When a
PORT CALLS
... an operations researcher answers

University professor gets his feet wet in the real world when he is pulled out of the classroom and put in charge of the Piraeus Port Authority in Greece

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OR/MS Today, April 1998, pp. 38-41.

In late July 1996, a high-ranking official of the Greek Government asked me if I was interested in the position of General Manager of the Piraeus Port Authority (PPA). Being a full-time professor at the National Technical University of Athens (NTUA) with a background in maritime transportation, logistics and operations research, I was, at first, baffled by the inquiry. Such positions in Greece were typically reserved for people with strong political connections to the party in power, and I had none. Also, at that time I was completely overloaded with assignments at NTUA, including the management of three major European Commission research projects (all in maritime transportation), and I did not want to completely break contact with them. And even though port management was certainly within the realm of my teaching and research activities, this was the real thing. I knew about the PPA only superficially, and I certainly did not have any experience of either managing a port or dealing with politicians or labor unions.

I expressed these views to the official. He said that the government wanted to break with tradition and appoint a specialist rather than a politician to this post. I asked for some time to think this over. Later that day he called me to announce that I was officially appointed by the Cabinet. The appointment was for three years, during which I could keep my NTUA duties on a part-time basis.

The port of Piraeus is part of the Athens greater metropolitan area (population about 5 million, about half of Greece). Each year about 12 million passengers go through the port, which is by far the largest in Greece (Thessaloniki is a distant second). The port is one of the most important in the Mediterranean, being located at the crossroads of three continents: Europe, Asia and Africa. In addition to passenger traffic, it also has a substantial volume of cargo traffic, in areas such as drybulk, general cargo and (most important) containers. In 1996, throughput was on the order of 10 million tons of non-containerized cargo and 585,000 TEU (Twenty-foot Equivalent Unit. This is the unit of measurement of container traffic, and refers to the standard 20-foot container).

All business dealing with the port is administered by the PPA, which is a public body independent of the City of Piraeus. The PPA is managed by the general manager, who is the port's chief executive and who reports to a 14-member Board of Directors. The Minister of Merchant Marine appoints the majority of the directors (including the President of the PPA). In fact, the Ministry of Merchant Marine, which is the ministry dealing with all aspects of Greek shipping (and which is independent of the Ministry of Transportation) oversees all ports in Greece. The total number of PPA personnel (including about 700 dockworkers) is about 2,100. The Authority is broken down into 12 departments and four minor divisions, all reporting to the general manager.

The PPA's annual budget is on the order of $120 million. Revenues in that budget come from cargo handling, port dues, storage and generally any charge to port users for services rendered to them. Expenditures go to salaries of PPA personnel, construction and maintenance of port infrastructure, purchase of equipment, and other port operating expenses. Historically, the PPA has never received any funding from the Greek state, but is legally obliged to financially support the City of Piraeus and four other adjacent municipalities. Some of the port's infrastructure development is financed in part from the European Union's Cohesion Fund and by a long-term loan from the European Investment Bank.

What was the situation with the PPA in mid-1996, and what could an OR professor do about it?

Things were a bit unsettling for Piraeus in mid-1996. The decision of container lines Evergreen and Lloyd Triestino a few months earlier to move their transshipment hub to Gioia Tauro in southern Italy was certainly bad news. And indeed, after several years of growth, 1996 saw the volume of container traffic through Piraeus decline by approximately 3 percent vis-a-vis that of 1995. This reduction was solely due to a reduction of transshipment traffic through the port, as local traffic of imported and exported containers continued to grow as in previous years.

The market for container transshipment is one of the most dynamic ones in liner shipping. With the economies of scale realized by large (up to 8,000 TEU) container vessels deployed on trunk routes worldwide, it is not cost effective for these vessels to make direct calls in many ports. For this reason, lines develop "hub and spoke" systems, in which smaller "feeder" vessels distribute containers to and from smaller ports, whereas larger "mainline" vessels connect only to larger ports ("hub ports").

Which ports establish themselves as hub ports worldwide is up for grabs, and the Mediterranean is no exception. The main trunk route of the Mediterranean is the one connecting the Far East with Northern Europe, through the Suez Canal and Gibraltar. Some of the traffic on this route makes no Mediterranean port calls. However, some of the traffic comes from (or is destined to) markets on the Mediterranean (or close to Mediterranean ports) or markets in the Black Sea, and therefore has to pass through a Mediterranean port, either as local traffic or as transshipment traffic.

Container lines such as Sea Land and Maersk have a huge transshipment terminal in Algeciras (Spain), where containers are switched not only between a mainline and a feeder vessel, but also between two mainline vessels (the latter practice is called "interlining"). Other lines use ports such as Malta, or Damietta (Egypt) as hub ports. The story of the Medcenter Container Terminal in Gioia Tauro is indicative, as this port was not even on the map in 1995, but via an aggressive expansion and pricing policy is now one of the top Med hub ports.

In Piraeus, the question was whether the 1996 decline was a "statistical glitch" or something more serious. Actually, transshipment had never accounted for more than 25 percent of the volume of container traffic through Piraeus, the bulk of the latter being local (mainly incoming) traffic. However, with the completion of a new 700-m length, 16.5-m depth quay and the delivery of four new Post-Panamax gantry cranes (all of which were targeted for completion by mid-1997), the box throughput capacity of Piraeus would about double. The question was, Who would bring in enough traffic to fill in the new capacity?

That was not a trivial question to answer. In fact, I soon discovered that the analysis behind the decision to acquire the new capacity was based on questionable assumptions. For instance, it was assumed that the investment cost for this new capacity would be paid off by revenue generated by new local container traffic, and that our tariff structure would remain unchanged.

I was amused to think that for an OR professor looking for opportunities to apply his sophisticated knowledge of hierarchical decision models, the fact that such a strategic decision had been made in prior years certainly made things easier: I was spared the trouble of justifying a similar decision myself. I only had to find a way to make it work.

The problem was that to fill in the new capacity by a substantial increase in local container traffic would involve factors that went beyond maritime transportation. Much of the local traffic through Piraeus goes to or comes from the Athens greater metro area, and only moderate growths were predicted for it. The only way to increase local traffic as a step function would be to divert the substantial traffic that came into or left Athens via other routes (for instance via Bulgaria onboard trucks) so that this cargo could be shifted to containers that pass through Piraeus. Given the myriad of possible routes to and from Athens, this "modal split problem with generalized costs" was considered too complex, so this possibility was dropped, at least as a short-term prospect. We wanted something fast.

This left the transshipment market as the only one to consider. With about 4 million

TEU annually transshipped within the Mediterranean, the pressing question was, Can we at least grab some of it? In the fall of 1996, and with two lines having just quit Piraeus, that was not an easy question either.

We knew that Piraeus enjoyed several advantages over rivals such as Malta or Gioia Tauro, none of which had a serious local market potential, or was close to the expanding Black Sea market. For a shipping line interested in transshipment, having a local market was an incentive, so that costs could be spread over more traffic. Of course, with the fluid situation in the container scene and with the cutthroat competition among carriers globally, we realized that it would take more than wishful thinking to lure box traffic to Piraeus. It was clear that having a good geographical location, some local potential and some spare capacity were not enough.

The approach that we followed was void of sophisticated OR models, but went back to fundamentals. Customers complained that our transshipment tariffs were not competitive. They were right, so we drastically reduced them, bringing them close to those of the competition. We established a sliding scale for the new rates, which were "flat," that is, the same for a 20-foot or 40-foot container, empty or laden. The new rate structure was substantially simpler than the old one. In calculating the rates, we went through the exercise of computing the marginal costs of the terminal, something that was never done before and was not as easy as it looked at first glance.

Customers also wanted guarantees of immediate berth and crane availability in order to use Piraeus as a hub. The spare capacity available provided a necessary condition for these guarantees. But we had to change our regulations to provide priority and enough equipment to companies in return for a guaranteed volume of transshipment traffic.

Last but not least, customers wanted to be able to sign a legal contract with the PPA in which all mutual obligations would be spelled out. So we changed our regulations so that the PPA could sign such contracts (before that, it could not).

All of these reforms went on in parallel with (and to some extent were driven by) negotiations with Mediterranean Shipping Company (MSC) and Norasia Line two carriers which cooperate on a worldwide basis. These companies were using Malta as a hub, but seemed to want something closer to the Black Sea. They were extremely demanding. They began talks with us in November 1996. When they first came to Piraeus, our biggest labor union was on strike. The lines were not enthused, but after some tough negotiations, we signed a contract with them a year later.

A difficulty in these negotiations was how to decouple the negotiation process (which was quite specific) from the process of regulatory and tariff reform (which was quite general). We wanted the contract to be compatible with the new regulations, but at the same time we wanted these regulations to be general enough so that a variety of other agreements could be signed in the future.

With a total traffic increase ranging from 70-85 percent in the first three months of the agreement vis-a-vis volumes a year before, it is fair to say that we succeeded in reversing the downward trend of 1996. In fact, 1997 closed around 680,000 TEU a 16 percent increase vs. 1996. There is also a good chance that traffic in 1998 will be above 900,000 TEU, a 32 percent increase vs. 1997 and a 54 percent increase vs. 1996, although one has to watch how the situation will stabilize. As other major lines have also expressed interest, we want to be careful before undertaking new commitments. According to "Lloyds List," Piraeus put itself back on the hub map.

Before this agreement was implemented, there was considerable concern from other users of the terminal that service to them would deteriorate as a result of the focus on the two lines that signed the contract. It turned out that these concerns were exaggerated, as service to other companies remained quite acceptable. However, the system may move close to saturation if we implement another similar agreement.

In the tariff reduction exercise, we did nothing on the tariffs for local (import or export) container operations. These tariffs are quite higher than transshipment tariffs, even though marginal costs are essentially the same between the two cases. The price difference reflects the substantial difference in the elasticity of demand between the two cases (which is low for local operations and quite high for transshipment). And although the PPA has no way of computing elasticity directly, it takes them into account implicitly in the above pricing policy.

OR / MS applications

Here are some interesting OR/MS-type problems with the container terminal:

1. ***Scheduling berthing priorities.*** Right now our scheduling policy is FCFS, although this can be overridden if necessary. As FCFS is not necessarily optimal, the question is, what policy is better? If FCFS is overridden, there should be at least some rules, so that the PPA is not accused of being arbitrary and unfair.

2. ***Booking by "rendezvous."*** We are thinking of switching to a system in which a line could book a berthing time slot in advance and is guaranteed service in that slot. That would streamline utilization of cranes during peak periods and would effectively increase our capacity.

3. ***Allocation of ships to berths and cranes.*** A question is: How many gantry cranes should be allocated to each ship on arrival, at which berth this should take place, and how many shifts of labor should be allocated?

4. ***Yard management.*** As containers are continually rearranged into the terminal's stacking areas, the question is how to do this so as to minimize movements of straddle carriers and increase throughput.

5. ***Route and schedule consolidation.*** By a suitable consolidation and rearrangement of their routes and schedules, many lines could find that coming to Piraeus for transshipment is beneficial. Which lines are prime targets for such a campaign by the PPA?

A difficulty that I face is that there aren't that many people with an OR background in the port. There are some people with a statistics background (we even have SAS installed), but clearly more are needed to tackle these problems. The implementation of a comprehensive computerization project, which is just under way, is expected to alleviate many of these problems and increase productivity in the terminal while reducing costs.

Tariff restructuring

Tariff reform in Piraeus was (and still is) very pressing. The berthing fee for a 500-foot ferry in the Piraeus passenger port was approximately $16 per day equivalent to that of parking a private car. This meant an effective cross-subsidy of passenger operations by container operations. The latter typically accounts for approximately 70 percent of PPA's annual revenues, whereas berthing fees for ferries account for only 0.7 percent. To rectify this, the PPA approved increases of up to 200 percent on ferry berthing rates, in spite of the screams of protest from local ferry operators.

The European Commission (Directorate General for Transport) has produced a draft of the so-called "Green Paper on Ports and Maritime Infrastructure." Although a Green Paper is only a document that records facts and issues guidelines as suggestions (as opposed to a White Paper that issues directives to comply with), principles such as "user pays," "transparency in port pricing" and "avoidance of state subsidies" receive prominent attention. The process of restructuring all tariffs that is in full swing at PPA moves us in the right direction as far as this document is concerned. The PPA actively participates in the European Sea Port Organization (ESPO) in discussing issues such as these.

Institutional model

The management and institutional model of the PPA dates back to the 1960s. This model has served the port well, never requiring the State to support it financially, and allowing the port to finance its own development. However, it is obvious that change is long overdue. As competition in the port sector has become stiffer, it is clear that the current model is not well-geared for flexibility and aggressive marketing. To correct this situation, the PPA is in the process of becoming a corporation owned by the State. An ultimate floating of stock in the Athens Stock exchange is envisaged, although this would probably take some time.

Epilogue

Some final remarks about my experience in this post:

1. My NTUA duties seem to be doing fine, although my students and other associates see me more in late afternoons, evenings and weekends. I still teach one course a year and I still have research projects (even some new ones). At times though, I feel schizophrenic working as both a producer and a consumer of R&D.

2. Dealing with labor unions is an interesting experience. The PPA has three major ones and 11 smaller. All seem to know what they want. Of course, we disagree many times, but that is normal.

3. Dealing with politicians is also an interesting experience. Following deep-rooted traditions of Greek politics, some of them seem to want to be involved in every imaginable aspect of the PPA operation. Interaction with them proved challenging at times.

4. There is one activity that has received a serious blow as a result of all this. This is my editorial responsibility, mostly reviewing papers for INFORMS journals. I don't have that much workload these days, but I know I am late in chasing referees, and in responding to authors. Sorry folks, I hope I'll be able to compensate for this somehow, some time.