4. DATA COLLECTION

In this chapter the collected data is presented beginning with the description of the SME in question. The interview partners are put into context, thus enabling the reader to better evaluate their positions. To allow a better appreciation of the description of the efforts undertaken to adopt an ERP system in said SME, the results of the interviews held in the SME and in its environment are presented prior to the case description of implementation itself.

4.1 Description of Case mSME in Mexico

The mSME described in this study (Z) was founded in 2000 in the Central Mexican city of Puebla by five family members. The family had a background of selling wood cutting tools imported from Germany. All family members held equal shares in the company; two family members were engaged as managing partners (GenDir and AdminDir). The shareholders convened meetings once a year to establish the future direction of the company.

The company had been focusing on high value-added activities since its beginnings, starting with attempts to produce wood cutting tools and diamond-plated drills. As these attempts proved unfruitful, the company focused in 2002 on machining jobs as subcontractor. First contacts to Puebla's strong automotive sector were established and within one year's time Z acquired its first manufacturing job for an important automotive supplier. Completing the strategic shift away from tools and sub-contract-manufacturing the company soon began to produce its first holding fixture for the mentioned customer. More personnel was hired, focused and trained on high precision design and manufacturing and Z established itself as producer of high-quality holding-, welding-, and eventually checking fixtures for the automotive sector.

Fixtures were used in serial production to facilitate assembly (holding fixtures), allow manipulation (welding fixtures) and verify the parts produced (checking fixtures). Fixture production required considerable input from the customer as each piece had to be made-to-order to match the customer's particular requirements. Usually a customer required one fixture to hold, manipulate or measure between one and three parts of his production. Consequently, there was little to none batch production within Z, not to speak of serial production. Depending on the features of the fixture the price varied between 6,000 USD and 15,000 USD per piece.

The USD was common currency for the product and for raw material. Raw material was priced depending on world market prices, forwarding fluctuations to Z. Smaller parts such as screws etc, wages and fixed cost were denominated in MXN. Z maintained a dual currency account.

The jobs produced for customers were organized as projects ("proyectos"). Each Purchase Order (PO) formed one project and could contain several fixtures. Since 2005 projects were identified using a four-digit subsequent number code. Customers were assigned a three-digit number code upon their first purchase. Customer codes were maintained in an excel file (cf. Appendix A)The complete project identification consequently consisted of seven digits as showed below:

Customer code 002-**0246Project code**

Based on the customer's requirements Z's designers developed a proposal, which was presented to the customer for liberation. After liberation intensive use of machinery, especially CNC machinery was required for manufacturing in order to meet rigorous tolerance limits. After machining, the individual components of a fixture were assembled (cf. also Figure 3). Due to the mentioned made-to-order character of the fixtures warehousing of end product was not an option for Z. For the same reasons raw material was stored only in very limited quantities.

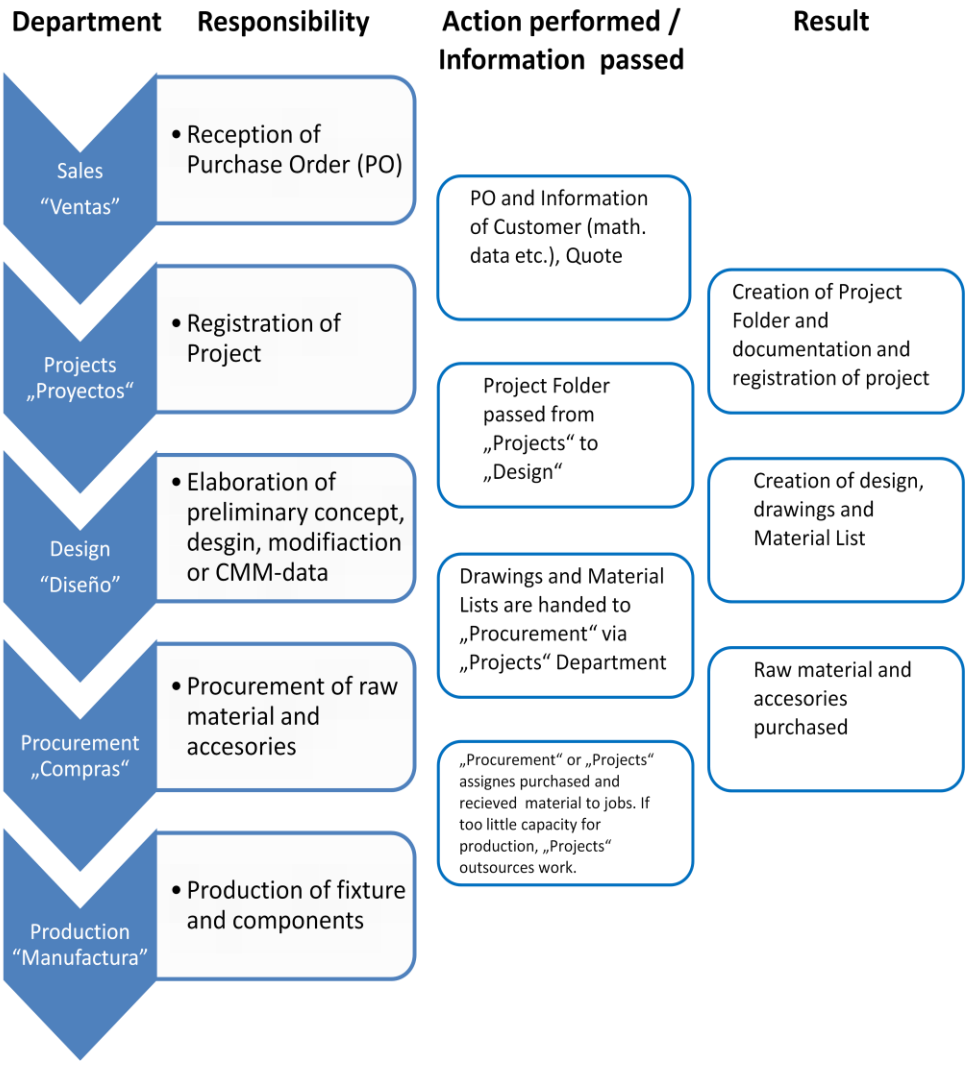

Figure 3. Production Planning Process at Z prior to improvements. From: Adoption from elaboration of ProjMng during interview on 07.04.2009

Z's organizational structure was shaped by its value-adding activities: Design ("Diseño"), Manufacturing ("Manufactura") and Measurement / Dimensional Verification ("Metrología") and backed by an Administrative Department ("Administración"). The organizational chart as used by Z differed from the organizational chart as perceived by the researcher. Both charts will be presented here.

The organizational chart as used by Z featured five levels and two departments: Administrative Department ("Gerencia Administrativa") and Projects Department ("Gerencia de

Proyectos"). The Projects Department bundled value-adding functions, while the Administrative department comprised support functions.

The Projects Department was divided into Design ("Jefatura de Diseño"), Manufacturing (Supervisión de Manufactura), Assembly ("Coordinador de Ensamble") and Measurement (Coordinación de Metrología).

Z's organizational chart as used in the then-current [spring 2009, *the author*] version of documentation for certification is displayed in Figure 4.

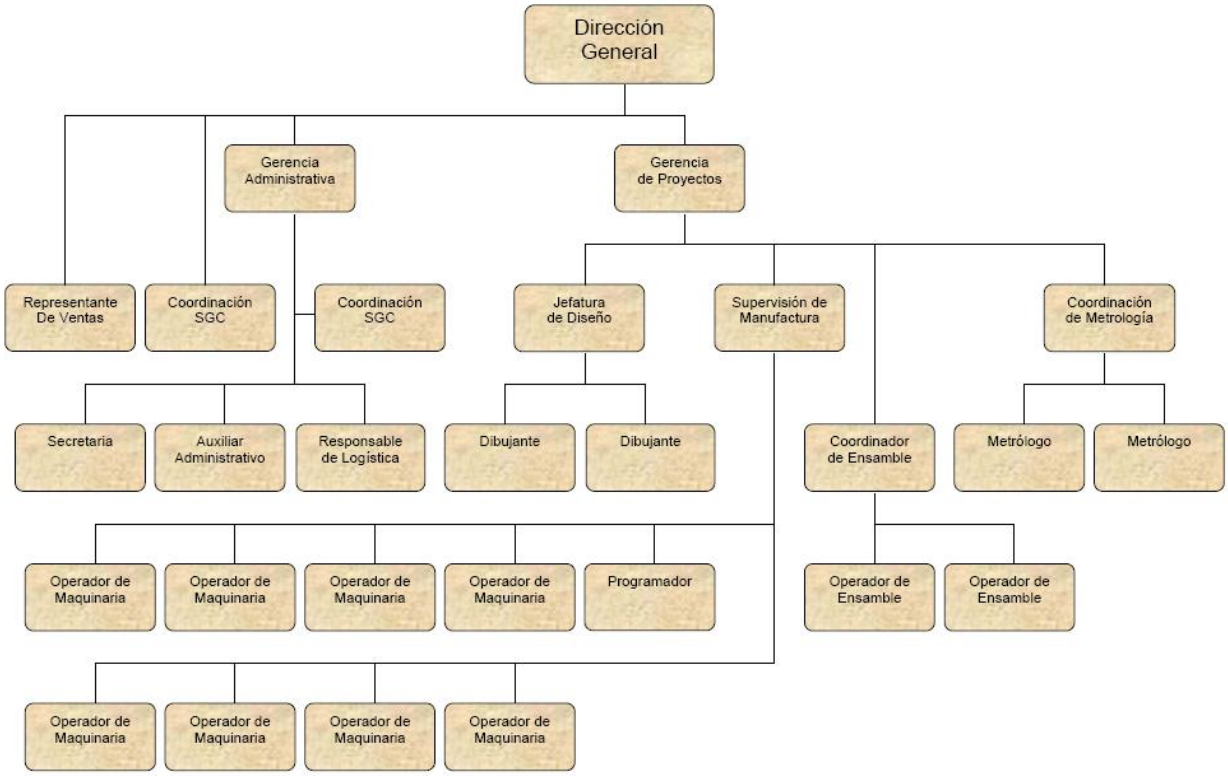

Figure 4. Organizational Chart Z as stated by Z. From: Manual de la Organización

The different perception of the researcher was based on observation and backed by the GenDir's statement:

"I planned [referring to what he calls "production planning", the author]

and by ProjMng's statement when asked about the most common reason for deviation in the production planning process:

"The most common deviations were the emergencies of [the GenDir]".

Those statements are seconded by the head of measurement when she notes, being asked about the reasons for deviations between planned and performed worked:

"[the GenDir] comes in [into the Measurement department, the author] and says: 'get this fixture out that you are measuring right now, and put this one in, it's more important now" ('viene [el GenDir] y nos dice: 'quitanse este dispositivo y menten este – es más importante ahora.').

Statements by the head of production, when asked why schedule changes occurred, are similar to those of the head of measurement. The mentioned statements indicate that the GenDir overrode the entire organizational structure at all levels and departments of the company, thus actually delimiting Project Planning Department's responsibility, i.e. putting it 'en par' with the remaining departments.

With respect to the Procurement and the Accounting function exclusively mentioned in the perceived organizational chart, the researcher understood that Z has a procurement, as indicated by the ProjMng when he draws up his perception of Z's business process explicitly mentioning "Compras" ("Procurement") as well as an accounting, indicated by the fact that one person was explicitly hired as accountant. Furthermore both functions are explicitly mentioned as part of the production process in a business plan recently presented by Z (cf. Annex B). The business plan mentioned here was used to apply for an export support program of the Mexican government.

Regarding the mentioned entities "Manufacturing" and "Assembly" they were not assigned department status by the researcher as they were within Z usually referred to with "Production", comprising both functions. As the Production department had no responsible assigned-to until the beginning of 2009, such a department is not mentioned in the researchers chart.

Z's organizational chart as perceived by the researcher is displayed in Figure 5.

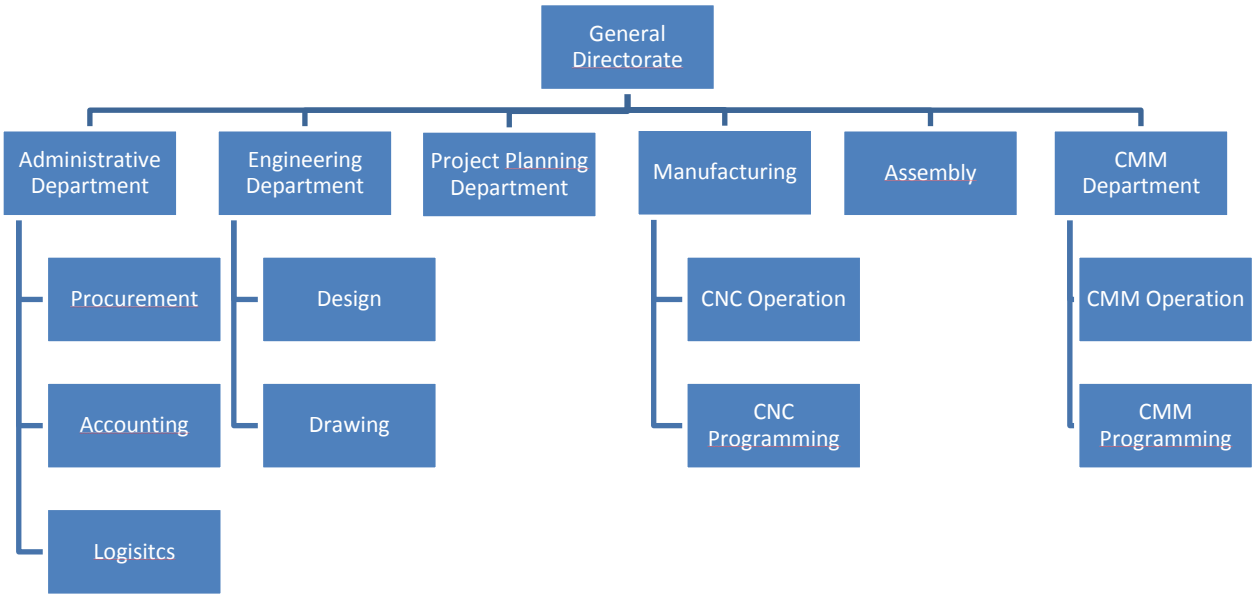

Figure 5. Organizational Chart of Z as perceived by researcher. Own elaboration

Z's business process comprised according to a recently [spring 2009, *the researcher*] released business plan the seven following steps (cf. Appendix B):

- Projects ("Proyectos"): Scheduling of the project once the deal was closed.
- Design ("Diseño"): Developing the preliminary design, gaining approval and detailing of final design and material list.
- Procurement ("Compras"): Procurement of raw material and accessories within the budget assigned-by and controlled-by Projects Department
- Production ("Producción"): Fabrication of the fixture
- Quality Control ("Control de calidad"): Measurement and certification of fabricated fixture.
- Shipping and Delivery ("Embarque y entrega"): Verification of the correct shipment and delivery by the Administrative Department.
- Accounts Receivable ("Cuentas por cobrar"): Verification that invoice is issued and payment is received.

As one of comparably few fixture-builders in Mexico Z managed to constantly augment its customer base, soon comprising customers in two important automotive centers of Mexico, the centre and the north.

In 2006 the company acquired a so-called CMM machine, allowing for high-precision measuring of fixtures after completion of its assembly. Thus being enabled to certify its products, Z received supplier certification from an important US-automaker, besides various already obtained government and NGO-certifications. For checking fixtures a CMM-certification was a necessity as the customer can verify his products only on a certified fixture. None of A's direct competition and one of its indirect competitors had the ability to certify its products by in-house CMM machines. In the entire Puebla region there were three CMM machines, one with a customer, one with an indirect competitor and one of lesser capacity with a third party. A fourth CMM machine was located in Mexico City with a third party.

Besides the CMM, Z's machine park comprises two CNC mills – one of which was acquired in November 2008 –, a CNC lathe, two conventional mills, one conventional lathe and a rectification machine. Owed to a limitedly developed banking sector in Mexico, investment goods such as machinery could not be leased but had to be financed with comparably extensive credits.

Contracting and retaining qualified employees posed a serious problem as headhunting was a common phenomenon. Particularly acquiring and training staff for running a CMM machine posed a considerable challenge.

Starting in the early summer of 2008, Z stepped up its efforts to obtain ISO90001 certification by improving its processes, part of which was aspired by the deployment of an ERP system. In fall 2008 parts of the administrative staff were trained on SCHEDU, software to improve the order scheduling process.

As of spring 2009 Z produced a turnover between 600,000 USD and 1,000,000 USD annually with a workforce of 40 headcount, 54 customers and 15 providers of goods and services.

Thus, and in compliance with the definition of the European Commission given above Z qualified as SME. Products and services offered comprised design and manufacturing of fixtures including certification, repair and re-setting of fixtures including certification and measuring certification of third-party products.

Z strived to increase its CMM capacity by obtaining a second CMM machine, furthermore plans of restructuring the company to allow for third-party certification of its fixtures – a requirement of international customers – was contemplated. The company proactively searched diversification, reducing the dependency on the automotive sector and exportation of its products.

By describing the case of the Mexican mSME Z the setting in which the process improvement efforts took place is outlined. In the following section, the interview partners and their points of view will be described.

4.2 Interviews

The interviews conducted were meant to assess whether or not the company under examination was suitable for the proposing a new categorization, to enrich case data and to triangulate statements of Z´s top management.

First the interview partners are presented in a concise fashion to help the reader appreciating their statements. In a second step the items of the interviews are grouped according to the research question they helped to answer and subsequently the answers are related to the corresponding items, stating the interview partner in parenthesis.

4.2.1 Interview Partners

For this study the following persons were interviewed the General Director of the SME in question, the Administrative Directors of the SME in question, the ProjMng of the SME in

question, a General Director of a German SME, a consultant specialized in deploying ERP systems and the organizer of a SME-manager network. In detail the interview partners were:

- General Director of SME (GenDir): The GenDir was responsible for acquiring "projects", i.e. for generating Sales ("Representante de Ventas") at the time of the study [spring 2009, *the author*]. He furthermore established the priorities of production and maintained customer contact. He was the supreme instance for budgeting questions and for ERP and SCHEDULE deployment.

  The GenDir reported once a year to the other owners of the company. He received reports and gave orders to the Administrative Department ("Gerencia Administrativa") as well as to the Projects Department ("Gerencia de Proyectos"). Furthermore he received reports and gave orders to the Head of Design ("Jefatura de Diseño"), the Manufacturing Supervisor ("Supervisión de Manufactura") and the CMM Coordination ("Coordinación de Metrología"). If the GenDir considered it necessary he intervened directly with the operators, foremen and designers.

  The GenDir was one of the five founders of the company and he held 1/5 of the shares. He was trained at Universidad de las Américas, Puebla, one of Mexico's top 10 private universities, from which he obtained undergraduate degree in Mechanical Engineering ("Licenciatura en Ingeniería Mechanica). He completed semesters in the US and obtained his master degree at the University of Warwick, UK in Production Systems. The GenDir was in his late 30s and had worked prior to his assignment at Z for several years with a 2,000+ employees multinational of the automation sector.

- Administrative Director of SME (AdminDir): The AdminDir was responsible for all supporting functions not directly related with production. Added to this responsibility for Human Resources (not mentioned in organizational chart), Procurement (not mentioned in organizational chart) and Administration of the company (not mentioned in organizational chart), the AdminDir oversaw Logistics ("Responsable de Logistica") and Accounting (not mentioned in organizational chart).

She was helped by an aide ("Auxiliar Administrativo"), by an accountant for internal accounting (not mentioned in the organizational chart) and by an external accountant's office for fiscal accounting (not mentioned in the organizational chart). Furthermore she could, to a limited degree, draw from assistance of a consultant (not shown in the organizational chart and partially paid for by a governmental program).

She reported to and received orders from the GenDir. Owed to the fact that the AdminDir represented the function Procurement, she received orders also from Design ("Diseño") – for the Material List – and from the Manufacturing Supervisor – for material requirements not covered in the Material List. The AdminDir gave orders to the logistical operator ("Responsable de Logistica"), to the accountant for internal accounting (not mentioned in the organizational chart), to the aide ("Auxiliar Administravo") and to a limited degree to Z's various interns.

The AdminDir was one of the five founders of the company and she held 1/5 of the shares. She was trained at Universidad de las Américas, Puebla and received a undergraduate degree in International Relations ("Licenciatura en Relaciones Internacionales"). She was in her 30s and had worked prior to her assignment at Z at a leading EDC contractor (EDC= plant engineering, design and construction) and at an automotive industry provider in the procurement department.

- Project Manager of SME (ProjMng): The ProjMng was responsible for registering the new projects, scheduling production, contracting sub-contractors to perform jobs that (for capacity or for technical reasons) could not be performed within Z. As project manager he was also responsible for maintaining the contact with the sub-contractors, the customers and for receiving sub-contracted parts.

  The ProjMng reported to and received orders from the GenDir and received purchase requirements from Sales ("Representante de Ventas", note that GenDir performs Sales' tasks) and from Supervision of Manufacturing ("Supervisión de Manufactura") in case of needed sub-contracting. In his function, the ProjMng gave orders to Design

("Diseño"), Drawings ("Dibujos"), Supervision of Manufacturing ("Supervisión de Manufactura") and to Coordination of CMM ("Coordinación de Metrología"). If he considered it necessary, the ProjMng intervened directly with the individual operators. The ProjMng joined Z in 2005 after working as responsible production manager in a SME in the alimentary sector. He held an undergraduate degree from Technológico de Monterrey, Campus Puebla –a top-drawer private university- in Engineering ("Licenciatura en Ingeniería"). During the time of the study he was enrolled in a part-time master-degree program at Universidad Popular Autónoma del Estado de Puebla, a reputable state university. The ProjMng was in his 30s.

- Implementation Consultant of ERP provider (ImplConsl): The ImplConsl was a business consultant, responsible for effective training and implementation of the ERP system acquired by Z. He visited customers usually once during and once after the completion of the implementation phase, i.e. he did not implement the system and train the staff himself but is rather deployed his expertise and experience in order to help the customer to do so. He was responsible to his customers and to the managers of his company (software developer of the ERP, different company than Z).

  The ImplConsl held an undergraduate degree in Liberal Arts and a master degree in Business Administration. He had significant experience in ERP software deployment.

- Organizer of SME network (NetOrg): The NetOrg was head of the regional branch of an organization focused on supporting prospective enterprises with strategic advice and connections. He helped to identify candidates for the support offered and organized informal meetings between top managers of different companies. The organization in question identified Z as a support-worthy company.

  The NetOrg was trained in International Business Administration at the Reims Management School, France and at the Universidad de las Américas Puebla, obtaining undergraduate degrees from both institutions. At the time of the study the NetOrg was

completing a master program in Investment Projects at the Universidad de las Américas Puebla.
Prior to his assignment at the networking organization, NetOrg held management posts at various multinationals with strategic responsibilities for various countries in the Central- and South American region.

- General Director of German SME (GenDirGER): The GenDirGER at the time of the study owned and managed a technical consulting SME in Germany. There she was responsible for acquisition customers and implementation of customer-projects with focus on production improvements. She was university lecturer at the master-degree program of a renowned German university. Prior to the current venture she had owned and managed two SMEs, and had worked in various managing positions of a 10,000+ employee aluminum-producing multinational company.

  The GenDirGER had no relation with Z and did not know Z.

  The GenDirGER held the German title of Diploma (FH) in business administration, Human Resources ("Diplom-Betriebswirt (FH) mit Schwerpunkt Personalwesen").

4.2.2 Interview Results

As stated in Chapter 3, Methodology, the interviews were examined with focus on the PF-impeding and PF-facilitating factors recognized by the interview partners in order to allow for developing a categorization that better assess when a SME should formalize a certain procedure. To better understand a SME's motivation the benefits associated with formalization-yielding measures were inquired upon.

The Interview Results were grouped according to the concepts mentioned in the literature and are presented subsequently.

Drivers of PF

The first set of questions translated into items inquiring on the drivers and inhibitors of PF in SMEs. The main focus of starting the development of the question was to identify reasons for Process Formalization.

The GenDirGER, an external third party to Z and not affected by the way Z organized itself identified as reasons behind the formalization of processes in general legal requirements and the goal of obtaining a certification for the company as a whole. She recommends to formalize – or in her words: to standardize – processes that involve low-skilled worker as formalization is relatively easy and gains are relatively high compared to formalizing complex procedures.

Not as 'abstract' as the drivers identified by the GenDirGER, the ImplConsl, with a general knowledge of the ERP-adoption efforts of Z and drawing from extensive ERP-deployment experience across different regions identifies

"the need for improved information, faster information and the ability to share common information"

as drivers of ERP adoption. He does not recognize any region- or even country specific drivers of PF.

The NetOrg considers networks where the owner-manager of an SME can talk to (owner-) managers who successfully formalized certain processes as a significant driver for PF as the owner-manager could get somewhat trusted feedback on a system's advantages. Focusing more on intangible aspects, NetOrg understands the concept of opportunity cost and the related information requirements as an important driver of PF. As information requirements point towards the adoption of an ERP and thus towards PF, understanding opportunity cost and understanding that for determining whether a project will be profitable or not points towards an ERP and PF, thus taking a line of reasoning comparable to the ImplConsl.

Z's management identified rather 'concrete' reasons for formalizing such as shortening the production, assembly and measuring times and lead times in general. Referring to the lead times one member of the Z's top management observed:

"Era evidente que teníamos un desmadre" ("It was clear that we had a huge problem.")

Interestingly there are two somewhat competing views on the reasons for formalizing the process; while the GenDir observed lackluster profitability

("after finishing the projects there was just no money in the pocket")

the AdminDir and ProjMng are more focused on the lead times as a reason.

Adding to the mentioned abstract and concrete reasons for formalizing a process, the GenDir stated personal reasons for why he implemented an ERP:

"From personal experience I know about the importance of ERP […]"

When asked about external organizations and their role for PF, the GenDirGER observes customers as often pushing towards it. However the GenDirGER perceives customers not as pushing directly towards formalization but rather indirectly by requiring certifications form their suppliers:

"I would emphasize on that the customer whishes to see a certification in first place, hoping that the certification assures proper processes."

Other then the customers, the GenDirGER identifies the lawmaker as a body that pushes towards PF, an observation that is congruent with the above-mentioned notion of the legal requirements as a reason of PF.

With respect to organizations pushing towards formalization Z's top management concurs when it comes to customers. The GenDir emphasizes on that customers did not tell Z to implement a certain system, however they made it clear that the production planning process had to be changed once Z began to run late in deliveries. The ProjMng seconds the notion that customers did not directly indicate which tools to implement, rather customers

"helped [us] by giving us and idea of which processes […] [we had] to improve."

and then

"[o]ther bodies, usually somehow governmental organizations or programs (e.g. PDNP of Instituto Poblano de la Productividiad y Competitividad) helped us to identify the correct tools for solving our problem"

Just as the GenDirGER noted that the customers usually want to rest assured of proper processes when they require certification, Z's AdminDir states:

"[c]learly they want to have a control over what are you about to do."

when asked on the customers' motivation for indicating changes in processes of their providers.

However, referring to the relative importance of customers' pressure, Z's top management largely agrees that they would have implemented the ERP, and thus PF even without customer pressure and governmental support. Says the AdminDir:

"[…] we would have implemented the changes even if the clients would not have pushed for them."

Summarizing the interviews held, the drivers behind ERP-adoption or more broadly, behind PF are legal requirements, information requirements, customers who want to exert certain control over their providers, governmental institutions that seem to help alleviating the pressure exerted by powerful customers, informal exchange between PF practioners and owner-managers of SMEs, intentions to improve the efficiency and profitability of a process, decreasing lead times and intentions to obtain certification.

Obstacles to PF in SMEs, Stoppers Inhibitors

Contributing to the existing literature the second part of the first sub-research question identified inhibitors of PF as perceived by Z's top management and the other interview partners.

The GenDirGER identified a strategic problem preventing SMEs from formalizing their processes:

"[…] if a company is unable to answer questions with regards to its strategic orientation than that is certainly a big problem too."

An unclear strategic direction hinders SMEs to establish clear and measurable objectives and desired outcomes, a factor considered as inhibiting possible PF by NetOrg. GenDirGER, consistent with her above-mentioned statements, seconds the notion that non-measurable and poorly defined goals that were not established prior to commencing the PF efforts, are to be considered serious inhibitors. Drawing from his experience in implementing ERP systems, ImplConsl supports the view that a

> *"[…] lack of clear direction and planning […]"* and the *"[…] inability to plan effectively […] severely limits a SMEs capacity to formalize processes.*

When GenDirGER states that a lack of employee participation threatens the success of any PF-efforts she in fact supports the position of ProjMng who considers a lack of communication of the goals and means of the planned PF by the Z's top management as a factor that jeopardizes its success.

Going from the strategy, the plans of implementation, their communication and the rallying for their support amongst employees to the actual implementation a member of Z's top management considers the overriding of plans and procedures by superiors as a strong inhibitor of PF:

> *"The main problem is, that [the GenDir] intervenes a lot, as he changes the plans every day."*

The perception of the 'disturbing' nature of the GenDir's interventions is also observed by another member of Z's top management when it states:

> *"The most common deviations [between the planned and the actually performed tasks] were the emergencies of [the GenDir]".*

Strongly related with such perceptions is the notion of the GenDirGER, stating that it is problematic for the formalization of a process when

> *"you have the management who all the time wants to cut short or wants to override things".*

Such "sacred processes" (ImplConsl), exemplified by the GenDirGER with the German sentence

> *"Wir haben das schon immer so gemacht, warum sollen wir es also jetzt auf einmal anders machen?" ("We have always done it like that, so why should we do it differently all of a sudden?")*

indicate a *"comfort zone"* (ProjMng) of the integrants of a company that jeopardize the success of PF-efforts (ProjMng).

NetOrg and ImplConsl understand the risk of upsetting more or less successful existing processes perceived by top management and the resulting sticking to "*sacred processes"* (ImplConsl) and reluctance to make *"sacrifices"* (NetOrg) as serious impediments to PF.

The ProjMng identifies three sets of constraining or inhibiting factors for PF, each related to a different contingency strategy: the afore-mentioned lack of communication by the top-management, which can be overcome by improved communication; the "negation of change" or the idea that the "*comfort zone*" can be maintained, which can be overcome by a 'quit-pro-quo' negotiation (e.g. if you agree to input your labor hours into the system, there will be no extra hours on Sundays) and finally and, in his perception of great importance: an unrealistic approach towards duration planning, which the ProjMng sees as critical to be changed:

> *"As long as we do not talk about real dates [referring to durations and beginnings of tasks] we will get nowhere."*

With a little more distance to Z, and not referring specifically to Z but to PF in SMEs in general, the ImplConsl considers four factors as inhibitors: the fear of change (reflected to a certain degree in the unwillingness to leave the "comfort zone" identified by the ProjMng), the tendency to protect one's own job, a lack of understanding of the purpose and benefits of the ERP and finally a lack of clear planning of the ERP-deployment by the top management. To overcome the mentioned inhibitors the ImplConsl proposes a strategy of inclusion of all stakeholders, of training and education and, in case that none of the aforementioned works: exclusion

> *"If the situation arrives to this tactic [meaning that inclusion and training were fruitless] the implementation is in danger unless the offending parties can be isolated until they are corrected or removed."*

Referring to the often-sounded inhibitor of limited cash flow or limited financial means respectively there seems to be little accord amongst the interviewed-parties. For AdminDir limited financial resources are a serious inhibitor,

> *"The mayor obstacle was the money, the investment you have to do. Had we had more money, we would have gotten a different [meaning a better-suited, the author] system."*

The GenDir concurs:

> *"Well, foremost there is the financial issue, such an ERP is relatively expensive and not always do they offer financing plans".*

The NetOrg also shares the line of reasoning stating

> *"a serious obstacle to ERP implementation is an insufficient cash flow."*

However, the GenDirGER, also a SME owner-manager states upon inquiry on the effects of limited financial resources:

> *"No, I don't think that money is an issue. Certainly, as the formalization progresses, lacking money can call attention but it does not stop or impede formalization efforts."*

Concluding the statements made on inhibitors of PF several issues have to be mentioned: limited accord on the strategic direction of the SME, deficiencies in planning the PF , poor establishment of measurements and goals, lackluster communication of the PF-efforts, limited understanding of the PF's benefits and purpose, inadequate systems in term of language, reluctance to throughout tackle and adapt procedures, reluctance to adapt to new procedures , limited financial resources (contested) and underestimation of time and efforts required for adoption.

Benefits of PF

The second sub-research question that helped to answer the overall question on when SMES should formalize their processes inquired on the benefits and drawbacks of PF. Items used during the interviews searched to identify the goals of recent efforts of PF thus identifying expected benefits and on benefits as such, thus mainly identifying perceived benefits.

As Z implemented two formalizing IT systems, an ERP and SCHEDUL their specific benefits were investigated.

Inquiring on the goals –i.e. on the expected benefits – of PF, there is a marked variation between the perception of Z's top management and unrelated third parties such as the GenDirGER: whilst the GenDirGER identifies as the prevailing goal of formalizing processes cost cuttings, none of Z's top management mentioned such goals directly. The ProjMng states that

> *"we [referring to Z's top management] wanted to achieve a reduction of downtimes in production owed to some critical points in the third shift [night shift]."*

a point shared by the GenDir who stated:

> *"The idea behind the implementation of the ERP is, to have a better reporting and control on worked hours […]".*

Besides improving the control over critical shifts, Z's GenDir aimed for having

> *"the right information on hand at the right time, to financially evaluate our projects*."

The ImplConsl states as benefit of the ERP with particular relevance to Z:

> *"[The p]rimary benefit to [Z] of the [ERP] implementation is the ability to accurately collect and assess job cost data as well as to view the status of jobs […] this leads to more profitable jobs or at least the possibility to accept more projects with the same resources."*

Also drawing on the importance of cost information the NetOrg seconds:

> *"I think to them the greatest benefits of the ERP are that they will be able to identify the cost of each development and the profitability of each "project". They will be able to decide whether or not to accept a new project."*

The third member of Z's top management meanwhile perceived that specific goals were not set:

> *"we didn't set specific goals like 'this and that we want for the sales' […]";*

she rather felt that Z aimed for organizing themselves better by implementing the ERP.

As for the SCHEDUL implementation –the second as PF considered software deployment within Z – the GenDir stated that

"the SCHEDUL was to cut lead times by having a better communication."

On this point the ProjMng has a slightly different opinion:

"F or the SCHEDUL we wanted to improve the production scheduling in general, i.e. from the reception of the Purchase Order to the delivery in order to fight the delays we had. I have to admit that I wouldn't say that that SCHEDUL helps us to reduce the lead-times […]" and *"the benefits of the SCHEDUL are imaginative because we are still utopist, we do not apply the SCHEDUL the way we should. I don't say the software doesn't work but we are not using it adequately."*

A more general view, and less pessimistic, is expressed by the AdminDir:

"SCHEDUL should really help us to plan better into the future."

Besides considering the benefits brought about by SCHEDUL as a tool for organization she also sees some 'meta-benefits':

"[SCHEDUL] ha despertado una preocupación de que hay que organizarse a mediano y no a corto plazo" ("SCHEDUL has created a preoccupation towards organize ourselves with a mid-term and not with a short-term horizon").

Talking on PF and its benefits to SMEs in general the ImplConsl considers that

"[t]he most important aspect of production planning is that it [is] performed in a consistent manner. Even a flawed process can result in a good answer if it is followed consistently."

Slightly expanding his point of benefits to Z, the NetOrg sees control as the *"central benefit"* of PF, understanding 'control' also as 'control over information':

"*one gets access to information that allows taking decisions, one can take much more informed decisions." and "Process formalization is important. It is beneficial and furthermore it is necessary for growth [referring specifically to a SME context]"*

Augmenting her earlier-mentioned statement of cost-savings as benefits of PF the GenDirGER considers simplification of procedures as an important benefit:

"a formalized process usually gets simpler, so you do not need super-bright ("überqualifizierte") people; there are more people that can handle a formalized process."

Summing-up the benefits of PF mentioned by the interview partners it becomes apparent that consistency and thus simplification, cost-savings, improved access to and availability of information, improved information as such and an improved planning (however not necessarily shortened lead times) are considered as the central benefits. Rather on a 'meta level' the benefits of PF revolve around a heightened conscience for the planning horizon and around a decrease of required skills, thus augmenting the pool of possible workers.

Obstacles to PF in SMEs, Drawbacks

The second set of questions revolved around the disadvantages related to PF as perceived and experienced by the interview partners.

With respect to drawbacks that occur during the adoption of a formalizing system the ImplConsl notes:

> *"The most common drawback to occur during an implementation is the natural resistance to change […]" and "[that] the most valued personnel must lend a high percentage of their time to the project. This often leads to reduced attention in other areas."*

The *"resistance to change*" is also recognized by the GenDirGER as a drawback:

> *"Usually you have quite some lack of understanding on behalf of the employees. They say: 'We have done it like this all the time, so why all of a sudden should it be bad way of doing things' ('Wir haben das schon immer so gemacht, warum sollen wir es also jetzt auf einmal anders machen?') And then you have the management who all the time wants to cut short or wants to override things […]"*

Seconding the notion of *"resistance to change*[4]*"* the NetOrg states:

> *"I think that's a serious problem, people that are unaccustomed to the ERP […]"*

and adding to perception that *"valued personnel"* has do dedicate a considerable amount of time to the implementation the NetOrg notes the cost associated with such dedication:

> *"The cost are a disadvantage: the cost for the software package, the cost of implementation, including cost for financial and human resources employed to implement the system"*

[4] Resistance to change can be considered a drawback and a stopper depending if it is surpassable or not / how many resources are required to overc ome the resistance.

The ProjMng also considers a *"resistance to change"* as a problem of PF, stating:

"The main obstacle ("obstaculo") will be the way the guys ("muchachos") [referring to the production employees] will perceive the system. They will feel controlled and at the end of the day it is control what we do."

Other members of Z's top management seem to struggle with distinct notions of PF, such as the AdminDir stating:

"I think the main disadvantage is that all [referring to the ERP] comes in English, it's not like anyone [in the company] could come and search information." and "In my opinion [the GenDir] risked too much by buying a US ERP system ('encabrichó demasiado con comprar un ERP gringo')".

Referring to a more general perception of PF and its drawbacks, the GenDir states:

"It makes us a little bit more vulnerable to technical blackouts. If the ERP goes down, then there is no procurement etc. But that's about it with problems of the ERP."

The notion of a limited flexibility due to PF, brought forward by the Net Org:

"[…] in the long run the rigidity of an ERP can be a problem. A SME is very flexible and depending on their ERP package they might lose some of that flexibility."

is not shared by the GenDir:

"the system that we use is designed around small shops and it doesn't limit our flexibility."

Referring to a broader perception of the supply chain the NetOrg considers the possibly limited compatibility of a specific system as problematic:

"Another problem could be the compatibility to other systems that complicate the interaction with providers or let's say with big customers."

Summarizing the problems with ERP in particular and PF in general the uneasiness of employees, the man hours required to implement it, the cost associated to man hours and system acquisition, the cultural barrier, a heightened dependence and on software and a (possible) decreased flexibility have to be mentioned together with (possibly) limited compatibility and issues arising from that.

Key Success Factors of PF in SMEs

For the second element of the empirical study of this paper the Key Success Factors (KSFs) for PF in SMEs were investigated.

The interview partners from third parties agree that the support of all affected is an important factor determining the success of any PF effort. The ImplConsl recommends

> *"to involve as many players as possible in the process [as a] project manager cannot succeed unless the people who actually perform the work, are involved."*

The GenDirGER emphasizes a particular characteristic of SMEs when stating:

> *"[i]n an SME there are a lot of people that want to tinker ("basteln"), they don't want templates, they don't want standardization – so it's crucial to get their support besides their objections. [And w]hen I say bringing all the employees into the boat, I mean all the staff, including the management. As long as they [referring the management, the author] override the formalized process it will not take hold."*

The NetOrg augments the point of communicating the efforts, stating that the staff should not only be informed but rather *"convinced".*

All the interviewed coincide that there must be a pronounced willingness to question and to change processes. The ImplConsl calls for an

> *"objective view of current procedures […]. No aspect of the process should be considered to be 'sacred' or to be outside the possibility of review.",*

the NetOrg urges to

> *"[…] start thinking about the way they do things" and have to "[…] understand that the change will require sacrifices from all".*

With the focus more on what the to-be-formalized process should be like and less on what it takes to make it that way, the GenDir suggests that

"[i]t is of crucial importance that the processes are standardized in order to implement a system like ERP or SCHEDUL."

and the ProjMng seconds

"My most important advice would be to have a structured organization".

More focusing on the process of formalizing than on the organizational antecedents the ImplConsl recommends to

"to have a written plan [and to] update it regularly"

while the NetOrg expresses the same notion with:

"I think it's crucial that the management most clearly and concretely establishes the objectives and the goal of the implementation. […] Those goals and objectives have to be transmitted to the workforce, convincing them of the goals and winning their support."

The ProjMng, as a member of Z's top management seconds the importance of a clear plan and clear objectives when stating that *"a certain procedure"* is *"important".* Looking beyond the implementation and focusing on its outcome the GenDirGER strongly recommends to

"visualize the standardization's results. If you can tell the people: 'See that is how bad it was before, and that is how good we are now', than that always helps to win support and to get the people accepting the changes."

With regards to the implemented system the AdminDir emphasizes that

"it is crucial that the explanations of the program come in a language that is spoken by all the staff, so that anyone can go into the system and search for information and use it."

With the implemented system in a native language a profound understanding or, in the words of the ImplConsl

"to become well-educated on capabilities of the new system"

is significantly facilitated.

While the GenDirGER somewhat bitingly remarks that

"a little pressure from the outside such as looming bankruptcy or a customer threatening to phase-out contracts" has *"never been bad",*

the AdminDir strongly emphasizes to

"implement such a big change in a moment that is not all that critical in terms of work load. When everyone is doing the urgent and not the important ("cuando se hace el urgente y no el importante") it is difficult to find time for such a big implementation."

Concerning the financial burdens of system deployment the NetOrg strongly recommends to assign all the resources necessary:

"Top-management then has to put all the tools in place that are necessary to achieve the outlined goals – if it means that people have to partially freed from work to implement the system, so be it; if it means that money has to be spend, so be it; if it means that certain orders cannot be accepted, so be it."

and the GenDir suggests that

"*anyone attempting such an implementation considers the cost of the system"* while reminding that *"there are no instantaneous benefits, there is rather a 'deployment curve' ('curva de aranque') that has to be considered. One cannot expect immediate benefits."*

Coinciding with the NetOrg in terms of people assigned for deployment the AdminDir notes that

"it is very important that one person dedicates itself totally to the project."

Concluding, the KSFs mentioned for PF are the support of the employees, an un-obstructed willingness and capability to change processes, a clear objective, plan and goal under which to change the processes, sufficient resources and a profound understanding of the deployed system.

4.3 Description of Process Improvement Efforts

The attempt to improve the production planning process at Z consisted of the deployment- and adoption-efforts of two different systems: an ERP system and a production scheduling software, SCHEDUL. Both systems were deployed subsequently, beginning in the second semester of 2008. Their deployment, however, was not independently from one-another, rather were both systems deployed in order to cope with the challenges facing Z related to not kept promised delivery. Consequently, both deployment efforts are treated as parts of a greater total, the production planning improvement efforts.

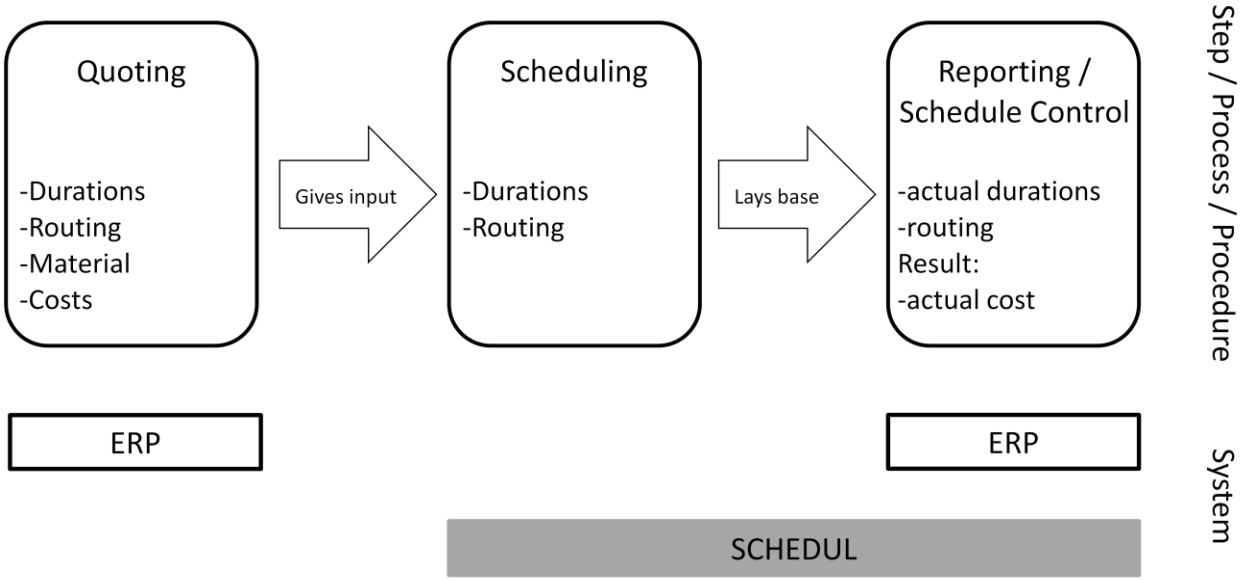

*Figure 6.*Elements of the production planning process and related systems. Own elaboration

In the summer of 2008, Z hired an intern (InternDa) to help implement the recently acquired ERP system. The intern was supposed to report directly to the GenDir and to support the implementation and adoption of the system in the administrative area ("Auxiliar en la implementación del sistema ERP en el área administrativa. Esto no sería enteramente tu responsabilidad sino solamente apoyar en esta tarea.").

Drawing from a memo written by the intern for a meeting with a professor specialized on the subject, the goals established for the ERP deployment were a

> *"[m]ore meaningful accounting [that allows to] identify beforehand which Project will be lucrative and which wont [and to s]horten [the] lead-times [while] enabling on time hand-over of [the final] products".*

The notion of a "more meaningful accounting" was seconded by the GenDir when he stated in an interview that the goal of the ERP implementation efforts was

> *"to have the right information on hand at the right time, to financially evaluate our projects."*

However the intern's perception that the ERP had been acquired to force-down the lead times, was not shared by the GenDir:

> *"I bought the ERP not so much to bring down the lead times […]"*

During the first weeks, data was added into the system, a task particularly challenging with respect to the nomenclature for raw material; according to recollections by the intern and drawing from a journal note dated 04th of August 2008, material classes were frequently changed and the center of feedback talks with the GenDir. Furthermore the confusion with respect to the system's goals persisted, eventually resulting in the afore-mentioned meeting with the specialized professor. The meeting led the intern to draw up the business process of Z, particularly because no suitable graphical expression of Z's business process existed. The only existing graphic depicted the interactions between the various company functions and not the timely sequence of steps undertaken from approaching the customer to delivery of the final product.

In order to find a way to shorten the lead times, and also to account for the statements made in literature the intern drew up Z's business process as perceived by him, searching for evitable loops and redundancies. In an iterative approach the process was depicted and interaction between Z's organization and the deployed ERP modeled.

By early September first tests were run for quoting with the ERP (cf. Appendix C). Initially problems surfaced with the layout of the ERP's quote; specifically it was not possible to input pictures. After clarification with the software developer, quotes including pictures could be generated. Pictures were of great importance to Z for quoting as they allowed to unequivocally state the referred to fixture and change.

To-be quoted projects frequently accumulated, leading to a vast number of quotes to be issued in short time. With the new, and by comparison rather detailed and thus time consuming way to quote using the ERP, plus the fact that pictures, while being incorporated finally, couldn't be incorporated in the traditional fashion quoting was only done at few occasions using the to-be adopted ERP. To date [spring 2009, *the author*], the majority of quotes at Z is done in the traditional fashion, not using the ERP, albeit the share of 'ERP-quoted' projects picked up.

After completing the initial training on the ERP system, identifying the interfaces between Z's business process and its ERP system, and after some initial test quoting using the ERP, by fall 2008 the intern prepared training lessons in Spanish. The classes were meant to facilitate the first steps within the ERP for Z's staff that was not fluent in English. The classes were each tailored to their recipient, covering the most important functions to be performed by the recipient, according to the interfaces identified earlier when drawing up Z's business process.

Between early October and late November 2008 the ERP was down due to insufficient funds by Z. Delays in down payment lead to a temporarily cancelation of the license and thus blocked the system.

By mid October, the GenDir undertook an effort to improve the production planning, contracting training on the use of SCHEDUL software:

> *"[the SCHEDUL] […] helps us to actually control the lead times. It allows us to organize the projects more easily." (GenDir).*

SCHEDUL was program that allowed sequencing various steps, establishing dependencies between steps and thus allowing to 'dynamically' schedule even large and complex projects. 'Dynamic' scheduling in this context means, that a change in one step of the sequence adequately translates into changes on all dependent steps. The software allows for simplistic as well as complex scheduling, depending on the user's requirements. SCHEDUL furthermore enables the user to 'track' the project's progress thus permitting a control over which projects run late.

Z's manufacturing character as opposed to a more serial type of production brought with it a great number of output, or "projects" that had all specific requirements in terms of production input, begin- and end-dates. This augmented significantly the complexity to be dealt with while scheduling.

In October and November 2008 the existing work load as was still high while the number of incoming projects was compared to the prior months smaller.

When the SCHEDUL training began, the intern, in an effort to standardize the procedures created template for scheduling the different types of work, mentioning the majority of data featured in the ERP (that, by the beginning of November, was still down). The reasoning was to use the data created in one system to maintain the other, i.e. data input into SCHEDUL for scheduling reasons could be input into the ERP for quoting reasons and vice versa.

Members of Z's regular staff seemed to not be able to dedicate a significant portion of their time to the use of SCHEDUL. With the complexity of multiple projects, each with multiple products the SCHEDUL software began to show certain drawbacks, requiring from the user being very conscious about what he / she was doing and comparably skilled in order to not provoke malfunctions or incorrect data.

In November 2008 InternMa, a student from the Universidad de las Américas Puebla and studying electronical engineering in an undergraduate program, joined Z. InternMa was supposed to overtake the remaining implementation and adoption efforts from InternDa who was expected to leave Z after finishing his internship in December of the same year. InternMa was thought on both the scheduling software SCHEDUL and the ERP system.

InternDa assumed the task of maintaining up-to-date the data in SCHEDUL, re-adjusting the projects' sequence in case it was necessary. As to increase the applicability of the information thus created, the intern developed formats (cf. Appendix E), stating the sequence and calculation of tasks, adjusted for each function such as Assembly or Measurement.

Interestingly Z used similar files between 2005 and early summer 2008, when the project management changed. Although the person that created and applied the original files did not leave the company, existence and experience with those files were not commented to InternDa when he attempted to improve the applicability of the SCHEDUL data.

Early December 2008 the ImplConsl visited Z to clarify questions that had occurred since the purchase and initial deployment back in summer 2008. The visit was a regular, scheduled visit that is included in the price of the ERP package Z bought. With respect to his visit the ImplConsl states:

> *"Normal customers with a 5-user system and not using [the ERP's] accounting module will have an implementation phase of three to six months after the process [of implementation, the author] begins. It is common to have a follow-up visit after the first year of implementation in order to optimize the performance. "*

The ImplConsl stayed 16 working hours, divided on two days, at Z's, holding meetings and workshops with the persons responsible for the ERP's deployment, the GenDir, the intern and InternMa. The ImplConsl put emphasis on the need to 'get the system off the ground', re-iterating that however incomplete early tries with working with the system might be

> *"one has to get started in order to learn how to use it"*.

During his stay the ImplConsl trained the above-mentioned on the use of the system's component feature; a feature allowing for much more detailed material selection, routing and – if the function is used – scheduling[5]. Particularly the component feature proofed helpful to Z, as now each component would have its individual routing, allowing for much more precise report of labor. On the projects run in the ERP, Z to date uses the component function, printing the traveler of each component on back of the component's drawing.

By mid December 2008 InternDa left to company to complete his studies, dedicating from January 2009 on, a maximum of 8h a week to the support of implementation efforts intending particularly to focus on training the staff in the use of the ERP and SCHEDUL, drawing on the files for training created earlier in the year. Besides training the intended focus was to partially

[5] At Z scheduling is not performed with the ERP but with a separate system, SCHEDUL.

relief regular employees as the InternDa expected a substantial part of double work during the implementation phase, i.e. it was expected that during adopting the new systems ERP and SCHEDULE certain processes would be performed in the new system as well as in the traditional way.

By the end of December 2008, YOL joined Z, at first without a concrete job description and assigned to learn the early steps of using the SCHEDUL and ERP. YOL was trained by InternMa on both systems use, with occasional help from InternDa for particular complex cases.

Z's formalization efforts continued in the year 2009, when organizational restructuring and a significantly more effective deployment of the ERP and – possibly – the SCHEDUL software were aspired. In March 2009 a newly hired intern, InternRub was assigned as main aide in executing the ERP implementation efforts.

With the description of the process improvement efforts complete, the next chapter focuses on analyzing the data provided in this chapter as to better understand when a SME should formalize its processes and how the items have to be adjusted in order to identify formalization requiring antecedents.