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The Influence of Production Planners and Schedulers at Manufacturing and Commercial Interfaces

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ABSTRACT

This article describes empirical research undertaken to identify how production planners and schedulers in manufacturing businesses exert influence on employees in production and commercial departments. Through the analysis of observations and interviews conducted in four case studies, sources of power were identified and categorized. It was found that although production planners and schedulers often did not have formal authority, in practice they had considerable influence. In the main, their sources of influence resided in their access to information, company agendas, and influential arenas, as well as their knowledge and social skills. The discussion draws from the findings examining influencing behaviors and considering their implications. The findings inform associated research on the processes, behaviors, and roles that schedulers and planners perform at functional interfaces, in support of effective and responsive order fulfillment. © 2008 Wiley Periodicals, Inc.

1. INTRODUCTION

In manufacturing businesses, effective production planning and scheduling can be key to business success (MacCarthy & Wilson, 2001). Particularly in turbulent business environments, the interfaces production planning and scheduling have with both the commercial and manufacturing sides of the enterprise need to be effective to ensure production can respond quickly to customer demands. Here, the commercial side includes both marketing and sales. Extensive research has identified the conflict between manufacturing and the commercial side of the business (Clare & Sanford, 1984; Crittenden, Gardiner, & Stam, 1993; Gunasekaran, Tirtiroglu, & Wolstenscraft, 2002; Spencer & Cox, 1994) and their divergence in goal orientation (Crittenden, 1992; Lawrence & Lorsch, 1986; Maltz & Kohli, 2000; Shapiro, 1977). However, the coordination between manufacturing and the commercial side has been identified as crucial for company success (Hill, 1997; Mukhopadhyay & Gupta, 1998; Skinner, 1969). Despite this there is a lack of research on this at an operational level (Parente, 1998; Swamidass, Baines, & Darlow, 2001; Whybark, 1994). Further studies have identified production planning and scheduling as providing a bridge between

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manufacturing and commercial departments (Parente, 1998) and that planners/schedulers in everyday work activities need to cope with and balance the sometimes incompatible agendas and perspectives of manufacturing and marketing/sales personnel (Karltun & Berglund, 2002). Incompatible goals and/or means to goals within organizations generate the need for individuals to influence others using various forms of power (Pfeffer, 1981). Recognizing this, this article sets out to investigate the work and role of planners and schedulers in relation to how they influence manufacturing and commercial employees at these key manufacturing and commercial interfaces.

2. POWER AND INFLUENCE

Power is defined in different ways. Power is "the ability of those who possess power to bring about the outcomes they desire" (Salancik & Pfeffer, 1977, p. 3) or "the capacity to effect (or affect) organizational outcomes" (Mintzberg, 1983, p. 4). French and Bell (1999, p. 283) point out the necessity of social interaction and define interpersonal power as "the ability to get one's way in a social situation." A generally accepted definition is that "A has power over B to the extent that A can get B to do something that B would not otherwise do" (Dahl, 1957). Handy (1993) distinguishes between influence and power by stating that influence implies the use of power, while power is the resource behind it. Handy further states that having influence is the same as having the power to influence.

Extensive literature identifies many sources of power in organizations. French and Raven (1959) put forward five bases of power associated with what they defined as social power: (1) reward power, where the power holder has the ability to reward another person; (2) coercive power, where the power holder can punish another person; (3) legitimate power, where the power holder has a legitimate right to exert influence; (4) referent power, where a person identifies himself/herself with the power holder; and (5) expert power, where the holder of power possesses expertise that is needed by another person. This includes informational power, where the holder of power possesses important information. Later, informational power was considered as a separate power base (Raven, 1965). Mintzberg (1983) made a similar identification of five bases of power: (1) control of resource; (2) control of technical skill; (3) control of a body of knowledge; (4) legal prerogatives, where a person has the exclusive right to impose choices; and (5) access to those who have power based on the first four power bases.

These different sources of power have been compiled to provide categories for analysis (see Table 1). The categories considered are in relation to interpersonal influence and are mainly based on Handy's (1993) power categories that in turn are derived from French and Raven (1959).

3. METHODOLOGY

3.1. Research Approach

The authors' particular interests are in gaining a better understanding of the human and organizational aspects of production planning and scheduling processes in real-world scenarios. The literature review emphasized the importance of planners and schedulers in interactions between commercial and manufacturing; however, there was little evidence on how they influence in practice. Therefore, it was decided to focus the research on this area. Case study research was chosen as it is particularly valuable when the intention is to examine

TABLE 1. Categories of Power Used in the Analysis

Resource power derives from possession of valued resources. To be an effective power base, an individual must have control of the resources and those resources must be desired by others. Resources can be material or nonmaterial as in the case of grants of status. Resource power can be compared with Etzioni's (1966) control over resources and rewards.
Position power is legal or legitimate power related to an individual's formal position in the company (Bolman & Deal, 1991). This can also be described as the legal prerogatives to have the exclusive rights to impose choices (Mintzberg, 1983). It gives the occupant of a role in the organization all the rights of that role. It includes access to information and right of access to networks. In the latter case it is possible to form alliances to gain more power. It will also give access to those who have power (Mintzberg, 1983). Position power may also include the right to organize, for instance, the physical and social environments, the flow of communication, and the right to decide. Furthermore, it includes control over agendas.
Expert power is based on individuals possessing expert knowledge that is needed and acknowledged by others. It is a power base that doesn't require any sanctions and is the socially most accepted. As stated, French and Raven (1959) define informational power as a form of expert power; it includes control over information, which may be the result of a certain position.
Personal power emanates from an individual's personality and is sometimes referred to as charisma, popularity (Handy, 1993), or referent power (French and Raven, 1959). It can be enhanced by an individual's position. Studies show that individuals who efficiently execute power are characterized by eloquence, ability to listen, and quick comprehension (Pfeffer, 1981).
Physical or coercive power is the power of superior force and it is rarely used in modern organizations.
Negative power is when power is used contrary to accepted practice and includes the ability to interfere with things that happen. It is a latent power base and may be more evident in stressful situations.

phenomena in their natural setting (Meredith, 1998), and it is a very powerful approach that can provide a rich set of data on real-world practice (Eisenhardt, 1988; Voss, Tsikriktsis, & Frohlich, 2002).

To achieve the objective, empirical studies based on four cases (two companies in Sweden and two in Britain) were analyzed with respect to planners'/schedulers' interaction with, and influence on, the commercial and manufacturing side of the enterprises. The research took observations from a number of case studies and analyzed them individually and cross-case (Yin, 1994) in relation to a synthesis of established theory on sources of power and influence.

3.2. Case Study Selection and Description

Case studies were selected to include a range of companies with different types of products and production processes that inhabited different business environments; all were manufacturers of discrete products. This selection of diverse cases provided rich data for theory building. The following companies were used as cases: a sawmill, a parquet floor manufacturer, a DIY product manufacturer, and a steel manufacturer (see Table 2).

3.3. Data Collection

In each case data were collected from the observation of work activities of planners/schedulers and interviews with employees in planning/scheduling, manufacturing, and commercial

TABLE 2. Case Company Characteristics

Company	Size	Products	Business and Production Context and Challenges	Planning Priorities
Sawmill (Sweden)	42	Beams, boards, planks	Long-term contracts, with customer calling off required volumes Special demands from prioritized major customer Uncertainties in production process outcome	To optimize the high value outcome of the sawing process regarding quality and volume To achieve the optimal fit between available timber and customer demand
Parquet Floor Manufacturer (Sweden)	1,400	Parquet floor	Uncertainties in production process outcome Large number of product variants	Find best possible fit between production capability and delivery demands
DIY Product Manufacturer (UK)	400	DIY adhesives	Highly responsive customer service required Product-focused plant Shared goals throughout organization	Manage stock vs. service trade-offs to provide off-the-shelf delivery at low cost Fast track urgent orders
Steel Manufacturer (UK)	>2,000	Industrial steel products	Highly volatile demand Commodity type market Unpredictable processes Liquid steel constraint	To manage demand based on profitable work selection To share liquid steel supply across mills to ensure plant utilization and deliveries

departments. In each case, the researchers recorded descriptions of tasks, timescales, peoples' roles and goals, use of aids (meetings and systems), communication patterns, and physical location.

The employees that were interviewed are shown in Table 3. The interviews concerned the planning and scheduling process in the companies, how the interviewees were involved in or influenced by the planning and scheduling process, and interactions between the planners/schedulers and manufacturing and commercial departments.

Through both observation and interview, data were obtained to establish the tasks influenced, who influenced whom, why influence was required, where (in relation to forums) and when it occurred, which form it took (related to categories identified in literature), and how it was applied. Approaches to maintain sources of power were also identified.

3.4. Data Analysis

As recommended by Eisenhardt (1989), each case was first examined in its own right to develop a unique understanding of the issues, variables, and factors relevant to the case. In this way unique patterns could emerge for each case and be considered prior to seeking generalizations cross-case. For each case:

TABLE 3. Number and Position of Interviewees

Company	Number of Interviewees	Position of Interviewees
Sawmill	15	Scheduler, purchaser, marketing manager, CEO, production manager, delivery officer, operators, forklift truck drivers
Parquet Floor Manufacturer	23	Scheduler, scheduling manager, sales manager, customer help desk officers, operators, supervisors, production group leaders and foreman, forklift truck drivers, purchaser, quality coordinator
DIY Product Manufacturer	11	Planner, supply chain manager, production team leader, customer services personnel, demand manager, product manager, manufacturing manager, engineering, managing director
Steel Manufacturer	9	Manager of load control, load controller, commercial business planners, manager of planning and scheduling, schedulers

1. The role and scope of planning and scheduling was defined to establish key planning tasks and the functional areas that the planner/scheduler would be expected to influence in their achievement.
2. Observations were made to identify sources of influence and propositions were developed to support an understanding of how and where they were applied.

   Then cross-case:
3. The predominance of, and reasons for, forms of influence at commercial and production interfaces were analyzed.
4. The case-specific propositions that had been generated were evaluated cross-case.

4. FINDINGS

Consistent with the analysis approach described earlier, the case studies are initially presented individually. The cross-case comparison is presented in the next section.

4.1. The Sawmill

The sawmill belonged to a larger sawmill group. It was organized in two subunits. The sawmill had 42 employees. The secondary woodworking unit was used for planing operations and produced some of its own products. The sawmill mainly produced for the international market; 40% of company production was exported to Japan, with a smaller quantity to Taiwan. The sawmill's primary focus on the Japanese market put new demands on the company, such as producing beams with very fine tolerances and specific shipping conditions.

The planning and scheduling work at the sawmill was chosen for analysis. The scheduler's main contribution was to optimize high value output from the sawing process achieving both volume and quality production. In addition, it included achieving optimal fit between available timber supply and customer demand. In order to reach these goals the scheduler tried to influence supply, customer demand, and the production process. The scheduler also took part in controlling the quality grading of high-value goods produced by the

TABLE 4. Location and Sources of Influence of the Scheduler at the Sawmill

Location	Specific Task	Observed Behavior	Source of Influence
Sales and Marketing	Handling customer orders	The scheduler persuaded sales and marketing to sell specific products using personal knowledge (on products) and up-to-date information of production status to influence them	Information power Expert power based on deep knowledge about production
Production	Distribute schedule to production Modify schedules Problem-solve	Production accepted the scheduler's position of authority to instruct them through the schedules he distributed to them Up to date information, thorough knowledge and personal skills were used to propose overtime to meet the schedule Solved a variety of problems with production management and personnel	Position power based on access to people with power and right to organize Expert power Information power Personal power
Other Schedulers	Develop schedule	Applied the information and knowledge he possessed when jointly scheduling with the forest planner and other schedulers responsible for saw, planing operations, and delivery	Information power Expert power

business. The company aimed to sell most of the sawmill production based on long-term contracts, typically agreed for a 3-month period. The sawmill marketing manager set up customer contracts. The customer then "called off" the required volume of product within the contract terms. The scheduler's key activities in relation to sales and marketing included updating the computer systems with customer orders and contracts, and influencing sales to sell all products including the lower value by-products that were automatically produced with leftover wood.

In relation to production, the scheduler developed schedules and distributed work orders, controlled production outcome by personal visits in production, and executed production plans (including increasing work hours to manage scheduled production). Schedules were developed in collaboration with representatives from adjacent processes such as timber supply, the saw and planing facilities, and distribution. The scheduler also participated in product development projects and problem solving. The interfaces with manufacturing and commercial are described in Table 4.

In the interface with sales and marketing, the marketing manager used his position power. However, the scheduler used his information and knowledge to influence sales to focus more on selling the by-products. The scheduler showed great social skill in "smoothing the system" (as further described by Karltun & Berglund, 2002) making it possible to deliver products when personnel in sales had not followed accepted internal procedures for authorization from the scheduler.

The scheduler was considered an expert. He had 35 years of work experience in different positions and had good knowledge on machinery and the constraints in production. This, combined with his access to information from various groups within and outside the company, gave him legitimacy in all activities. His ideas were respected and although he did not have formal authority, he exerted strong influence on production.

The following propositions were drawn from the observations made in the sawmill:

1. The scheduler is a social actor performing a coordinating role between sales and marketing and manufacturing.
2. A combination of expert power and personal power provides the scheduler with perceived personal integrity that helps him smooth out difficulties and conflicts.
3. Long work experience gives legitimacy to the scheduler's suggestions and contributes to both expert power and personal power.
4. The scheduler does not have formal authority but aspects of position power—such as access to networks, people with power, and information as well as the right to organize (in relation to production)—are evident.

4.2. The Parquet Floor Manufacturer

The parquet manufacturer was a major player on the world market with sales agents in many countries. It had a number of plants, mainly situated in Sweden. The main plant was studied. Scheduling involved the coordination of production with that of the other plants. The production scheduling function belonged organizationally to production and consisted of four people. Three main production flows were scheduled within the main site as well as production in two other premises. The scheduler's responsibility comprised of finding the best possible fit between production capability and delivery demands.

The scheduler's interface with the commercial side consisted of participation in weekly meetings with representatives from the sales department to discuss the status of customer orders and relate them to scheduled production. The scheduler also received new customer orders daily and frequent inquiries about customer orders from customer service representatives. Some of these inquiries could be handled directly by the scheduler, others were directed to production. There were frequent discussions and negotiations about alternative delivery dates and/or products.

The interface with manufacturing consisted of several weekly meetings with representatives from production to establish production status and manage incoming orders and maintenance improvements. The scheduler also had frequent personal contacts with operators, foremen, and production managers when providing them with schedules, controlling production outcome and status, incorporating production changes, and solving problems. The interfaces with the manufacturing and commercial departments are described in Table 5.

The scheduler did not have any formal authority in the hierarchy. However, he participated in several formal meetings with representatives from both manufacturing and commercial, thus having access to information and arenas for decision making, which in turn added to the scheduler's individual knowledge. This information power was further strengthened as the scheduler actively searched for relevant information, much of which was obtained from informal contacts, as a means to keep control.

The scheduler was respected due to his thorough knowledge on both production issues and up-to-date customer order statuses. His former work experience from production gave

TABLE 5. Location and Sources of Influence of the Scheduler at the Parquet Floor Manufacturer

Location	Specific Task	Observed Behavior	Source of Influence
Sales and Marketing	Handling customer orders and customer inquiries	Participated in weekly formal meeting with sales employees regarding customer order status. Scheduler representing production knowledge and most up-to-date information. Scheduler consciously strengthened good relation with sales and market department to facilitate support when needed.	Position power Expert power Information power Personal power
Production	Schedule production Modify schedules Inquire on production capacity	Participated in weekly formal meetings with commercial and production employees. Scheduler influenced common decisions with thorough knowledge and information on both commercial and production issues. The meeting was used as an arena for the formal collection of information. Scheduler received information informally from production employees, so he had up-to-date production status information on all production areas. Scheduler participated in general problem solving applying his knowledge of production. Scheduler had high legitimacy; schedules were not questioned.	Position power based on access to arenas and networks, right to organize Expert power based on recognized knowledge on production Information power Personal power

him legitimacy in contacts with production and generated confidence in the schedule. There was no other person that could directly replace the scheduler in terms of his range of knowledge; for this reason he was viewed as an expert.

Furthermore, the scheduler used his social skills in handling the different logics between manufacturing and commercial. The scheduler described how he used humor as a conscious means to cheer up and befriend customer help desk representatives to ensure their support when it was needed.

Additional propositions derived from the parquet floor manufacturer case were:

5. Based on the scheduler's access to key arenas, valuable information is gained and used to influence others.
6. Information power is gained not just from formal participation in meetings but informal interaction with employees from commercial and production.
7. Personal power supports negotiations with manufacturing and commercial.

TABLE 6. Location and Sources of Influence of the Planner at the DIY Product Manufacturer

Location	Specific Task	Observed Behavior	Source of Influence
Sales and Marketing	Plan production and inventory based on forecast	Had decision making autonomy within clearly defined limits Generated compromise plans based on his own interpretation of data	The planner has little influence (Staff in sales and marketing have position power as they are perceived to represent the "customer" with a right to demand)
Production Team Leader	Implement and progress schedules Manage schedule modifications	Planning instructed production Planning and production jointly solved problems where there were disturbances The team leader had no access to information on orders so was dependent on the planner's decisions	The planner has position power based on the right to organize and on access to information

4.3. The DIY Product Manufacturer

The DIY product manufacturer was predominantly a make-to-stock (MTS) business supplying its own and retail brand adhesive products to major DIY retail chain stores. The business competed on the basis of being highly responsive. Customer lead times were normally 2 to 3 days; however, for major customers same-day delivery was provided. Its manufacturing facilities were product focused, with four major product families all having their own dedicated manufacturing resources (people and machines). A production planner and production team leaders were associated with each of these. The planner had a relatively autonomous role performing a number of integrated tasks: production planning, inventory management, and supply call-offs.

Finished goods stock was held for off-the-shelf delivery; when demand was unanticipated and there were shortages work was fast tracked through production. Capacity was reserved for these eventualities. The key trade-off for the business was service level against finished goods cost. Finished goods inventory levels were also adjusted to smooth demand on production.

With the planning approach used and a volatile market, two activities were critical:

- Accurate forecasts and information on store promotions at the commercial interface
- Responsive rescheduling with production to achieve deliveries

The sources of influence observed at these interfaces are shown in Table 6. The planner had extensive knowledge of demand patterns at the item level as he dealt with his range of products on a daily basis. Unfortunately, he had little influence on the forecasts developed by sales and marketing. This resulted in changes being made to the master production schedule and compromise plans being developed to cover both the planner's and sales and marketing's projections of demand. As the planner said: "We do work to a forecast and a sales pattern as well . . . We could be left with our trousers down if we don't (also) make to

(sales and marketing's official) forecast." At this interface the planner's knowledge tended to be overridden by the forecasts provided by sales. This useful knowledge did help him to plan but did not provide him with expert power.

At the production interface the planner used a combination of information and position power. From the production team leader's perspective, the planner instructed the majority of activities. In his role, the team leader monitored and provided feedback on progress and on decisions that needed to be made: "I basically do what people tell me." With limited access to planning information systems, the team leader also realized he was unable to make rescheduling decisions independently as he had no knowledge of work priorities based on customer orders. However, in relation to handling disturbances, the planner and team leader had knowledge overlap on manufacturing processes and sequencing logic. This meant that they could problem solve together to modify the schedule; in these situations the planner considered himself to be in a support "fixing role."

In this organization, decision making was relatively autonomous, areas of authority well defined, and goals were aligned; so the need to influence (in a political sense) did not appear in this context. However, although the planner was very knowledgeable and could forecast demand for product at an item level, he had to use the forecasts provided to him by sales and marketing. This needs to be understood in the context of the company ethos. This ethos was illustrated by two statements made by the Managing Director: "I think the responsiveness for serving the customer is the most important thing." "I think we (those running the operation) do view ourselves very much as the service provider to the front end of the business, the sales force and the sales and marketing team are our customers as well as . . . " Emphasis on the position (associated with representing the customer) held by sales and marketing overrode the planner's expert knowledge resulting in the planner implementing what he considered to be compromise plans.

Additional propositions derived from the DIY product manufacturer case were:

8. Position power based on the right to organize is effective in an organization with a hierarchical structure where autonomous roles have been clearly established.
9. The need to influence can be minimized where the company ethos and goals are shared.
10. A customer-focused ethos may legitimize the dominance of commercial over planning resulting in the overruling of planning expertise.

4.4. The Steel Manufacturer

The steel manufacturer made products such as sections and plates for industrial and construction applications. At the time of study it was targeting high-premium niche markets and needed to handle high variety with quick turnarounds for its customers.

The whole operation was vertically integrated with the liquid steelmaking facility supplying three specialist rolling mills (each dedicated to a particular range of product). Each mill was run as a separate business with its own commercially orientated business directors, and sales teams responsible for their specific range of products and associated markets. The vertically integrated resources were interdependent and production processes were inherently difficult to manage with out-of-specification steel having to be rapidly reallocated to orders and mills. Basic oxygen steelmaking (BOS) furnaces producing liquid steel must run 24 hours a day. With the objective being to bring in the most profitable work and to ensure all mills had sufficient demand to run efficiently there could not be any over- or

undercommitment on orders (order acceptance must be carefully managed) and mills vied for supplies for their particular customers and business.

Load control was the function responsible for the liquid steel plan. This function consisted of the load control planner and his assistant. The liquid steel plan scheduled and allocated steel production in relation to specification and volume, and as the liquid steel facility was the constraint, set limits on customer demand that commercial activities needed to manage. To generate the plan, the load controller took an overview of commercial issues, production capability, and the status of the plan across all the vertically integrated supply chains. To provide a plan that optimized production efficiencies and meets customer demands, steel must be shared across the mills. Any changes in status of production and orders required immediate decision making and negotiation as they affected both the production plan and the way demand needed to be managed by the mill businesses.

For the load control function to generate a liquid steel plan, knowledge needed to be drawn from a variety of sources within the business. A load management team, incorporating managers and specialists from different functions (the load control planner, commercial planners affiliated with mills, finance, technical process planners, and liquid steel schedulers), had been set up to inform these decisions. The team reviewed plans formally on a weekly basis, informally daily. Decisions made by the team, particularly sharing steel supply between the mills and external customers, needed to be approved by the business directors and required negotiation. The agreements were then taken back to relevant functional areas via team members. In particular, the plan informed sales teams for each mill on order intake and production on production requirements.

The sources of influence that the load control planner was observed to have on the cross-functional team, the business directors who represented commercial interests of each mill, and production personnel are described in Table 7.

The load control planner did not officially have the right to decide the steel allocation. He did, however, have substantial influence over these decisions. He had access to key networks of decision makers and decision information. He had expert knowledge and was the only individual with a complete overview of the situation, agendas, and previous solutions. Also he had significant personal power with a strong friendship network in all functions, in which loyalty and trust had been established over many years of shared experience.

The load control planner could and did influence senior management, and with liquid steel as the critical resource in the overall operation, this influence could significantly impact order intake and mill business performance and therefore employees' achievements and remuneration within the organization (e.g., sales volumes). From this perspective, the load control planner was perceived to have substantial, though indirect, resource power.

The load control planner's sources of influence were many and were consolidated in various ways. A highly complex spreadsheet had been developed by the load control assistant who gathered accurate data from extensive networks. "How we get the information in our helicopter is driven a lot by what the load control assistant does. He gets reports from everywhere known to man." This information was owned by the load control function and used to generate a limited range of options to present to senior management. This placed the load control planner in an advisory role where the load control planner's preferred option (established with the cross-functional, cross-business load management team) could be presented preferentially. Once agreed, objectives to support the plan were set by the business directors and directed down the organization. In this way, the load control planner effectively used the business director's position power to enforce his decisions.

TABLE 7. Location and Sources of Influence of the Load Control Planner at the Steel Manufacturer

Location	Specific Task	Observed Behavior	Source of Influence
Cross-Functional Load Management Team	Generate liquid steel plan	Used authority of business directors to set team objectives (agendas) Managed own spreadsheet database on production status and plan implications Set situation awareness in load planning meeting to indirectly influence negotiation The team core consisted of a close-knit and long-standing friendship group Used extensive networks for intelligence into other functions and events	Position power based on right of access to key people and information, expert, and personal power
Business Directors	Achieve agreement on plan, sharing of steel and inventory levels	Gave limited choice of plans and emphasized consequences Used the load control spreadsheet as a "what if" analysis tool to demonstrate the validity of recommendations; this was owned, developed, and managed by the load control function	Position power based on information; expert and indirect resource power
Liquid Steel Production Schedulers	Implement and change plans	Liquid steel schedules were generated based on the load control plan Changes to plan were accepted based on trust and acceptance of the load control planner's expertise	Position power based on the right to organize, expert and personal power

Further, the load control planner orchestrated the legitimization of his expert status. As negotiations between businesses on shares of production and current inventories of steel could be highly complex, many individuals from the load management team were involved in the process. The load control planner presented background information and opinions at the weekly formal meeting to provide situation awareness to all concerned prior to these negotiations. Here the load control planner's access to the directors' agendas and the objectives set by the directors were used to legitimize his view on "best" solutions.

Additional propositions derived from the steel product manufacturer case were:

11. Ownership and control of information and expert knowledge create the need for a judge–adviser relationship and dependency of senior managers on their adviser.
12. By influencing the agendas and communicated objectives of senior managers, the planner can legitimize his plans throughout the organization.
13. Where multiple players vie for production, the planner may be able to influence others on the basis of perceived resource power.
14. Planners can consciously actively develop and maintain their sources of power; these in turn can be used to reinforce each other.

TABLE 8. Sources of Influence at Production (Prod) and Commercial (Com) Interfaces

	Sawmill		Parquet Floor Manufacturer		DIY product Manufacturer		Steel Manufacturer	
Source of Influence	Prod	Com	Prod	Com	Prod	Com	Prod	Com
Resource Power	—	—	—	—	—	—	—	X
Position Power:								
• Formal (Line) Authority	—	—	—	—	—	—	—	—
• Access to Information	X	X	X	X	X	—	X	X
• Access to Networks	X	X	X	X	—	—	X	X
• Right to Organize	X	—	X	—	X	—	X	—
Expert Power	X	X	X	X	X	—	X	X
Personal Power	X	X	X	X	X	—	X	X
Physical Power	—	—	—	—	—	—	—	—
Negative Power	—	—	—	—	—	—	—	—

5. ANALYSIS AND DISCUSSION

Generalizations drawn from consistencies in observational and interview data were examined against relevant theories using a form of analysis recommended by Miles and Huberman (1994). A table was used as a cross-case data display to establish the planners'/schedulers' prevalent sources of influences at interfaces. It was also used to identify any exceptions warranting further analysis (see Table 8).

In Table 8, expert and information power were considered separate categories as the case study observations showed that these sources of influence could be readily differentiated. For the planners and schedulers, expert power was derived from being recognized for having the knowledge needed to understand the implications of decisions made and how to manage them. This was very different from having access to information and was firmly based on experience.

From the cross-case comparison the following was found:

- The right to organize occurred at the production interface in all cases; the planners and schedulers being responsible for instructions and plans.
- Position power based on access to information and to networks was prevalent at both commercial and production interfaces; an exception is in DIY products.
- Expert power was identified at all interfaces; an exception was in DIY products.
- Only in one case was resource power utilized, though in an indirect form.
- Physical power and negative power were not observed in any of the cases.

The propositions were also analyzed cross-case to critique their general applicability (see Table 9). This approach was taken to deepen understanding and explanation on sources of influence (Glaser & Strauss, 1967). In this way, a number of propositions were supported; none was refuted.

The practiced reality (Westlander, 1999) demonstrates a number of potent power bases from which the planners/schedulers act. The findings demonstrate that planners and schedulers are not generally regarded as actors with formal authority, particularly at the commercial

TABLE 9. Propositions Attributed to Each Case

	Propositions													
Case Study	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sawmill	X	X	X	X	X	X	X	—	—	—	—	—	—	X
Parquet Floor	X	X	X	X	X	X	X	—	—	—	—	—	—	X
DIY Products	X	X	X	X	X	X	X	X	X	X	—	—	—	—
Steel Products	X	X	X	X	X	X	X	—	—	—	X	X	X	X

interface (Proposition 4). They do, however, exert strong influence. Their influence emanates mainly from their control over information and knowledge, access to networks and key decision makers (Propositions 2 and 5), and personal power related to social skills (Proposition 7). This may be regarded as lack of authority and power from the formal organization.

Power associated with access to and control of information is clearly significant in all cases (Proposition 5). One example was in the steel manufacturer where the load control planner, having access to real-time information associated with customer orders and production across the whole business, could influence senior management. This supported his position as a chief adviser in a judge–adviser relationship (Sniezek & Van Swol, 2001). This essential role of planning and scheduling work has been identified as an information hub and filter role (Crawford, 2000) or an information node (Berglund & Karltun, 2007). The empirical research shows that planners and schedulers, purely by virtue of their coordinating role in the organization, function in what Mintzberg (1975) defines as an informational role and Handy (1993) as a junction-box for information. Access and control of information is clearly also used as a basis to maintain power (Propositions 11 and 14).

Long service experience and associated knowledge (Proposition 3) provides planners and schedulers with expert power and strong legitimacy. This was apparent in the woodworking industry (Berglund & Karltun, 2007) and also observed in the steel product manufacturer (Guinery, 2006). The DIY case reinforces this proposition as it was established that although the planner here had knowledge of demand patterns, this was not acknowledged as he was relatively new to the business and his opinion had limited legitimacy.

The significance of personal power (Propositions 1 and 2) demonstrates that the social skills of planners and schedulers are important. This is not the least important as they were faced with and had to deal with different commercial and manufacturing logics.

Findings also support the assertion that "different power bases are often used in combination" (Raven, Schwarzwald, & Koslowsky, 1998; Propositions 2, 5, and 14). This was significant in all cases and particularly apparent in the steel product manufacturer where the load control planner utilized a huge array of sources of power, even to the extent of establishing organization processes and structure to strengthen his position.

Other observations of the load control planner in the steel manufacturer have generated specific additional propositions (11 and 12) in relation to influencing and using the influence of senior managers. The need and ability to do the latter is perhaps indicative of a larger and complex organization. Furthermore, influence through perceived resource power (Proposition 13) was observed in this case.

The planner at the DIY product manufacturer was the exception in a number of areas. He was the least influential with commercial as commercial's authority was legitimized by the

company's customer focus. This led to inefficient workarounds. However, at the manufacturing interface, he had the direct right to organize manufacturing. This was achieved through assigned responsibilities and aligned goals (Proposition 8). It is hypothesized that the shared ethos and goals reduced the need to influence, which would indicate that alignments between departments could reduce the need to use other sources of power.

The research has developed propositions from a limited number of cases to contribute to existing research. In particular it has shown the informal power bases from which planners and schedulers commonly act. This understanding has value in a number of practical applications that include assessing the skills requirements of planners and schedulers, and establishing how best to induct and train them. Also it could be used to establish how an organization might be adapted to better fit the integration needs of commercial and manufacturing using planning/scheduling as an intermediary. This is likely to be of particular value as it represents one aspect that should be considered when establishing appropriate ways of achieving effective and responsive order fulfillment.

6. CONCLUSIONS

The empirical research described here demonstrates that planners and schedulers in daily work exert strong influence on other employees in manufacturing and commercial departments. They do not hold legitimate power as expressed in the formal organization; instead, individuals draw on a vast repertoire of reinforcing sources of power to influence others. Their influence emanates mainly from their access to and control of information and their ability to apply their expertise to interpret this information and examine the impact of decisions made across different areas of the business. Here, access to company agendas and influential arenas is key. Often forms of influence are seen to be consciously developed and maintained. It was also shown that personal power related to social skills is significant.

These findings contribute to increased knowledge on how planners and schedulers influence manufacturing and commercial. The discussion draws from the findings to develop propositions and consider their implications. It is envisaged that the ideas and knowledge gained from this will support further research in this area. In particular, research that addresses ways of improving joint decision making, the selection and training of key planners and schedulers, and the utilization of expert knowledge. All of which are key to achieving responsive order fulfillment.

REFERENCES

Berglund, M., & Karltun, J. (2007). Human, technological and organizational aspects influencing the production scheduling process. International Journal of Production Economics, 110, 160–174.

Bolman, L. G., & Deal, T. E. (1991). Reframing organizations: Artistry, choice and leadership. San Francisco: Jossey-Bass.

Clare, D. A., & Sanford, D. G. (1984). Cooperation and conflict between industrial sales and production. Industrial Marketing Management, 13, 163–169.

Crawford, S. (2000). A field study of schedulers in industry: Understanding their work, practices and performance. Doctoral dissertation, University of Nottingham, Nottingham, UK.

Crittenden, V. L. (1992). Close the marketing/manufacturing gap. Sloan Management Review, Spring, 41–52.

Crittenden, V. L., Gardiner, L. R., & Stam, A. (1993). Reducing conflict between marketing and manufacturing. Industrial Marketing Management, 22, 299–309.

Dahl, R. A. (1957). The concept of power. Behavioral Science, 2, 201–218.

Eisenhardt, K. M. (1989). Building theories from case study research. Academy of Management Review, 14, 532–550.
Etzioni, A. (1966). Moderna organisationer [in Swedish]. Stockholm: Aldus.
French, J. R. P., Jr., & Raven, B. H. (1959). The bases of social power. In D. Cartwright (Ed.), Studies in social power (pp. 150–167). Ann Arbor, MI: Institute for Social Research
French, W. L., & Bell, C. H., Jr. (1999). Organization development. Upper Saddle River, NJ: Prentice-Hall.
Glaser, B. G., & Strauss, A. (1967). The discovery of grounded theory: Strategies for qualitative research. Chicago: Aldine.
Guinery, J. (2006). Knowledge integration in production planning, scheduling and control. Doctoral dissertation, University of Nottingham, Nottingham, UK.
Gunasekaran, A., Tirtiroglu, E., & Wolstenscraft, W. (2002). Gap between production and marketing functions: A case study. Management Decision, 40, 428–435.
Handy, C. B. (1993). Understanding organisations (3rd ed.). Harmondsworth, UK: Penguin Business Library.
Hill, T. (1997). Manufacturing strategy: Keeping it relevant by addressing the needs of the market. Integrated Manufacturing Systems, 8, 257–264.
Karltun, J., & Berglund, M. (2002). Production scheduling in practice: A study of managing goal conflicts. In J. K. Christiansen & H. Boer (Eds.), Proceedings of the 9th International Euroma Conference, Copenhagen Business School, Copenhagen, Denmark.
Lawrence, P. R., & Lorsch, J. W. (1986). Organization and environment: Managing differentiation and integration. Boston: Harvard Business School Press.
MacCarthy, B. L., & Wilson, J. R. (Eds.). (2001). Human performance in planning and scheduling. London: Taylor & Francis.
Maltz, E., & Kohli, A. K. (2000). Reducing marketing's conflict with other functions: the differential effects of integrating mechanisms. Journal of the Academy of Marketing Science, 28, 479–492.
Meredith, J. (1998). Building operations management theory through case and field research. Journal of Operations Management, 16, 439–452.
Miles, M. B., & Huberman, A. M. (1994). Qualitative data analysis (2nd ed.). Thousand Oaks, CA: Sage.
Mintzberg, H. (1975). The manager's job: Folklore and fact. Harvard Business Review, 53(4), 49–61.
Mintzberg, H. (1983). Power in and around organization. Englewood Cliffs, NJ: Prentice-Hall.
Mukhopadhyay, S. K., & Gupta, A. V. (1998). Interfaces for resolving marketing, manufacturing, and design conflicts. European Journal of Marketing, 32, 101–124.
Parente, D. H. (1998). Across the manufacturing–marketing interface: Classification of significant research. International Journal of Operations & Production Management, 18, 1205–1222.
Pfeffer, J. (1981). Power in organizations. Cambridge, MA: Ballinger.
Raven, B. H. (1965). Social influence and power. In I. D. Steiner & M. Fishbein (Eds.), Current studies in social psychology. New York: Holt, Rinehart & Winston.
Raven, B. H., Schwarzwald, J., & Koslowsky, M. (1998). Conceptualizing and measuring a power/interaction model of interpersonal influence. Journal of Applied Social Psychology, 28, 307–332.
Salancik, G., & Pfeffer, J. (1977). Who gets power—And how they hold on to it: A strategic contingency model of power. Organizational Dynamics, 5, 3.
Shapiro, B. P. (1977). Can marketing and manufacturing coexist? Harvard Business Review, September–October, 104–114.
Skinner, W. (1969). Manufacturing: Missing link in corporate strategy. Harvard Business Review, May–June, 136–145.
Sniezek, J. A., & Van Swol, L. (2001). Trust, confidence and expertise in a judge-adviser system. Organizational Behavior and Human Decision Processes, 84, 288–307.
Spencer, M., & Cox, J. F. (1994). Sales and manufacturing coordination in repetitive manufacturing: Characteristics and problems. International Journal of Production Economics, 37, 73–81.
Swamidass, P. M., Baines, T., & Darlow, N. (2001). The role of manufacturing and marketing managers in strategy development. International Journal of Operations & Production Management, 21, 933–948.
Voss, C., Tsikriktsis, N., & Frohlich, M. (2002). Case research in operations management. International Journal of Operations and Production Management, 22, 195–219.

Westlander, G. (1999). People at work: Investigating social-psychological contexts. Lund, Sweden: Studentlitteratur.
Whybark, D. C. (1994). Marketing's influence on manufacturing practices. International Journal of Production Economics, 37, 41–50.
Yin, R. K. (1994). Case study research: Design and methods (2nd ed.). Thousand Oaks, CA: Sage.