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Production Phase-Out During Plant Shutdown

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Abstract

Today’s industry environment is characterized through a very unpredictable market. Therefore, companies establish robust production and logistics systems [1]. However, sometimes the established robustness does not prevent companies from location dynamics, including plant shutdowns or plant relocation [2]. Then, particularly, when big companies are involved and plenty of jobs are at risk, the public pressure is immense [3], which requires an effective management. Even though the market forces are obvious, the research intensity related to plant shutdowns is comparably low [4]. Appropriate expertise can be gained especially for the production phase-out (a repeated procedure), which is the operative implementation of every plant shutdown, but also takes place during standard product elimination.

The paper’s aim is primarily to conceptualize the different plant shut-down options. Second, it targets on analyzing how the production phase-out and the plant shutdown are organized in industry and to investigate if and how these processes can be standardized to avoid inefficiencies. In-depth expert interviews have been conducted. A purposive sampling strategy was followed including companies ex-post to their plant shutdown caused by insolvency, consolidation, offshoring, divestment/product elimination and outsourcing. Based on the empirical results, the relation between production phase-out and plant shutdown is emphasized. The evidence results in a framework of plant shutdown reasons and concluding processes. The further developed process for production phase-out during a shutdown displays a form of guideline for companies.

Keywords: Product / production phase-out; plant shutdown; closure; location dynamics; offshoring; outsourcing

1. Introduction

Globalization, raising customer demands, as well as shortened product life cycles are significant current trends of supply networks [5]. In order to meet those requirements, companies start to build stable and flexible supply networks. Especially in mature industries, where the customer’s bargaining power is relatively high and a declining demand is faced by the companies, industry needs to provide robustness.

Sometimes the company’s robustness does not prevent from declining demand leading to plant downsizing [6], which may result in closures [7]. Extending the downsizing definition of Cascio [8], we define the plant shutdown as the planned elimination of an entire plant site, thus terminating all production and the production-related activities including the cleaning of the shop-floor and the associated warehouses.

In early literature, plant closures were seen as ultimate and negative option, sometimes named ‘corporate restructuring’ causing mass lay-offs and economic challenges at the regional and local level [9]. Even though closures in a single plant firm indicate a failure, plant shutdown in a multi plant firm may be a route to business success [10]. Simultaneous to facility closures, new ones start and the shifts need to be regarded as normal business alternative. Linking shutdown to project management makes ending a natural phenomenon [11].

Nevertheless, companies, despite already having accomplished several plant shutdowns, do not have any structured approach, nor even a contact person with knowledge and experience giving advices [12]. Companies need an ending-competence, including managerial skills beyond day-to-day business [11]. Thus, we intend to develop a shutdown process basing on the four production factors. The process includes activities to be performed in
Regina Grussenmeyer et al. / Procedia CIRP 19 (2014) 111 – 116

the operative environment of the production. Having defined process stages and underlying activities, clear shutdown goals can be set, thus making benefit from the closedown effect [13], an increase in productivity and improved quality without any change of capital investment during shutdown plant [14]. Furthermore, we conceptualize different closure alternatives through analyzing German companies’ shutdowns.

For defining a common starting point and a process, which is repeatedly performed in every company, not only during closure, we take the production phase-out. We define the phase-out as follows: Production phase-out is a process, enabling a company to terminate a product’s production at a certain plant. Starting after the phase-out decision, it ends with the finalization after the end of production.

The remainder of this publication is as follows: section 2 analyzes the literature on plant shutdown and production phase-out. Section 3 describes the methodology applied. Section 4 deals with the conceptualization of shutdowns, followed by the process model elaboration in section 5. The final section discusses the results, explains the contribution to research and management and gives an outlook on further research.

2. Literature Review

2.1. Plant Shutdown

The plant shutdown (or plant closure) literature’s extend is very limited. Most authors focus on the employee’s perspective. The existing publications deal with aspects such as union organization [7], social [9] and psychological [15] consequences of workers relocation. Despite that research focus, there is a second trend, investigating why plants need to shut down [10], which characteristics make it more likely for a plant to be closed [16–18] and how to predict those happenings [6]. Furthermore, strategic considerations (e.g. divestment or market exits) are explored [19], and downsizing, without incorporating the shut-down is regarded [7]. For example, firms must carefully evaluate the national and local circumstances [20], e.g. the economic situation.

The first two publications actually dealing with the management of shutdowns are two articles of Janssens and Vansina-Bobbaert [21 & 22] out of which the first one describes a shutdown problem and the second one develops a shutdown management system. The authors elaborate different “go’s” and “no-go’s”, especially regarding the employees’ treatment. They also consider aspects regarding the quality control and the production machines. All solutions they provide follow the target of keeping the production as the same quality and quantity output as before plant closure announcement.

The third publication relevant for managing closures relates managing a shutdown to project management [11]. The authors’ focus is on ending the business relations with suppliers, through developing an ending competence for the company’s employees.

To the best of our knowledge, there is only one publication elaborating a shutdown management system.

Butler et al. [12] studied the case of Vauxhall Motors Luton when it was closed in 2002. The authors develop a facility closure management model containing a five stages approach including stage activities: (1) managing corporate brand name / legacy, (2) managing communications, (3) managing closure, (4) managing investment in employees, and (5) managing continuity of operations. It is depicted in figure 1.

From the depicted activities within every shutdown stage, not every single one is relevant for production. Only the ‘production plan’ of stage 3 indicating the need for a capacity planning for the period from shutdown announcement to the end of production, and the ‘performance measurement’ of stage 5 which intends to monitor the plant performance, target on operations management. Furthermore, the stages do not seem to be subsequent ones, they more aggregate different managerial tasks under certain headings.

As described above, mostly the human perspective is deeply investigated. Management approaches can be found seldom or on a very abstract level. The remaining production factors – material, and machines including equipment and facilities according to [23] – are not touched in any publication. Apart from this limitation, shutdown research focuses on marketing and strategic management. Also the empirical evidence can be criticized, since all shutdown management articles are based on a single-case study approach. Furthermore, incorporating the consequences, so to say what is happening after the end of production is not explained.

However, one research area related to the plant closure is the so-called product elimination literature. It deals with the production-oriented view on a product to be eliminated and how production can phase-out this product. The link is that during factory closure, the production necessarily has to be phased-out. Within this literature, we expect to as well gain insights for a phase-out during plant shutdown. Since no literature is available for the specific case of phase-out during a plant shutdown, we will subsequently analyze the general phase-out literature.
2.2. Production phase-out and product phase-out

In literature, the product phase-out deals with the implementation of a product elimination decision [24]. It is the process enabling companies to no longer produce a product anymore. The product phase-out is consequent to the product elimination decision and starts with planning. The product phase-out ends with the finalization after the end of production [25].

The production phase-out, which we defined in section 1, slightly differs from a product phase-out. For example, the Volkswagen AG (VW) shifted the entire “Käfer” (=Beetle) production to Mexico in 1964. Therefore, the German production was phased-out, while the car was still available to the market until 1985. Thus, the product was not phased-out. For a shutdown, the production phase-out is relevant, since companies might shift their production to another plant site.

Different product phase-out processes were developed, which were aggregated to a generic model in [25]. This process contains four stages – planning, implementation, control, and finalization. However, the existing phase-out literature only deals with the product phase-out, not including production phase-outs. Reflecting the phase-out literature analysis given in [25], no phase-out article includes the shutdown option. Furthermore, most publications are written in German, so the other researchers’ access to their results is limited. In addition, their findings are not deeply validated (using only single case study methodology) and are limited to two branches (automotive and electronics industry).

3. Research Gap and Methodology

The literature review presented in chapter two shows two main gaps in research. First, it is not clearly known what consequences result out of the plant shutdowns. Reasons for the closure are described to be efficiency problems, not describing what happens to the different production factors after the closure. This results in the first research questions:

1. Do different shutdowns show individual reasons and consequences?

Second, the phase-out process for shutdowns is not clearly defined. This comes along with only one-dimensional investigations (i.e. only on the employee’s perspective in the shutdown literature and on the product perspective by the majority of the phase-out literature). However, the phase-out process’s quality is proven to create a company’s performance increase [26]. Thus, the second research question is as follows:

2. How does a holistic process for production phase-out during plant shutdown look like?

Our study aims at first proving a framework on shutdown reasons and consequences. We attempt to give a broader insight into the shutdown beyond the efficiency problem. Our second target is to develop a shutdown phase-out process and its underlying activities. The research questions address the gap of a holistic shutdown understanding. Therefore, the qualitative methodology represents an appropriate fit among the research questions (how) and the prior theory (nascent) [27], [28].

Since the investigation is exploratory in nature, we selected eight in-depth cross sectional interviews with companies producing in Germany or German-owned companies. We purposively selected experts from companies obtaining different phase-out strategies during their closure. Data was collected through in-depth and semi-structured interviews (with experts from different departments such as production, marketing, and product portfolio managers). Interviews were conducted on-site, recorded, and then transcribed in full-length to enhance data analysis effectiveness. Additional company internal documents were requested, which could support the results coherence (multiple sources of evidence and literature cross-check). Table 1 shows companies’ characteristics.

| Firm | Branch | Products | Phase-out Strategy |
|------|--------|----------|--------------------|
| S    | Storage equipment | 1 (+ variants) | Immediate phase-out |
| T    | Medical products  | several     | Slow phase-out     |
| U    | Paper industry    | 5          | Slow phase-out     |
| V    | Electricity industry | 1       | Immediate stop     |
| W    | Carrier vehicles  | 5 (+ variants) | Planned slow phase-out but immediate stop caused by strikes |
| X    | Construction material | 1 major | Only modifications |
| Y    | Storage vehicles  | 1 (+ variants) | Slow phase-out     |
| Z    | Construction site | 3 (+ variants) | Slow phase-out     |

In this study, the quality of the research design is ensured through the use of multiple sources of evidence in the data collection. We performed within-case analysis and cross-case pattern matching, the cross-check of the results to ensure internal coherence of findings along with a rigorous study protocol including objective, selection criteria, sample description, respondents overview, data collection and data analysis techniques and interview blueprint.

4. Shutdown conceptualization

In literature, the shutdown reasons are described to be resulting out of plant efficiency problems [17]. However, our sample reveals additional insight. We detected shutdowns induced by efficiency difficulties and causing insolvency, consolidation, divesture, and offshoring, and outsourcing. Furthermore, there are two different alternatives, for what happens afterwards with the product, it can either be disposed, or its manufacturing is relocated. Creating a matrix out of the reasons and the consequences it is possible to map the interview shutdowns (table 2). As a matter of fact, there is no example for the field of offshoring-disposal. The underlying intention of offshoring is to manufacture the product in another region, so it is not subject to disposal or elimination. Additional information to each interview can be found below the table.
5. Phase-out process during shutdown

Factory shutdowns are “difficult, delicate and painful tasks” [22]. However, they are becoming more frequent in today’s business. This makes a shutdown process necessary, where the responsible managers can rely on. Meeting the production output quality and quantity goals by keeping the production stable is one of the main production targets, even during closure. Also, strikes (or even plant occupation) can be avoided through managing termination [21]. Since a production phase-out is the operative shutdown implementation across different closures, it can be taken as a starting point. A phase-out process includes four stages (1) planning, (2) realization, (3) control, and (4) finalization starting from the decision [25]. The shutdown decision is regarded as milestone before the process starts, thus it is not included into the investigation. At that decision point, closure is inevitable, no other options, such as sale or transfer, are remaining [11]. The following planning stage is linked to the first three stages described by Butler et al. (managing corporate brand name, managing closure, and managing closure). The realization stage is related to stages 4 and 5 (managing investment in employees, and managing continuity of operations) [12]. Furthermore, we add the process stages of control and finalization, because monitoring supports achievements reflection and after the end of production, the finalization takes place, which indicates the end of all support activities.

For the entire process, the four production factors man, machine and material, plus the management are taken into account. All activities described for the different shutdown process stages are depicted in table 3. For this new process we focus on the interview results. Therefore, activities mentioned by the experts were extracted and listed. Since the study is explorative in nature we did not count or weight the results (12 to 18 months). The difference might be caused between literature (6 weeks - 1 year [11, 29]), and interview results (12 to 18 months). The difference might be caused by stricter laws. I.e. to dismiss employees in Germany is complicated and time-consuming and unfair dismissals often cause lawsuits with a high financial insecurity [30]. Therefore, the closure duration is could be higher.

Whether or not the shutdown process depends on the shutdown reason cannot be stated at this early point of investigation. However, it is worth noting that especially the finalization stage activities depend on the consequences. For example, “send expert to new facility” or “machine shipping” only account true for relocation situations.

| Table 2: Shutdown framework | Disposal | Relocation |
|-----------------------------|---------|------------|
| Insolvency/efficiency       | X, Y    | W          |
| Consolidation               | U       | U, Z       |
| Divesture                   | V       |            |
| Offshoring                  |         | T          |
| Outsourcing                 | S       | S          |

S: The company strategically decided to leave the market and found a supplier which took over the product’s rights. The facility and equipments were disposed. The remaining stocks and the tools were sold to the supplier. Therefore, the case fits to both consequences. The company still has the product in its portfolio, which is now purchased from the supplier.

T: The relocation is targeted, but due to legal constraints emerged in the offshore region, the transfer is not finalized by now. Therefore, the German factory still is producing.

U: Two out of the three products manufactured were transferred to a sister plant while one was eliminated from the company’s portfolio. The machines were entirely disposed in order to avoid new market overcapacity due to a competitor buying it. Thus, this shutdown is placed in the disposal as well as in the relocation rectangle.

V: The closure of this plant site was due to a legal change, so a strategic divesture became obligatory. Because of a special production environment, it is not possible to relocate any of the materials or machines.

W: It was not intended to close the plant site; a consolidation without reducing the staffing level was planned. However, the employees started striking which caused the factory’s insolvency.

X: The product was already produced at different plant sites, so no relocation was necessary. Furthermore, the equipment was very old and could not be sold.

Y: It was planned to dispose everything, since the company decided to divest including a market exit, but one week before closure, the plant site was sold and left open.

Z: Due to the consolidation, the equipment and machines were not needed at the alternative plant site. They were sold to an Asian company which also supervised the deconstruction and the shipping preparation.

Resulting, it can be stated that beyond the rough description of efficiency problems mentioned in literature, there can be found more information regarding closure reasons and resulting consequences. Following, we look at the shutdown process with a focus on the phase-out for revealing further insights.
| Planning | Realization | Control | Finalization |
|----------|-------------|---------|--------------|
| Man      |             |         |              |
| • Defining clear responsibilities [21], cross-functional team (X, V), gather experienced members (W) | • Informatively, avoid media leaks [11] | • Replacing people who left the company [21] | • Working of last days for those workers who have been proven to "play sick" [22] |
| • Elaborating redundancy plans [11], developing motivation plan (T) | • Replacing people who left the company [21] | • Providing short-term feedback on quantity and quality [21] | • Clearing working space "one-day-to-take leave from things" [22] |
| • Preparing for unknown tasks [11] | • Avoiding absence and "playing sick" [22], asking for sickness certificates (Z) | • Performing motivation survey (V) | • Having a get together including plant manager [22] |
| • Preparing for unknown tasks [11] | • Having group leaders with shop floor authority instead of managerial imposed authority (shifts of frontier of control) [14] | • Keeping key personnel after closure for supplier relationship ending [11] | • Partnering gifts/vouchers of gratitude [22], indemnification (Z) |
| • Explaining any delay reasons (e.g. for maintenance or repair) for showing that it does matter [22] | • Reducing employee capacity while reducing minimum quantities (T, Z) | • Job-finding assistance after closure [22] | • Keeping FHR personnel until the finalization and in order to make contract changes or pay overtime (U) |
| • Explaining any delay reasons (e.g. for maintenance or repair) for showing that it does matter [22] | • Not repairing defect items (Z) | • Sending expert to new facility in relocation situation (T) | • Selling a new generation replacement and financial support if customer wants an old product (Z) |
| • Explaining any delay reasons (e.g. for maintenance or repair) for showing that it does matter [22] | • Avoiding high number procurements (Z), adopting procurement to output plan (X) | • Preparing claims reserves (V), fix clear targets (e.g. cost minimum) (S) | • De-activating facility [7], machine deconstruction and shipping preparation (Z) |
| • Explaining any delay reasons (e.g. for maintenance or repair) for showing that it does matter [22] | • Not repairing defect items (Z) | • Cost calculation, shutdown budget (S) | • Installing locks to secure the building [7], plant dismantling, clean-up (S) |
| • Explaining any delay reasons (e.g. for maintenance or repair) for showing that it does matter [22] | • Not repairing defect items (Z) | • Ensuring facility/environment safety during deconstruction (V) | • Cleaning plant site and warehouse (Z), clean machines (U) |
| • Explaining any delay reasons (e.g. for maintenance or repair) for showing that it does matter [22] | • Not repairing defect items (Z) | • Searching for further utilization of buildings (W) | • Ensuring facility/environment safety during deconstruction (V) |
| • Explaining any delay reasons (e.g. for maintenance or repair) for showing that it does matter [22] | • Not repairing defect items (Z) | • remaining stocks treatment, e.g. recycling, disposal, storage, safe (Y), transport to sister plants (X) | • Ensuring facility/environment safety during deconstruction (V) |
| • Explaining any delay reasons (e.g. for maintenance or repair) for showing that it does matter [22] | • Not repairing defect items (Z) | • Offering new generation replacement and financial support if customer wants an old product (Z) | • Ensuring facility/environment safety during deconstruction (V) |
| Machine |             |         |              |
| • Including potential shutdown into capacity planning [22] | • Planning the delivery of products that employees like to manufacture [21] | • Developing output plan [11], materials planning for remaining stock minimization (U) | • Deactivating facility (U) |
| • Including potential shutdown into capacity planning [22] | • Planning the delivery of products that employees like to manufacture [21] | • Planning remaining stocks treatment, especially for polluted materials (V) | • Machine deactivation and site preparation (Z) |
| • Applying for closing permissions (U) and deconstruction permissions (V) | • Developing output plan [11], materials planning for remaining stock minimization (U) | • Developing closure team (U) | • Replacing old machines with new ones (S) |
| • Applying for closing permissions (U) and deconstruction permissions (V) | • Developing output plan [11], materials planning for remaining stock minimization (U) | • De-activating facility (U) | • Replacing old machines with new ones (S) |
| • Exploring environmental impacts/audit, informing public and public discussion (V) | • Planning the delivery of products that employees like to manufacture [21] | • De-activating facility (U) | • Replacing old machines with new ones (S) |

Table 1: Holistic phase-out process and activities during plant shutdown

Regina Grussenmeyer et al. / Procedia CIRP 19 (2014) 111 – 116
6. Conclusions

During the last decades, many companies were obliged to downsize their production capacities [19]. Some of those corporate restructurings resulted in shutdowns. As closures become more frequent, being more than legal contract termination, through involving also great moral considerations [11], an ending competence needs to be developed. In order to ensure appropriate behavior, 5 out of 8 interview partners regard standardized processes as adequate.

With this research we decreased the huge gap in the shutdown literature. We developed a closure framework depicting different closure alternatives in terms of reasons and consequences. So, we detected additional shutdown reasons apart the efficiency problem.

Subsequently, we elaborated a process model mapping the different shutdown stages, for the phase-out being repetitive for every closure (W). Resulting from the conducted in-depth interviews and the scarce literature available, we developed for every process stage a plan highlighting activities for the individual production factors.

Even though the literature already stated that plant shutdown knowledge should be included into a company’s risk management practice, in none of the interview experts’ companies it was practiced. Plant managers, who often are obliged to execute a decision made by upper management, are additionally obliged to keep with production goals and quality targets (mentioned in 6 of the interviews). Two experts expect shutdown costs (ca. 20-30 Mio €) to decrease with standardized procedures, thus, our process description with the activities to be performed is validated. Especially a large-scale standardization (S) in this regard, the shutdown framework especially supports the planning stage of the shutdown process.

Obvious limitations come from the small sample size and the exploratory investigation (the German Ministry of Statistics refused to provide us country-wide closure data due to privacy reasons). This study is cross-sectional, but one-dimensional focusing on German companies. Generalizability can only be achieved with further standardized extended sample surveys. The process framework presents all activities which have been mentioned in a comprehensive overview. Further research should detect new, prove identified, and rank the importance of process activities. In addition, our assumption that standardization supports the closedown effect exploitation needs to be validated. Especially a large-scale investigation which should also detect further links between the shutdown reasons and the activities to be performed is promising.

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