

# Using multi-methodologies to carry out a strategic analysis of a public sector organisational unit

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## Abstract

*This paper reports on a project which analyzed the processes carried out by a unit within a public sector organization. The method used a combination of strategic and operational analysis tools. This combination proved to be complementary and effective in practice. This outcome of the study suggests that where a process analysis project has strategic considerations, as many do, then the use of strategic as well as operational analysis tools should be considered.*

## Introduction

This paper is a case study analysis of the machinery yard unit within a public service organization. A combination of strategic and operational tools was used to carry out the analysis. The paper follows in a line of process analysis case studies of public sector activity (Hughes et al, 2006). It also follows in a line of research that advocates combining strategic and operational analyses (Kiraka and Manning, 2005) and the use of multimethodologies when undertaking operational and strategic analysis (Mingers, 2001). Broadly speaking the project is a process reengineering study (Davenport and Short, 1990; Hammer, 1990; Hammer and Champy, 1993) although information technology does not play its typical enabling role.

The public sector organization in question is a local authority charged with providing road, housing, cultural and other services to a community of approximately 500,000 people in a county of approximately 2500 square kilometers in area. The machinery yard (hereafter referred to as the yard) was originally set up four decades ago to manage the vehicles and equipment belonging to the local authority. Most local authorities in the country set up, and still operate, a machinery yard.

The yard comprises a premises, vehicles and equipment and employs 34 permanent staff. The premises consists of a hard standing area for vehicles, an indoor and outdoor store, a vehicle workshop and a fitter workshop. Vehicles comprise ten 10t tipper trucks, two articulated tractor rigs, two tanker trailers, two low-loaders, two rubber-wheeled rollers,

two chipping spreaders, one bitumen spreader, one tractor with steel brush, three integrated pothole patching trucks and miscellaneous other vans and pickups; other equipment stored in the yard includes eight salt gritters that fit onto 10t trucks and nine snow plough attachments. Of the 34 staff the majority (23) are truck or machinery drivers, five are fitters and one is a general operative; administering and supervising the yard are five staff members: the yard engineer, the yard foreman, one accounts clerk, one store man and one quality assurance technician. During the peak summer season six additional temporary workers are employed – one driver and five general operatives. The age profile of yard employees is high with twenty two over fifty years of age and six over sixty.

The yard undertakes a variety of activities ranging from road maintenance to water and wastewater facility maintenance. From these activities the yard generates annual revenues of €5.8 million. The annual cost of running the unit is €5.7 million and so the unit makes a modest profit margin of just under 2%. However full head office overheads are not applied to the unit; if these were to be applied then it is likely that the unit's costs would exceed its revenues. Surface dressing of primary and secondary roads within the county is the most significant activity carried out by the yard accounting for 60% of revenues.

A strong overtime culture permeates the yard. Historically work practice agreements between the union and the organization have resulted in agreed overtime hours for additional duties. Over the past twenty five years a succession of these agreements were made. This has led to the current situation where most of the yard workers (drivers and fitters) receive regular rostered overtime i.e. overtime that is automatically received each week. The most financially significant agreement is that for travel time: drivers and fitters receive overtime for traveling from their home to the yard in the morning and from the yard to their home in the evening; for many employees this amounts to 17.5 hours of standard pay each week for every week of the year including annual leave.

Regular rostered and other overtime has led to several yard drivers and fitters being among the most highly rewarded in the entire local authority. It has also led to a fixed labor cost of €17,000 for regular rostered overtime that must be applied to yard activities. These high labor costs have also led to yard employees not being replaced by the local authority when they retire as was the case for two recently retired drivers.

The motivation for this study stems from the fact that the yard is currently renting its premises and the lease is due to end shortly. The yard has obtained from the local authority a site a short distance from the existing premises and has invited tenders for the construction of new premises on this site; tender quotations indicate that cost of a new premises will be of the order of €4 million. Before committing to this investment the local authority wished to analyze the activities of the yard with a view to improving their efficiency and effectiveness. The alternative to relocating activities in the new premises is to close down the yard and outsource the activities to the private sector.

## Method

The literature recommends that a modeling project should have input from two sources: domain experts and knowledge engineers (Roberts et al., 1983:7; Ljung and Glad, 1994:16) or process analysts (Klein and Petti, 2006). Domain expertise was provided by the yard engineer and by the director of infrastructural services of the local authority who has overall budget responsibility for the yard. Process analysis skills were provided by the author.

The approach taken was to use a mix of techniques from the fields of strategic analysis and operational analysis. This was because initial discussions with the domain experts indicated that the problems facing the yard were not simply to do with operational efficiency: a major strategic question-mark hung over the future of the yard. Also, as discussed earlier use of multimethodologies is useful in its own right.

The primary strategic techniques used were environmental analysis using the PEST technique (Wheelen and Hunger, 2006:73) and Porter's five force analysis to determine the attractiveness of the industry (Porter 1980 and 1985). This allowed the author formally consider alternatives such as the possibility of new entrants and substitute services.

The primary operational analysis techniques used were process decomposition (Martin, 1986:565) and soft system methodology: SSM (Checkland, 1985 and 2006). SSM is a formal methodology for structuring messy problem situations and taking action; this allowed the author untangle the knot of activities initially presented and consider the yard's situation from the viewpoint of a number of different actors. For a state of the art discussion of problem structuring methods refer to the special edition of the *Journal of the Operational Research Society* (2006. **57**: 757-883).

The approach taken was three-pronged and consisted of interviewing key actors, observing activities actually taking place and carrying out a desk study of yard documentation. Semi-structured interviews lasting between one and three hours were held with the director of infrastructure, the finance officer for the local authority, the yard engineer, the yard supervisor, the clerical officer, the store man, two customers (area engineers) and two bitumen suppliers. One full day was spent observing the surface dressing process. One full day was spent observing the water facility maintenance activity. One half-day was spent observing the pothole patching process.

The project was carried out over a six-week elapsed period during the height of the summer surface dressing season. As winter gritting does not take place during the summer season it was not possible to directly observe this activity.

## Strategic analysis

In this section I concentrate on the surface dressing process as this is the most significant process and the under most scrutiny within the local authority. I will firstly review the environmental analysis carried out using the PEST technique. Then I will review the industry analysis carried out using the five force approach.

Political change in recent years has led to several high profile new management initiatives within local authorities resulting in a stronger emphasis on strategic planning, customer service and value for money. One outcome of these initiatives is that local authorities have begun to outsource operational activities, for example refuse collection.

The primary outside influence on the yard has been the external economic environment. Over the past twenty five years the economy of the country has moved from being characterized by low labor costs and high unemployment to high labor costs and low unemployment. The increase in labor costs has had enormous impact on the yard as agreements denominated in overtime hours were inflation proof. As labor rates dramatically increased nationally in recent years so too did the cost of paying for work practice agreements by means of regular rostered overtime.

The increase in employment and general economic growth has resulted in significant social change. A net influx of people into the country has led to significant increased demand for housing and infrastructure at local and national levels. It has also led to a significant increase in levels of private and commercial traffic on regional and national roads. The increase in population, traffic, and demand for housing is particularly keen for this county as its towns act as dormitories for a nearby major city. For the yard this has required that increased attention be paid to traffic management and public and employee safety when carrying out surface dressing activity.

The technology used in yard activities has undergone little change over the past several decades. I will now examine the attractiveness of the industry using Porter's five force technique.

Surface dressing is largely a monopoly activity carried out local authorities within their county boundaries. It is not usually carried out by a local authority outside its county boundary although there is no reason why it could not do so if agreed between counties. In the county in question the local authority carries out all surface dressing on public roads within the county and does not carry out surface dressing outside the county boundary. Within the county rivalry among incumbents is therefore non-existent. Within the country surface dressing is a collective monopoly with each local authority looking after the needs of its own county. At national level rivalry among incumbents is therefore also non-existent.

Bitumen binder is a largely undifferentiated product supplied by four large suppliers of which three have depots within range of the county in question. The cost of switching between suppliers is low. While on the face of it one would expect that supplier power

over the industry would be low, traditionally suppliers have held a deal of power in the surface dressing industry and have largely dictated the price for bitumen binder. There is some evidence that this is now changing with incumbents taking a tougher stance when negotiating price.

Some suppliers are forward integrated and carry out road laying work but rarely surface dressing. However there exists a credible risk of forward integration as bitumen suppliers have indicated to the author that, while their primary interest is to sell bitumen, they are prepared to carry out surface dressing in order to do so.

While many local quarries supply stone good quality chippings are difficult to get. The incumbent uses two suppliers both external to the county. During the winter off-season the incumbent typically transports chippings from the supplier to a series of chipping dumps dotted around the county. Chippings are drawn from these dumps during the course of the surface dressing operation. Chipping suppliers are unlikely to move into the surface dressing operation as it requires a different skill set and specialized equipment; they therefore do not present a credible risk of forward integration.

As discussed earlier, labor has also held a great deal of power over the incumbent with unions traditionally negotiating firmly with local authority management and achieving agreements favorable to themselves. High labor costs have effectively eliminated the incumbent's profit.

Area engineers, responsible for roads within the county and budget-holders for road maintenance works, are the buyers in this industry. The county is divided into five areas and the five area engineers compete for the surface dressing service by placing their requirements with the yard engineer at the beginning of the calendar year. The yard engineer then decides the surface dressing schedule for the season and the schedule of hire-out rates for each vehicle. Area engineers are price-takers: they have little purchasing power as they have only one source of supply and can be mandated by their head office to use the internal supplier. Area engineers view the yard's surface dressing service as technically good but overpriced. This is partly due to the pricing mechanism used which results in some jobs carrying a higher per meter squared cost than others depending on whether or not the job was carried out at overtime rates. Also, the first and last jobs of the day bear the entire travel time burden. Jobs are billed by allocating timesheet hours to a job code. A rate for each hour is allocated to include labor, equipment and yard overhead cost: in effect an hourly hire-out charge for vehicle and driver. Area engineers are also acutely aware of the high labor costs of the yard.

In recent years area engineers have reacted against high yard hire-out charges by sourcing vehicles for winter road maintenance from private hire-out firms rather than from the yard. Water facilities have also on occasion outsourced maintenance fitters from private contractors rather than use yard fitters. Area engineers have not outsourced surface dressing work to private contractors.

There exists little threat from new entrants to the industry. Due to the current economic boom contractors have plenty of work and show little interest in surface dressing. However there is no reason why contractors could not enter the industry if they wished as they have the equipment, vehicles, labor and skills required. Recent change in the political climate means that local authorities are receptive to the possibility of outsourcing operational activities such as surface dressing to the private sector.

Substitutes for surface dressing exist but these are either many times more expensive or provide insufficient skid resistance. Hot rolled asphalt provides a skid resistant surface that lasts several times longer than surface dressing but is over ten times the price. Asphalt is laid as the final surface on many national primary roads but its price prohibits its widespread use on secondary roads, of which there are many in this county. Other forms of macadam are used as final surfaces in urban areas where traffic speeds are lower but these do not provide sufficient skid resistance for the open road.

## **Operational analysis**

The initial operational analysis carried out was a high level decomposition of the activities of the yard. These were identified as:

- Road maintenance
  - Surface dressing
  - Winter salt gritting
  - Drawing chippings
  - Pothole patching
- Facility maintenance
  - Water facility maintenance
  - Waste water facility maintenance
  - Roadside water pump maintenance
- Stores management
  - Materials stores management
  - Diesel fuel management
- Vehicle hire-out
  - All year hire out of vehicle and driver
  - Off-season hire out of vehicles.

Little synergy exists between these processes. The only overlap between the water based, road based and hire-out processes is that the yard supervisor supervises all yard workers: drivers, fitters and general operatives. There exists some synergy within the road based processes in that the same fleet of trucks is used for surface dressing, winter gritting and drawing chippings. However, while the fleet of 10t trucks is acceptable for surface dressing and winter gritting it is inefficient for drawing chippings over long distances. The stores provides safety equipment and road signage for use in surface dressing but the level of this activity is low. The diesel fuel service is used by all yard vehicles and also by other local authority vehicles.

Each high level process was analyzed using the CATWOE technique. However in this report I will concentrate on surface dressing as it is the most significant of the yard processes. The owner of this process (and indeed of all yard processes) is the director of infrastructural services who has authority to increase or decrease the level of yard services. The director is also the penultimate customer as it is from one of the director's budget headings that all yard services are paid. As discussed in the previous section area engineers are also customers as they are authorized to requisition the surface dressing service. Ultimate customers are the road users and taxpayers.

It is useful to consider the various transformations that take place. At the primary level chippings, bitumen and operator skills are inputs that are transformed by the surface dressing process into a finished road surface. A formal root definition for this is: 'a system to transform bitumen and chippings into a finished skid resistant road surface'. The world view here is a technical one in which inputs are transformed into outputs in a manner that is technically efficient and effective.

The actual surface dressing is carried out by a train of vehicles much like a moving assembly line. Preparatory work is firstly carried out: safety and diversion signage is placed in position, the road or carriageway is closed off and traffic diverted or managed via a stop/go system; an agricultural tractor equipped with a wire brush sweeps all debris from the road surface. A tractor and tanker trailer with attached bitumen spreader distributes a thin layer of bitumen across the surface of the road. A chipping spreader, hitched to a reversed tipper truck supplying chippings, distributes a layer of chippings over the bitumen layer. Next follow two rubber wheeled rollers that embed the chippings into the bitumen layer. Finally follow a number of general operatives who clean out any debris left after the process, fill any gaps in the dressing, and remove any excess chippings. When the tipper truck is empty of chippings it unhitches and goes to the nearest chipping dump to refill. A fleet of eight to ten tipper trucks, depending on the distance to the dump, keeps the spreader supplied with chippings. The second tractor and tanker trailer rig collects bitumen from the supplier ensuring a constant supply of bitumen. Once the new surface has been sufficiently rolled the road is reopened to traffic although a safety vehicle leads traffic for a period of time to ensure that a slow speed is maintained. Twenty permanent and four temporary yard employees carry out the surface dressing process. Area offices provide an additional four to ten employees making it a considerable operation in terms of personnel and equipment.

The surface dressing process has been well honed over the years and is carried out in a technically efficient manner. Set up costs for each job are high as the slow moving vehicles take some time to get to the site or else must be transported by low loader; ideally jobs should be substantial enough to take up a full working day. Average daily output is 25,000m<sup>2</sup> of dressed road; output for the season is approximately 2 million m<sup>2</sup> of dressed road.

Monitoring and controlling of the activity is carried out by the yard engineer who directly supervises the surface dressing activity. Monitoring and controlling of bitumen, chippings and finished surface dressing is carried out by the yard technician who takes

samples on site and later tests them in the yard laboratory; performance measures exist against which to rate each sample.

A number of constraints on the process exist. Surface dressing can be carried out only during the warmer months of the year: bitumen will not bind to chippings in low ambient temperatures. In recent years yard employees who retired were not replaced; many of the current employees are due to retire in the next few years and might not be replaced. Many of the yard vehicles are old; the local authority has been slow to invest in new vehicles for the yard.

At a more strategic level the transformation is as follows: the inputs are the county's roads and these are transformed over the course of a planning period into safer roads. A formal root definition is: 'a system that maintains the road network of the county at a satisfactory level of skid resistance in an effective and efficient manner'. The viewpoint here is managerial and the issues relate as much to prioritizing, scheduling and budgeting as to technical efficiency. Constraints are the available budget and the number of kilometers of road that it is possible to treat in a season with one surface dressing train.

While not formally declared, a third worldview can be deemed to exist: that the yard is a vehicle for generating overtime. The transformation taking place here is to turn inputs - available activity - into outputs - overtime; the beneficiaries of this transformation are the yard employees, in particular supervisors, drivers and fitters.

## **Discussion**

I will treat the discussion in two parts. Firstly I will discuss the result of the analysis carried out and the implications for the yard. Then I will discuss the approach taken and the complementary use of strategic and operational techniques.

The most important action for the local authority to take is to eliminate regular rostered overtime. This imposes a huge cost burden on the yard especially during the cold season when surface dressing is not carried out and revenues are low. This will not be easy to achieve as employees have been earning high wages for many years and will be reluctant to cut back on earnings. Also, anecdotal evidence suggests that such overtime arrangements are more widespread than the yard existing also in other units of the organization increasing the scale of the issue. However, unless this action is taken it is difficult to see a future for a yard in which senior management has lost confidence. In essence this requires comparing and reconciling the three yard world views: technical efficiency, value for money, and overtime. The nub about which implementation of change in the yard will centre is this reconciliation of three world views.

The yard in essence operates as a hire-out company: it charges for vehicles on the basis of hours worked (applying different charge out rates for different periods e.g. winter hire-out, standard and overtime with rates increasing in that order). No incentive to increase the efficiency of the yard activity exists as all time and costs are simply passed on to the customer. A pricing arrangement based on outputs would force the yard to become more

efficient in its cost structure. For example, if area engineers insisted on paying a price per m<sup>2</sup> for finished surface dressing this would force the yard to monitor its costs as it could no longer simply pass these on to the customer. It would also allow area engineers directly compare yard and private contractor rates making the industry more competitive.

The yard engineer holds budget responsibility for all yard activity but directly supervises only surface dressing, winter gritting and chipping drawing activity. The yard supervisor directly supervises the facility maintenance, pothole patching and hire-out activities. However, the yard supervisor signs off timesheets for all drivers, fitters and general operatives. This situation is potentially problematic as the yard engineer who supervises the surface dressing work on a day to day basis does not sign off timesheets for the staff carrying out the work. Also, the yard engineer, although having budget responsibility for the facility maintenance work, has little day to day involvement in that work. Increased control needs to be placed over the signing off of timesheets and the authorization of overtime.

Activity in the stores is so low that it is not possible to justify its continued existence. However a considerable amount of procurement of goods and services, especially hire-out of vehicles, is carried out within the local authority as a whole. This activity is largely ad-hoc with the local authority losing out on potential economies of scale. A new unit to monitor and control the procurement of goods and services across the entire organization could be set up, providing a new and expanded role for the store man.

Pothole patching is an area level activity and benefits little from its current location in a centralized yard. It is logical for responsibility for the integrated pothole patching vehicles to be decentralized to area offices. Facility maintenance also benefits little from its location in the yard as it has no synergy with any other yard activity. There exists another centralized wastewater maintenance facility within the local authority that is charged with maintaining the more modern wastewater treatment facilities (the yard maintains the older treatment works); the local authority would gain economies of scale if yard fitters were to be relocated to that centralized facility.

The budget for winter gritting is at area level but areas have no involvement in calling out or organizing the winter gritting process. It is logical for budget responsibility for winter gritting to be centralized. Indeed there is a case to be made for winter gritting activity to be organized on a multi-county level as currently regional roads may be gritted by one county and not by the neighboring county leading to the potentially hazardous situation of gritting suddenly ending at the county boundary.

The combination of strategic and operational analysis tools was found to be useful in practice. The two sets of tools were complementary with the strategic analysis setting the context for the operational analysis and the operational analysis putting structure on a 'messy' situation making it more tractable for strategic analysis. Both sets of tools are 'soft': the five force analysis is a form of economic analysis softer than traditional microeconomic analysis; SSM is a 'soft' operational analysis technique suitable for 'messy' unclear situations that involve people related and technology related issues. In

practice both sets of analyses were carried out in tandem with no distinction made to interviewees or domain experts.

The formal decomposition of activities made the situation tractable from a strategic point of view allowing issues to be raised against each distinct activity and also against the yard as a whole. Applying the concept of business processes was a useful one in itself as previously the yard had been viewed more as a collection of vehicles and staff than as a collection of processes. The process view also starkly demonstrated the lack of synergy between the various yard activities. The results of the study support the view of Kirika and Mullen (2005) that strategy determines processes and processes in turn determine structure.

The PEST technique, apart from setting the context for the entire study, also provided a number of categories under which the environmental constraints (the E in CATWOE) could be analyzed. The five force approach enhanced the CATWOE analysis: concepts of buyer and supplier power, switching costs, availability of substitutes, and threat of backward and forward integration deepened the understanding of customer (the C in CATWOE) and supplier (treated under A, other actors, in CATWOE).

One outcome of this research is to suggest that strategy texts include a review of operational analysis techniques and methodologies and in particular process decomposition. While the importance of processes (Ghoshal and Bartlett, 1998:ch.7) and the process of strategy making itself (Burgelman, 1996) have been accepted into the strategy literature, strategy texts traditionally do not discuss process analysis techniques per se (other than the value chain (Porter, 1985) which is a generic high level process decomposition tool; Porter (1996) has continued to emphasize the importance of activity analysis in his writings). Writers from the operations field have applied their techniques and approaches to strategic level analysis (Warren, 2002; Coyle 2004; Ackermann et al, 2005).

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