The design of logistics operations for the Olympic Games

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Abstract
Purpose – This paper aims to focus on the design of the organization, processes, and systems of Olympic logistics.

Design/methodology/approach – A systematic methodology has been developed to design the strategy and tactics of logistics operations for the Athens 2004 Olympic Games. This methodology considers Olympic-specific characteristics, host country characteristics, as well as lessons learned from previous games. It comprises the generation, analysis and evaluation of strategic alternatives, the development of core business processes and the prediction of resource requirements. Furthermore, the proposed method provides guidelines to complement the experiential knowledge that has been used exclusively in the past to plan the logistics operations of the games and similar large-scale events.

Findings – Successful design principles, such as model venue planning, standardization of materials, the establishment of the Logistics Command Center (LCC), as well as establishment of an independent administration function, can be applied regardless of the specific characteristics of the host country. However, there are principles such as outsourcing, warehousing, or just-in-time (JIT) deliveries, that are based on certain specific characteristics (constraints/advantages) of the host country, such as a mature 3PL market, the existence and availability of large warehouses, and the completion of the venues in sufficient time prior to the beginning of the games.

Practical implications – The proposed design process provides generic rules that may be applied to guide the set up of operations for future games. Furthermore, the paper offers some useful insights applicable to the logistics of large events.

Originality/value – It is the first time that a systematic view of Olympic logistics is dealt with, as opposed to experiential knowledge with local applicability that has been used in the past to plan similar operations.

Keywords Olympic Games, Logistics data processing, Business planning

Paper type Research paper

Introduction
The summer Olympic games are considered by many experts to be the greatest, non-defence related, world-wide logistics event. It is the gathering of over 15,000 of the world’s finest athletes competing in over 28 sports (SOCOG, 2001), in a period that spans approximately one month. Recent games typically attract 20,000 members of the media (both International Broadcasters and Press), are supported by about 150,000 staff members and volunteers, host over 5.5 million ticketed spectators and are watched by billions of TV viewers (ACOG, 1997; SOCOG, 2001).
In order to stage this great event, there are immense logistics challenges that focus on planning, managing and executing the receipt, tracking, storage, transportation, distribution, installation and recovery of all equipment and materials related to:

- external clients (National Olympic Committees, Broadcasters, Media, etc.);
- functional areas (FAs) of the Organising Committee of the Olympic Games (OCOG); and
- the logistics of the Olympic venues.

Some of these challenges are faced frequently in other large events, such as political conventions, trade shows, as well as sports events (e.g. the World Cup, Super Bowl and Formula 1 races). Despite the business importance of such events and the unique aspects of event logistics, the latter have been largely overlooked in the relevant literature.

The authors of this paper were tasked to develop the strategy and the principles of operations, as well as to design the detailed operations of the Athens 2004 Olympic Games. This task was conducted in years 3 and 2 prior to Games-time (G-3 and G-2). Subsequently, two of the authors were tasked to lead the delivery of Olympic logistics operations. In order to define the scope and characteristics of Olympic logistics, the authors initially reviewed the post-games evaluation reports from the Atlanta 1996 (ACOG, 1997) and the Sydney 2000 (SOCOG, 2001) Olympic games, which contained mostly high-level information on games logistics operations. However, due to the lack of significant related literature, the gathering of key data and the acquisition of actual operational experience was deemed necessary. To this end, two of the authors served as ATHOC observers in the Sydney games and had the opportunity to visit the related logistics facilities, observe part of the operations, and interviewed extensively top logistics managers. In addition, repeated workshops were held in Athens with the logistics managers of Atlanta, Sydney and of the most recent Commonwealth Games (Manchester 2002) to transfer scope-related knowledge and data, operations knowledge, as well as lessons learned from these events. In fact, aspects of the strategy for the Athens Olympic logistics and critical concepts of operations were discussed extensively with the Atlanta and Sydney logistics directors.

This paper presents the design of the Olympic logistics organization, processes and systems in order to achieve efficient and cost effective operations, while taking into account all significant constraints and factors that stem from the nature of the games. The methodology applied has taken into account Olympic-specific characteristics, host country specific characteristics, as well as lessons learned from previous Games. This methodology is based on generation of reasonable alternatives, evaluation of these alternatives, and selection of the most appropriate one (Lambert and Stock, 2000). The design process also provides generic rules that may be applied to guide the set up of operations for future games. This is perhaps the most significant contribution of this paper, since it is the first time that a systematic view of Olympic logistics is dealt with, as opposed to experiential knowledge with local applicability that has been used in the past to plan similar operations. Furthermore, the paper offers some useful insights applicable to the logistics of large events.

The structure of the remainder of the paper is as follows: first, the scope of Olympic logistics and its unique characteristics are presented. Next, a summary of the Atlanta 1996 and Sydney 2000 experiences and the related lessons learned are discussed. The strategy for the Athens 2004 logistics operations is presented next along with the
basic directions for setting up significant business processes and for sizing the necessary resources for the Athens case. Finally, recommendations concerning the design of future Olympic logistics operations, as well as the logistics of other major events are summarized.

The scope and characteristics of Olympic logistics

Scope of Olympic logistics

Owing to the size of Olympic Logistics operations, as well as for reasons of organizational and implementation effectiveness, the Organizing Committee of Olympic Games (OCOG) of each host city had formed a special department, responsible for the design, implementation and management of all related activities, including:

- demand planning and analysis;
- contract management;
- international freight forwarding;
- receipt, warehousing and distribution;
- asset management;
- delivery management;
- venue logistics management (VLM); and
- reverse logistics.

In each of the recent games, the OCOG has been called to coordinate logistics services for several internal and external client groups. The term “internal client” is used to describe all FAs of the OCOG that may require logistics services. Major internal clients include sports, technology and overlays (i.e. the necessary construction related additions and/or alterations to render an existing structure fit for Olympic use). The term “external client” is used to describe all the athletic and non-athletic groups, organizations and individuals outside the OCOG but directly related to the staging of the Games. Major external clients include the National Olympic Committees, media, as well as all vendors and suppliers.

The major activity of the supply chain that concerns external clients (outside the OCOG) is transportation, i.e. freight forwarding – including customs clearance procedures – from the point of origin to the destination Olympic venue (and the reverse). The OCOG (internal) supply chain is the most extensive and comprises demand planning, procurement, warehousing, transportation and distribution, managing Games-time deliveries, and reverse logistics (i.e. post-games removal and recovery of materials). Logistics activities at Olympic venues include receipt at venues, in situ material handling, local storage, installation, etc.

It is noted that the provision of services to the above-mentioned clients is not obligatory in all cases. Each host city forms its particular contractual agreements with the clients (ATHOC, 1997), in which the services to be provided are specified.

Characteristics of Olympic logistics

The event character of the games imposes several unique characteristics to Olympic logistics that greatly affect the design of the related processes and systems developed by each OCOG. The most important of these characteristics are the following:
- **Transient nature.** The duration of the Olympic games, both summer and winter is approximately two weeks. Although, in both cases, there is a long planning period (2-3 years), substantial logistics activities take place within a period that starts about a year prior to the games, and two to three months after the games end. Thus, the entire operation is a transitory one with no steady state processes.

- **Size.** Typical numbers from recent games characterize the large-scale of logistics activities and include: more than 6,000 containers imported in the host country, about 100,000 m² of warehousing space utilized, over 400 material handling equipment units used and about 1,000 logistics staff employed.

- **Demand diversity and uncertainty.** There exists large diversity of items and equipment to be managed; furthermore, there exists uncertainty in quantities, as well as in the arrival and departure times. For example, the items to be managed may include anything from sail and regatta boats, to technology items, equestrian horses, furniture, medical supplies, etc. In addition, there is only limited prior knowledge of the demand size and timing, as both external and internal clients announce of some requirements only months or even days prior to the opening ceremony. Furthermore, the transfer of knowledge from previous games is very limited as far as quantifiable information is concerned due to, mainly, the rapid dissolution of the OCOG after the Games.

- **Firm schedule and milestones.** The Olympic games is a classical case of a project with immovable deadlines (Kerzner, 2001). The date and time of the opening ceremony, as well as the entire schedule of the games, is set as soon as the games are awarded to a candidate city, i.e. 7 years before the games start (G-7). This schedule cannot be changed, and forms a hard constraint for planning and project management of games operations, including logistics.

- **Work right from the first time.** In addition to the fixed schedule, the Olympic logistics staff does not get a second chance to correct mistakes. During the two weeks of the games, every mistake may have significant implications; furthermore, there is no time to improve processes, procedures or provide additional staff training.

- **Staff mix.** Typically, the staff of the Olympic logistics team (especially the labour force) is newly hired, and in most cases inexperienced. Furthermore, most OCOGs use volunteers. In Olympic logistics, a ratio 1:1 of professional staff-to-volunteers is not unusual.

- **Integration requirements.** Logistics contributes greatly to the integration of Organizing Committee operations. It provides significant material resources to all FAs of the OCOG, and is responsible for timely delivery of these resources in the right quantity and quality. Thus, during both planning and execution, logistics interfaces continuously with a wide range of clients with interdependent requirements.

In addition to the above unique characteristics, the environment of the country that hosts the games needs to be considered carefully in designing the organization, which will perform the logistics tasks. Some of the significant aspects of the external environment to be considered include the following:
The host country location. This affects most notably freight forwarding operations. For example, most freight in the Sydney games was transported to Australia by sea, while in Greece, for the Athens 2004 games, freight will be transported both by sea and by land. This affects the customs clearance and security screening processes at the Gateways of the host country, as well as the lead times and contingency plans that concern freight.

The logistics infrastructure. This includes the availability of ample, appropriate and cost effective warehousing space (covered and open) in the greater area of the Olympic venues, as well as other warehousing and transportation resources (appropriate space at the venues, material handling equipment, information technology, etc.)

The host country’s logistics know-how and logistics business environment. The maturity and state of advancement of logistics in the host country are possibly the most significant factors of the external environment. It is clear that a mature logistics culture provides to the OCOG much greater flexibility and a wider range of decision choices.

It is noted that many of these characteristics are relevant not only to the Olympic Games, but also to other major events (sports events, trade shows, etc.). For example, all events are transient, have a firm schedule, they are characterized by diverse and uncertain demand, are supported by staff of diverse experience and background, and there is virtually no margin for error. Based on the nature of the event, planners should recognize which of these characteristics are critical and plan accordingly. It is emphasized, however, that much of the design approach for Olympic logistics is relevant to most other events due the size, range of activities, and importance of the games.

The logistics operations of recent Games

The implementation of logistics services varies in several aspects between the various host cities of the previous games. The information below concerns the Atlanta 1996 and the Sydney 2000 Olympic games and encapsulates valuable lessons concerning strategy and organization, which should be considered in designing the logistics operations of future games.

The logistics operations of Atlanta 1996

Strategic decisions.

- **Model venue planning.** Effective methods were developed for the optimisation of the space required at each venue and for the determination of the FF&E needs for each FA operating within each space. The logistics department (LD) used one venue as a model, for which complete identification of the needs and requirements in materials and FF&E was carried out and the associated logistics requirements were determined. By extrapolating this plan to all venues, LD was able to estimate approximately 80 per cent of the total needs.

- **Venue podding system.** Each venue was allocated a predetermined space in the warehouse for storing the venue’s material and equipment. This system simplified the process of warehousing, checking for delays, missing items, etc.
Oversight of the entire process was provided by the VLM of the respective venue. It has to be noted that this method is not, however, space efficient.

- Legislation. A special Public Law was passed by the US Congress in May 1994, allowing for reduced entry documentation and eliminating quota requirements for Olympic-related goods. This legislation reduced the importation costs significantly, and facilitated more efficient processing.

- Environmental considerations – waste management and recycling. ACOG developed and implemented voluntarily an integrated waste management plan with a goal of diverting up to 85 per cent of all generated solid waste from landfills.

Organization. The Atlanta Logistics Department comprised four major divisions, as shown in Figure 1.

The logistical support division was responsible for warehouse operations, the transportation and distribution of all materials and equipment, the coordination of all international shipping and customs brokerage procedures, and asset management and tracking.

The responsibility of the venue logistics division included the identification of material requirements for all venues, as well as the provision of dock management and delivery scheduling at competition and non-competition (villages, etc.) venues.

Thus, all logistics tasks outside venues fell under the responsibility of the logistical support division. This combined international forwarding and customs clearance with domestic transportation, warehousing and distribution, i.e. two major operations with different requirements, processes, or even culture. On the other hand, the assignment of venue logistics operations in a separate division was appropriate, since in all OCOGs venues are considered as internal clients and have their own organization that comprises several functions, including logistics. The logistics manager of a venue reports in a matrix fashion to both his/her venue manager and to the venue logistics division. Furthermore, the related venue processes are separate from (and interface with) the central logistics processes.

The fact that the LD had its own administration, led to efficient control of staffing, planning budgets, and other administration related procedures. Finally, LD was responsible for waste management and recycling, processes that are not directly related to logistics.

The logistics of Sydney 2000

Strategic decisions. One of the major strategic decisions of the Sydney 2000 Logistics Team (S2LT) was the outsourcing of major processes and services to third party companies with specialised logistics expertise. Of course, S2LT maintained the final

Figure 1.
The Organization of the Atlanta 1996 Logistics Department
control and management of operations. Major functions outsourced were provision of experienced personnel in freight forwarding and customs clearance; technological support (i.e. implementation of an inventory tracking and material planning system, as well as software for scheduling of vehicles delivering to venues). Outsourcing differentiated the Sydney Olympic games from previous games. This enabled S2LT to adopt industry best practices, and provided a dynamic and professional skill set specifically designed to meet the challenge of supporting the games.

Established of a Logistics Command Center (LCC), which provided coordination for warehouse management, freight transport and customs clearance, asset tracking and inventory management, Master Delivery Scheduling (MDS) for venues.

The concepts of just-in-time (JIT), and direct-to-site (DTS) deliveries were adopted, in order to minimize warehouse space requirements, related costs, as well as all errors and risks associated with warehousing. JIT also reduced the need for sophisticated warehouse management systems. Weaknesses of the JIT and DTS concepts included the risk of identifying shortages or errors late without the possibility to recover, and late deliveries.

Security self certification program. The purpose of the Self Certification Program was to allow authorised and certified Olympic vendors and suppliers to pre-screen and seal their freight at their facilities (under the supervision of the Security Dept) prior to delivery to an Olympic venue. This process facilitated priority access to Olympic venues while maintaining a high level of security.

Organization. The Sydney logistics organization (S2LT) included five divisions as shown in Figure 2.

Venue logistics performed planning, implementation and management of the logistics activities at each venue (scheduling, shipping, distribution, supply operations, asset management, recovery). The responsibility of the Olympic operations subdivision included planning, operation and management of the Olympic warehouses, management of the vehicle checking points (Marshalling Yard, etc.), scheduling of deliveries and security processes. The Freight and Airport Operations subdivision coordinated all transportation and freight operations, concerning the Olympic Family and Olympic Clients. Finally, S2LT was responsible for procurement and its own administration.

In this case there was an organizational separation between domestic logistics and international forwarding. This is considered appropriate, especially since these two tasks were outsourced to different providers. As was the case in Atlanta S2LT managed its own administration activities, a clear strength. Finally, procurement was the responsibility of logistics maintaining the integration of the supply chain.
Comparison of the logistics operations of recent games

The specific characteristics of the host country (and/or state) affect greatly the planning and implementation of logistics operations. For example, the ample availability of warehousing space and other resources in Atlanta, allowed the Atlanta 1996 LD to develop an entire logistics division in-house. On the other hand, the extensively developed 3PL market of Australia enabled the S2LT to outsource most of the essential processes.

Some of the abovementioned processes, such as model venue planning, standardization of materials, the establishment of the LCC, as well as establishment of independent administration, can be applied regardless the specific characteristics of the host country. Other processes are based on certain preconditions, such as the existence and availability of large warehouses, a mature 3PL market and the completion state of the venues in sufficient time before the beginning of the games. Thus, the design of logistics operations in each host country should sufficiently examine and address the specific characteristics of the external environment that influence the applicability of key principles.

An immediate result of the design choices of the OCOG are the resources employed to execute the logistics operations. Table I presents the respective numbers for the Atlanta 1996 and Sydney 2000 Olympic Games.

It is evident that the application of Direct to Site and JIT deliveries in Sydney reduced the size of the necessary warehouse space and the number of transportation vehicles required, in comparison to the Atlanta figures. It is also evident that the above figures are influenced by the budgetary constraints of the organizing committee as well as market availability. However, a lower limit of resources must be set, so as to ensure the successful implementation of the logistics processes.

### Strategy for the Athens 2004 logistics operations

The key issue in setting the logistics strategy of the Athens Organising Committee (ATHOC) concerns outsourcing. It has been clear that outsourcing certain major logistics activities should be examined carefully, given the high specialization required to accomplish these activities, the intrinsic temporary nature of Olympic logistics, as well as the non-core (although critical for the success of the Olympics) processes involved.

### Feasibility of outsourcing for the Athens Olympic logistics

The strong evidence that outsourcing was successful in Sydney had significant influence in the formation of the Athens strategy. This evidence was obtained from the Sydney post-games report, from direct observations conducted by the Athens team during the Sydney games, and from interviewing top S2LT management.

<table>
<thead>
<tr>
<th>Resources</th>
<th>Atlanta 1996</th>
<th>Sydney 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warehousing space</td>
<td>131,000 m²</td>
<td>67,500 m²</td>
</tr>
<tr>
<td>Material handling equipment (number)</td>
<td>Not known</td>
<td>165</td>
</tr>
<tr>
<td>Transportation vehicles</td>
<td>+400</td>
<td>21 (dedicated)</td>
</tr>
<tr>
<td>Human resources (employees)</td>
<td>163</td>
<td>550</td>
</tr>
<tr>
<td>Human resources (volunteers)</td>
<td>500</td>
<td>500</td>
</tr>
</tbody>
</table>
It is also pointed out that S2LT outsourced most of its logistics operations during the Sydney test events, having thus the opportunity to assess various options (and contractors) in a test environment. The success of logistics in these test events built confidence to both the outsourcing option and to the related contractors. In addition, the rigorous selection process followed by S2LT, and the strong induction program, enhanced the possibilities of success. As a result, in the intense two-month period prior to the games, as well as during games-time, both the observations of the Athens team and the self-assessment of S2LT top management converged to the conclusion that service levels were consistently above average, the number of failures was minimal, and customer satisfaction was high.

The success of outsourcing in Sydney provides a good benchmark, but by no means it guarantees that a similar strategy will be successful in Athens. A necessary, but not sufficient, condition for success of this option is the existence of a robust base of logistics providers in the Athens area, both in warehousing and distribution (3PL) as well as in freight forwarding services.

In order to assess the related strengths of the Athens logistics market, the authors conducted a survey, followed by a workshop with representatives from candidate companies. In addition to evaluating market strengths, the scope of these activities was to both inform and activate the logistics community to prepare for possible forthcoming tenders by ATHOC.

Figure 3 shows sample results concerning the top 35 3PL companies of the Athens area, with respect to four of several capability criteria examined in the survey. These criteria are compared in Table II. to the related requirements as quantified by the Sydney Olympic logistics experience. This comparison provides strong indications that the Athens 3PL market does possess the size and the management capability to respond to the Olympic logistics challenge, especially when one considers that interested companies may:

- form joint ventures to perform the Olympics-related work; and
- use temporary staff and rented infrastructure to handle the related overload.

Finally, as far as freight forwarding is concerned, the Athens logistics community appears also to be capable of handling the related requirements, since both the international sponsor of freight forwarding services for the last five summer and winter Olympic games and its top competitors have strong local presence.

**Nominal operating scenario**

The method followed in order to set and analyse the different options for outsourcing consists of grouping the logistics activities into major tasks, the related logistics processes into major functions and cross-analysing the resulting groups in an appropriate manner. Subsequently, a nominal operating scenario is presented, serving as the basis for generating outsourcing options.

The major tasks of the LD are presented in Table III. The major operations and the related business processes necessary to accomplish the tasks of Table III are listed in Table IV.

The nominal scenario that relates major tasks to the major operations is presented in Table V. Each cell contains the party being responsible for the corresponding task-operation combination. The nominal scenario of Table V is further discussed.
Freight forwarding and customs clearance. It is clear that forwarding and customs clearance services shall be delivered by an experienced international forwarder – 3P – (as was done in all recent games), since it is neither feasible nor advantageous for ATHOC’s LD to develop internal forwarding and customs clearance support capabilities. LD will define the responsibilities of the forwarder, and will provide the appropriate information about forwarding procedures to the NOCs and other external and internal clients. Furthermore, there will be a joint planning effort with the Greek Customs Service to develop procedures and systems to facilitate importation of Olympic cargo. The coordination and control of the processes should be a joint responsibility of LD and the forwarder.

Table II.
Comparison of Sydney’s Olympic requirements to the capacity of the top five (5) Athens-based 3PLs

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Sydney requirements (r)</th>
<th>Capacity of top five 3PLs (c)</th>
<th>Ratio r/c (per cent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warehousing area</td>
<td>60,000 m²</td>
<td>194,000 m²</td>
<td>31</td>
</tr>
<tr>
<td>Staff managed</td>
<td>550</td>
<td>2,278</td>
<td>24</td>
</tr>
<tr>
<td>Distribution vehicles</td>
<td>21</td>
<td>357</td>
<td>5.9</td>
</tr>
<tr>
<td>Annual turnover</td>
<td>30 m€</td>
<td>173 m€</td>
<td>17.34</td>
</tr>
</tbody>
</table>

Figure 3.
Selected data from thirty-five (35) logistics providers in the Attica area

IJPDLM 36,8 630
### Major tasks and activities of Olympic logistics

<table>
<thead>
<tr>
<th>Major task</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freight forwarding and customs clearance</td>
<td>Transportation into Greece of items and equipment belonging to National Organizing Committees (NOCs) the greater Olympic and Paralympic Family ATHOC (imports only)</td>
</tr>
<tr>
<td>Warehousing and distribution</td>
<td>Management of ATHOC’s warehouses (receipt, breakdown, quality control, put away, picking, consolidation, etc.) Distribution of items and equipment to venues</td>
</tr>
<tr>
<td>Venue logistics</td>
<td>Receipt, storage, installation, maintenance (in some cases) of venue items and equipment</td>
</tr>
<tr>
<td>Delivery coordination</td>
<td>Coordination of deliveries of goods, items and equipment into venues by suppliers of ATHOC (delivery scheduling, security assurance, security control, etc.)</td>
</tr>
<tr>
<td>Asset tracking</td>
<td>Development and operation of a comprehensive asset tracking system</td>
</tr>
<tr>
<td>Reverse logistics</td>
<td>Asset reclaim, transportation, warehousing, tracking, disposal or distribution</td>
</tr>
</tbody>
</table>

Table III. Major tasks and activities of Olympic logistics

### Major operations and processes of Olympic logistics

<table>
<thead>
<tr>
<th>Major operations</th>
<th>Business processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning</td>
<td>Strategic and operational planning demand management</td>
</tr>
<tr>
<td></td>
<td>procurement of third party services</td>
</tr>
<tr>
<td></td>
<td>procurement and preparation of other resources (e.g. warehousing space, IT systems, etc.)</td>
</tr>
<tr>
<td></td>
<td>staffing, etc.</td>
</tr>
<tr>
<td>Coordination</td>
<td>Coordination with all clients</td>
</tr>
<tr>
<td></td>
<td>other FAs of ATHOC</td>
</tr>
<tr>
<td>Service delivery (or task execution)</td>
<td>Delivery of warehousing transportation and distribution services</td>
</tr>
<tr>
<td></td>
<td>venue logistics</td>
</tr>
<tr>
<td></td>
<td>venue deliveries, etc.</td>
</tr>
<tr>
<td>Control</td>
<td>Processes that ensure service quality and efficiency safeguard customer satisfaction</td>
</tr>
</tbody>
</table>

Table IV. Major operations and processes of Olympic logistics

<table>
<thead>
<tr>
<th>Process task</th>
<th>Planning</th>
<th>Coordination</th>
<th>Service delivery</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freight forwarding and customs clearance</td>
<td>LD</td>
<td>LD, 3P</td>
<td>3P</td>
<td>LD, 3P</td>
</tr>
<tr>
<td>Warehousing and distribution</td>
<td>LD</td>
<td>LD, 3P</td>
<td>LD or 3P</td>
<td>LD, 3P</td>
</tr>
<tr>
<td>Venue logistics</td>
<td>LD</td>
<td>LD</td>
<td>LD, 3P</td>
<td>LD</td>
</tr>
<tr>
<td>Delivery coordination</td>
<td>LD</td>
<td>LD</td>
<td>LD, 3P</td>
<td>LD</td>
</tr>
<tr>
<td>Asset tracking</td>
<td>LD</td>
<td>LD</td>
<td>LD or 3P</td>
<td>LD, 3P</td>
</tr>
<tr>
<td>Reverse logistics</td>
<td>LD</td>
<td>LD, 3P</td>
<td>3P</td>
<td>LD, 3P</td>
</tr>
</tbody>
</table>

Table V. Responsibility for tasks and aggregate business processes

Notes: LD, logistics department of ATHOC; 3P, third party delivering the corresponding service
Warehousing and distribution. The solution of outsourcing appears to be more efficient based on the following reasons:

1. It will be very difficult for ATHOC to set up a large enterprise that will operate, in any significant manner, for only 6-12 months. These difficulties arise from:
   - the inability to recruit experienced staff for such a short period, at both the operator and the management level;
   - the inability to secure certain resources, especially warehousing IT systems; and
   - the complications of staff training, and set-up of effective management systems.

2. The cost of setting up and operating such a major logistics operation, as well as training the staff employed, is estimated to be much higher than the cost of hiring an experienced, specialized company to perform the same tasks. Significant cost enhancements will result from high set-up costs (especially related to management and IT systems), as well as high operating costs due to increased staff salary rates for limited employment.

3. The risk of assigning such a significant task to a newly formed, inexperienced organization is much greater than outsourcing it to an experienced third party, for which such tasks form its core business.

However, as in the case of forwarding, the LD is required to assume responsibility for planning, coordination, control and contingencies (Ballou, 2003).

Venue logistics. Venue logistics should be a major responsibility of the LD. Only limited third party services may be used, if deemed necessary. This decision is based on the following:

- This is a core activity of the LD and of ATHOC. Logistics is a significant part of venue operations, which are performed almost exclusively by the Organizing Committee. In this environment, significant involvement of a third party may be disruptive and ineffective.
- According to experience from previous games, venue logistics is an area that volunteer involvement is critical. In fact, several hundred volunteers will comprise the majority of venue logistics staff. It is, thus, natural that the management of this staff should be the responsibility of the LD directly.

Delivery coordination. Delivery coordination comprises several major activities, such as the development, implementation and application of a MDS system, development and implementation of the security assurance system, which will be applied at the supplier’s site, etc. It is clear that many of these activities are core responsibility of the LD.

Asset tracking. In the context of the Athens Olympics this task involves:

- Development of the asset tracking method, rules and procedures
- Development and implementation of the required IT support, including the asset management software, and any automation that could be possibly applied (e.g. bar-coding.)
- Implementation and application of the asset tracking procedures prior, during and after the games.
Planning, i.e. setting the specifications of the procedures and the IT systems, is the responsibility of the LD, in close collaboration with finance and procurement; so is the coordination with the relevant FAs (internally) and with the suppliers of ATHOC. However, there is a strong case for outsourcing the operation of the asset management system to an experienced third party, such as a major auditing firm. In this case, there will be joint control and contingency planning between the LD and the third party firm.

Reverse logistics. This group of activities will be performed following an identical strategy with the one presented for warehousing, distribution and transportation; that is, service delivery will be outsourced and planning, coordination, control and contingency management will be the responsibility of the LD, which will cooperate with the third party in key tasks.

Discussion
Obviously, at the time of forming the strategy for the Athens Olympic logistics there is no guarantee that the plan will be successful, especially as far as outsourcing is concerned. However, there are strong arguments to that effect, including:

- Sydney’s success with outsourcing both freight forwarding, and warehousing and distribution operations (see section: Feasibility of outsourcing for the Athens Olympic logistics)
- The availability of experienced third party logistics (3PL) companies in Greece with sufficient infrastructure (see section: Feasibility of outsourcing for the Athens Olympic logistics)
- The presence of experienced international freight forwarders in Greece, including companies that had significant participation in previous Olympic Games (see section: Feasibility of outsourcing for the Athens Olympic logistics)
- The robust process of selecting the most appropriate contractors, which was put in place by the Athens team, and the flexible contractual arrangements (see, e.g. section: Processes and organizational aspects)
- The robust management processes that ATHOC’s logistics team developed to support and manage these contractors (see also section: Processes and organizational aspects).

In addition, the risks of the outlined plan appear to be significantly lower to the corresponding risks of the alternatives (see related discussion in section: Nominal operating scenario), and led to the unequivocal selection of the proposed strategy.

Tactical planning for the Athens 2004 logistics operations
Having made the decisions that chart the logistics strategy for the games, the basic business processes that implement this strategy were developed and overviewed below along with the organization that supports these processes.

Freight forwarding and customs clearance
Figure 4 shows the processes involved in freight forwarding and the locations at which these processes take place. Concerning the collaboration with the official freight forwarder, ATHOC has decided to recommend the selected company to all interested parties (NOCs, etc.), ensuring that major part of the business will be carried out by only
one company with which ATHOC will be in close collaboration, thus guaranteeing direct access to all available information regarding the status of the process for each client.

Furthermore, the official forwarder will not be given exclusive rights to deliver Freight services for the games, in order to let the market set the related prices under competition practices. It is obvious, however, that the official forwarder will have an advantage over competition. For reasons of security and operational effectiveness, the number of forwarders entering each Olympic venue during the lock down period (period in which access is permitted only to authorised personnel) will be kept as low as possible.

**Warehousing and distribution**

*Processes and organizational aspects.* The flow of the materials and equipment is shown in Figure 5. The suppliers, sponsors, etc. will deliver to the Olympic Logistic

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**Figure 4.**
Schematic representation of the freight forwarding procedures

**Figure 5.**
Schematic representation of the warehouse and distribution flows
Center (OLC). The 3PL firm will be responsible for the receipt, storage, handling, and picking (if required) within the warehouse, as well as the transportation and delivery of the materials and equipment to the venues. Transportation between venues will also be the responsibility of the 3PL. However, all logistics-related processes within the venues will be the responsibility of the venue logistics teams of ATHOC.

Several decisions pertain the collaboration between ATHOC and the 3PL company:

1. ATHOC will provide the warehousing space and other resources (such as forklifts, FF&E, etc.).
2. The 3PL will assume responsibility for management and staffing the warehousing and distribution activities, as well as provision of transportation vehicles.
3. ATHOC, jointly with the 3PL, will develop procedures, reporting mechanisms and systems for the above services.

The agreement established between ATHOC and the 3PL was designed to be flexible in terms of total numbers, of workforce and transportation vehicles, since the exact needs of ATHOC are not known prior to service delivery. Thus, planning of personnel and vehicles required each month is performed based on a rolling forecast basis. The exact numbers are agreed between the two parties, whereas ATHOC reserves the right to alter the agreed numbers if deemed necessary. The payment structure is a “cost-plus” variant which:

- minimises the risk for the 3PL; and
- safeguards ATHOC against excessive resource numbers and low productivity.

It is emphasised that risk minimization with respect to the 3PL (and the assumption of risk by ATHOC) is essential, since the games demand for logistics services is highly unpredictable. On the other hand, the a priori agreement concerning resources, based on a rolling demand forecast, limits the risk for ATHOC.

A performance monitoring mechanism is used in order to:

- quantify the rolling forecast; and
- monitor the performance of the 3PL.

This mechanism is based on market benchmarks.

Estimation of resources. A simple method has been developed for estimating the warehousing space required for storing the related materials and equipment. Since the exact requirements of the FAs will not be known until a few weeks before the games, a “good” estimate is necessary to prevent expensive oversupply or operationally costly undersupply of warehousing space. The approach has been based on the demand of Sydney and on ATHOC’s service levels. A spreadsheet model was developed, which uses the volumes/weight of materials and equipment managed by the S2LT, and, based on certain assumptions, estimates the Athens 2004 cumulative volumes/weight and the corresponding warehousing needs.

The data that provided Sydney’s point of reference and the Athens assumptions are provided in Table VI (SOCOG, 2001). The percentage difference between Sydney and Athens is due to geography; it is expected that in the 2004 games land shipments will be increased, while the number of sea containers will be decreased.
Based on this point of reference, the approach followed steps 1-4 below:

1. estimate the equivalent weight of the contents of the sea containers;
2. assume the distribution of total weight among the major item groups;
3. estimate peak volumes to be warehoused (coexist in the warehouse during the same time period); and
4. determine the warehousing area needed to store these items.

For step 1, the average weight ratio of 16 tn/container was used, based on an estimate of the weight-to-volume ratio of the materials and equipment to be warehoused. For step 2, the assumptions captured in the second and third columns of Table VII were used (which, in turn, were based on Sydney data – SOCOG, 2001). For step 3, the following assumptions were used (Table VII):

- no NOC items or equipment will be stored in ATHOC’s warehouses (since all will be stored in the Olympic Village in team containers);
- no overlays will be stored in ATHOC’s warehouses (since they will be delivered directly to the venues being constructed);
- 80 per cent of sports equipment will be warehoused and only 20 per cent of sports equipment will be delivered directly to the venues (since the venues will be ready to accept equipment only a short period prior to the games);
- 90 per cent of technology and telecommunications equipment will be warehoused and only 10 per cent will be delivered directly to the venues (for the same reason as the sports equipment); and

<table>
<thead>
<tr>
<th>Item group</th>
<th>Distribution of total weight</th>
<th>Percentage of warehoused</th>
<th>Warehousing period factor</th>
<th>Stacking layers in warehouse</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sea shipments (per cent)</td>
<td>Land shipments (per cent)</td>
<td>Sea and land (per cent)</td>
<td></td>
</tr>
<tr>
<td>NOC equipment</td>
<td>25</td>
<td>12</td>
<td>0</td>
<td>–</td>
</tr>
<tr>
<td>Sports equipment</td>
<td>15</td>
<td>10</td>
<td>80</td>
<td>0.8</td>
</tr>
<tr>
<td>Technology</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>equipment</td>
<td>40</td>
<td>25</td>
<td>90</td>
<td>0.85</td>
</tr>
<tr>
<td>FF&amp;E</td>
<td>10</td>
<td>25</td>
<td>20</td>
<td>0.7</td>
</tr>
<tr>
<td>Overlays</td>
<td>10</td>
<td>28</td>
<td>0</td>
<td>–</td>
</tr>
</tbody>
</table>

Table VI.
Sydney equipment volumes (SOCOG, 2001) and Athens predictions

Table VII.
Weight distribution and warehousing parameters

Note: “Mostly 20 ft
20 per cent of FF&E will be warehoused in ATHOC’s facilities and the remaining 80 per cent will be warehoused by the furniture supplier and will be delivered and installed directly to the venues.

All other items and equipment have been incorporated into the above groups. Furthermore, in order to model the fact that not all stored items coexist in the warehouse during the same time period (due to test events, deferred deliveries and shipments to venues, etc.) the reduction factors of column 5 of Table VII were used (Tompkins et al., 1996).

Step 4 was performed using the assumptions of Table VIII (Tompkins et al., 1996), and the values of the last column of Table VII, i.e. the weighs were converted to equivalent unit loads (equivalent pallets in this case), the pure storage area requirements were determined and allowances were added for significant warehouse aisles, break down and consolidation areas, etc.

The results obtained are presented in Figure 6 and provide a total requirement of 88,000 m².

Venue logistics

Resource planning is the key issue for successful implementation of venue logistics. The needs of each venue in logistics staff (management, paid staff and volunteers) were derived by setting up a simple venue organizational structure and determining the

<table>
<thead>
<tr>
<th>Pallet weight (tn)</th>
<th>0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of pallets/m²/stack</td>
<td>0.6</td>
</tr>
<tr>
<td>Percentage of aisle area</td>
<td>15</td>
</tr>
<tr>
<td>Fixed warehouse area (m²)</td>
<td>500</td>
</tr>
</tbody>
</table>

Table VIII. Unit load and warehouse parameters

![Figure 6. Estimate of total warehousing requirements](image-url)
related requirements per position. Specifically, logistics at each venue are managed by a Venue Logistics Manager (VLM) and an Assistant Venue Logistics Manager (AVLM) that cover two 12 hours shifts during games-time. They are responsible for staff recruitment and training, material and equipment ordering, receipt, installation, tracking and reverse logistics, and the coordination of the logistics team. Three material handling equipment operators (for 24-hour operation,) and a crew of 5-12 staff and volunteers have been assigned to each venue depending on its size. Staff and volunteers are responsible for the provision of logistics services, i.e. loading/unloading of trucks, transport and installation of materials and equipment within the venue, as well as general maintenance and cleaning of the logistics compound.

It has been deemed critical to recruit each VLM a year prior to the games (G-1). This allows the VLM to participate in the detailed operational planning of the Venue.

Material handling equipment numbers and transportation vehicles were estimated based on several parameters, such as venue size, sport to be hosted, number of competitors, competition days, etc. The option of taking into account the competition schedule to share resources among Venues was used whenever possible by considering the possible risk of service problems arising due to conflicts among the venues.

A summary of the resources employed for venue logistics is presented in Table IX.

### Asset tracking
A comprehensive system has been specified and implemented to track and control all assets been managed by ATHOC, taking into account the following principles:

- The assets are tracked by the system down to the venue level/FA level. A separate Room Data Tracking system is being used to track assets down to room level.
- Each FA (e.g. sports, technology, etc.) has developed a separate asset coding system. The asset tracking system incorporates these systems into a unified coding system.
- Overlays and venue constructions (e.g. tents, air-condition systems, etc.), materials and equipment belonging to and managed by the Sponsors as well as consumables are not tracked.

### Organization
The organization designed for ATHOC logistics combined the strengths of the Atlanta and Sydney logistics organization. Thus, ATHOC will establish a LCC from which all activities will be managed and monitored. The LD management team is based at the LCC and is organized in five sections, as shown in Figure 7.

The planning section is responsible for planning all activities related to technology, procurement and staffing, as well as budgetary control. The freight forwarding section

<table>
<thead>
<tr>
<th>Resources required for venue logistics</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material handling equipment</td>
<td>140</td>
</tr>
<tr>
<td>Transportation vehicles</td>
<td>30</td>
</tr>
<tr>
<td>Human resources (employees)</td>
<td>650</td>
</tr>
<tr>
<td>Human resources (volunteers)</td>
<td>250</td>
</tr>
</tbody>
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</tr>
</tbody>
</table>
is responsible for the coordination with the freight forwarder. All freight forwarding and Customs Clearance operations are being monitored, related problems are addressed, and robust information is provided to clients regarding the forwarding process and transportation status. The responsibilities of the administration section include the customer’s help desk as well as all coordination with ATHOC’s FAs, such as Sports, Catering Cleaning and Waste, etc. The operations section has been maintained separate from freight forwarding and provides coordination with the 3PL and monitoring of the 3PL’s performance. Finally, the venue operations section performs planning, implementation and management of the logistical activities related to the venues.

Security issues
In the wake of 9/11, security is one of the most critical parameters of the 2004 Olympic and Paralympic Games. The responsibility for implementation of the Olympic Security Program lies with the Olympic Games Security Department (OGSD), an autonomous branch of the Hellenic Police. ATHOC’s LD, in close collaboration with OGSD, will operate three vehicle security and flow screening areas, designated as Marshalling Yards (MY). The latter will be equipped with four pallet-size and three truck-size (one for each Yard) X-ray machines, able to detect any kind of dangerous and prohibited items. All delivery vehicles will undergo a security check in one of the Marshalling Yards, depending on the location of the destination venue. The time of vehicle arrival will be defined by the LD, in order to guarantee a smooth vehicle flow and a high service level.

After undergoing the obligatory security screening at the MY, a vehicle should satisfy the following conditions in order to be allowed entrance to a venue:

- Adherence to the delivery schedule set by the LD according to the MDS, which safeguards against excessive time elapsed between security screening at the MY and arrival at the venue.
- The driver and any passengers should possess appropriate accreditation for the particular venue.
- The vehicle should bear an appropriate Vehicle Access and Parking Permit Scheme (VAPP) for the particular venue.

Finally, prior to arriving at the delivery point of each venue, the vehicle will undergo further security screening at the following two areas:

1. **Vehicle check point (VCP)**. An area located outside the parking control zone, in which security personnel will perform a visual check of driver and vehicle accreditation.

2. **Vehicle screening area (VSA)**. An area by the entrance of the venue, where the cargo seals placed at the MY, and/or vehicle compartments are inspected, and some other security checks are performed, as appropriate.

Figure 7. The organization of ATHOC logistic department
The smooth and effective operation of all areas depends on:

- an effective MDS; and
- effective communication between the LD and OGSD for direct problem resolution.

**Recommendations for designing the logistics operations of future Olympic games and other major events**

The design process of Olympic logistics is shown in Figure 8. As shown in this figure, the Olympic-specific characteristics, host country specific characteristics, as well as lessons learned from previous Games have been used to design the organization, processes and systems of the logistics functions within the OCOG. The design itself has been based on generation of reasonable alternatives, evaluation of these alternatives, and selection of the most appropriate one. A similar framework is also relevant to designing the logistics operations of other major events (sports events, trade shows, political concessions, etc.).

The specific characteristics of Olympic logistics (and indeed of other major events) arise mainly from the transient nature of the Games, the diversity and uncertainty of demand, as well as the firm schedule and immovable milestones. Other important Games-specific parameters include the mix of paid staff and (inexperienced) volunteers, and the inability to learn from mistakes and improve as you go along.

The environment of the country that hosts the games (or the event) also needs to be considered carefully in designing logistics operations. Some of the significant aspects of the external environment to be considered include the host country location (affecting freight forwarding), the country’s logistics infrastructure, as well as the country’s logistics know-how and logistics business environment.

Most of the recommendations included in Table X are applicable to other major events besides the Olympic Games. Their relevance, however, depends on the nature of the event. For example, in trade shows, in which the performance of freight forwarding is critical to the success of the event, securing a warehousing infrastructure early on is not relevant. However, the host country location and its logistics business environment need to be considered carefully in the early stages of planning. Thus, in planning the logistics of any major event, the characteristics that are critical for the success of that particular event should be identified early on, and the design of logistics operations should fully address them.

In addition to the recommendations of Table X, the design process should consider the principles that have been proven successful in previous games (Table XI). Several of these principles, such as model venue planning, standardization of materials, the establishment of the LCC, as well as establishment of an independent administration...
function, can be applied regardless of the specific characteristics of the host country. However, there are principles such as outsourcing, warehousing, or JIT deliveries, that are based on certain specific characteristics (constraints/advantages) of the host country, such as a mature 3PL market, the existence and availability of large warehouses, and the completion of the venues in sufficient time prior to the beginning of the Games.
References


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