previous works, but also provide valuable insight for SMEs, or firms of specific industries, with regard to ERP implementation. However, we must be cautious, because this is an ongoing project. As this stage, it is hard to figure out how an organization truly performs after fully adopting the ERP system, and what the side-effects of customization and organizational changes are.

Based on the findings, we highlight a new source of misfits forced by supply chain partners. It implies that the SC context should be taken into consideration when implementing ERP. We then classify four misfit types from the solution-oriented perspective by two orthographical dimensions. Finally, a casual schema of misfits, customization, BPR, and successful ERP implementation is proposed. In general, this proposed model not only provides companies a contingent guidelines in solving misfits problems of ERP implementation; it also explains the relationships between customization and BPR (i.e., complementary, rather contradictory). In contrast to previous studies, we suggest that the value of customization should be determined by "whether the customization affects current ERP practices" and "how well it solves the challenges of context specific requirements." Also, with regard to the BPR practice, we argue that by fully adopting ERP logic, a company merely achieves process standardization, rather than the rationality of the process. A truly successful ERP-based BPR is achieved only when the organization adjusts its process to ERP practices, aligns the process with its business infrastructure, and unifies the process as a single operation with only one practice.

REFERENCE

Adam, F., and O'Doherty, "Lessons form Enterprise Resource Planning Implementations in Ireland – Towards Smaller and Shorter ERP Projects," *Journal of Information Technology*, Vol.15, 2000, pp.305-316.

Bingi, P., Sharma, M.K., and Godla, J.K., "Critical Issues Affecting an ERP Implementation," *Information Systems Management*, Summer 1999, pp.7-14.

Holland, C.P., "Cooperative supply chain management: the impact of interorganizational information systems," *Journal of Strategic Information Systems*, Vol. 4, No. 2, 1995, pp.117-133.

Hong, K.K., and Kim, Y.G., "The Critical Success Factors for ERP Implementation: An Organizational Fit Perspective," *Information & Management*, Vol.40, 2002, pp.25-40.

Nah, F.F.H., Lau, J.L.S., and Kuang, J., "Critical Factors for Successful Implementation of Enterprise Systems," *Business Process Management Journal*, Vol.7, No.3, 2001, pp.285-296.

Serene, C., Vathanophas, V., and Ling, P.S., "ERP Process Models: A Focus Group Study," *Proceedings of the 7th Asia-Pacific Decision Sciences Institute Conference (APDSI)*, Bangkok, Thailand, July 2002.

Smyth, R.W., "Threats to ERP Success: A Case Study," *Proceedings of the 6th Pacific Asia Conference on Information Systems (PACIS 2002)*, Tokyo, Japan, 2002.

Soh, C., Kien, S.S., and Tay-yap, J., "Cultural Fits and Misfits: Is ERP a Universal Solution?" *Communications of the ACM*, Vol.43, No.4, April 2000, pp.47-51.

Sumner, M., "Risk Factors in Enterprise-wide / ERP Projects," *Journal of Information Technology*, Vol.15, 2000, pp.317-327.

Tan, H.O., and McLaurin, I., "Using Cluster Analysis to Analyze the Reasons Why Businesses in Scottish Manufacturing Industry Failed or Succeed in the Implementation of Enterprise Resource Planning Systems (ERPS)," *Proceedings of the 7th Asia-Pacific Decision Sciences Institute Conference (APDSI)*, Bangkok, Thailand, July 2002.

Van Everdingen, Y.M., Van Hillegersberg, J., and Waarts, E., "ERP Adoption by European Midsize Companies," *Communications of the ACM*, Vol.43, No.4, April 2000, pp. 27-31.

Wan, A., Ling, P.S., and Huang, J., "Barriers to ERP Implementation: An Action Research," *Proceedings of the 6th Pacific Asia Conference on Information Systems (PACIS 2002)*, Tokyo, Japan, 2002.

Wu, J.H., Wang, Y.M., "Enterprise Resource Planning Experience in Taiwan: An Empirical Study and Comparative Analysis," *Proceedings of the 36th Hawaii International Conference on System Sciences (HICSS 2003)*, Hawaii, USA, 2003.

Zhang, L., Lee, M.K.O., Zhang, Z., and Banerjee, P., "Critical Success Factors of Enterprise Resource Planning Systems Implementation Success in China," *Proceedings of the 36th Hawaii International Conference on System Sciences (HICSS 2003)*, Hawaii, USA, 2003.

Yen, D.C., Chou, D.C., and Chang, J., "A Synergic Analysis for Web-based Enterprise Resources Planning Systems," *Computer Standards & Interfaces*, Vol.24, 2002, pp.337-346.

Table 1 Misfits and the solutions found in this case

	Company level	Industry level	Country level
Data	◦ Customer-dependent order formats (and IDs): solved by **customization** ◦ On-site data input: to be solved by **customization**	◦ Data quantity (including materials, products, and orders) ◦ Limited value of data reuse: solved by finding the potential values of those data set	
Functional	◦ Authority control: process **reengineering** / restructure and choosing suitable **ERP** principle ◦ Practical constrained: adopting multiple **ERP** approaches concurrently ◦ Heuristic based MRP and CPP: replaced by **ERP** modules ◦ Redundant tasks: process **reengineering** ◦ Inconsistent operations within suppliers: **restructure** and matching with **ERP** ◦ Incompatible with manufacturing systems at plants: to be solved by **customization** through **ERP** open interfaces	◦ Material control: standardization and matching with the **ERP** logic ◦ Some core functions (e.g., sample): **customization** ◦ Inconsistent between information, physical and payment flows: partly solved by **ERP**, **customization**, and **process refinement** ◦ Flexibility of order updates: partly solved by **customization** to match **ERP** operation ◦ Scheduling difficulties (due to regulations such as quota and features of the style): partly solved by adding business rules inside **ERP** modules	◦ Payment practice (SME-oriented practice): compromised use of **ERP**
Output	◦ Required reports: to be solved by **customization** ◦ Performance report / cost analysis: to be solved by **customization** ◦ Suggested schedule outcome: ERP output is still not confident	◦ Required reports: to be solved by **customization** ◦ Suggested schedule outcome: ERP output is still not confident	◦ Regulations (e.g., shipping document): to be solved by **customization**