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Intelligence as a Multiplier of Logistic Effectiveness: A Practical JLSG Model Without Logarithmic Transformation

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Abstract

This paper develops a multiplicative model of logistic effectiveness for a Joint Logistic Support Group and explicitly links logistics performance to the fighting power construct used in doctrine. It further expands the intelligence support factor as a composite index that captures both the availability and quality of relevant data, information, and intelligence inputs and the operational performance of intelligence processing that supports the commander's decision-making. The model also accounts for information-volume effects, recognising that both insufficient and excessive reporting can reduce utility, and it distinguishes between enduring, organic intelligence capability (as part of the physical component of fighting power) and the day-to-day process performance of intelligence processing (as part of the intelligence support factor). Finally, the paper places the model in the context of a continuously changing operating environment, including hybrid threats that can disrupt logistic support and reduce achievable effectiveness. The paper provides definitions and equations, proposes measurable indicators, demonstrates the calculations with a numerical illustration, outlines a calibration approach, and offers practical recommendations for application beyond command-and-control elements at the Joint Logistic Support Group level.

KEY WORDS: *intelligence; Joint Logistic Support Group; logistic effectiveness; logistics performance; military mobility; reception, staging and onward movement*.

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1. Introduction

Sustainment provides the right support in the right quantity and quality, at the right place and time, and the joint logistic support network links nodes, organizations, activities and sites across the joint operations area [1]. In deployment and theatre-opening activities, the Joint Logistic Support Group (JLSG) normally becomes the designated commander for reception, staging and onward movement (RSOM) under the Joint Task Force (JTF) commander [2]. This makes the JLSG an appropriate analytical level for comparing alternative support arrangements, route options and protection measures.

The problem is no longer limited to throughput. Current doctrine describes a contested logistics environment in which adversaries target logistics operations, facilities and movement across all domains [4]. Recent European cases have included arson, cyber espionage, interference with rail activity and Global Positioning System disruption affecting transport infrastructure, all of which are relevant to military mobility and support networks [7, 8]. Logistic effectiveness must therefore reflect both internal readiness and external disruption.

At the same time, intelligence support to sustainment has become a practical requirement rather than an auxiliary service. Recent practice emphasizes timely, accurate, relevant and tailored analysis for sustainment commanders and staffs [5, 12], while the need for logistics intelligence at the operational level was already identified decades ago [6].

Intelligence affects not only warning and protection, but also route selection, node prioritization, movement sequencing, contractor management and command decision-making.

The analytical section has potential for advanced statistical analysis; however, this paper prioritizes usability for routine staff by presenting the model in a non-logarithmic form that can be readily applied in planning conferences, staff worksheets, and simple spreadsheets

2. Doctrinal Basis and Research Approach

The model is grounded in three doctrinal observations. First, the JLSG operates inside a networked sustainment system rather than as an isolated unit; accordingly, effectiveness must be assessed across the JLSG's joint logistic support network (see Figure 1) and not only inside a headquarters [1]. Second, RSOM depends on close interaction with troop-contributing nations (TCNs), host nations, movement-control elements and other enabling actors [2, 3]. Third, modern sustainment must be planned under conditions of continuous observation, disruption and cross-domain attack [4].

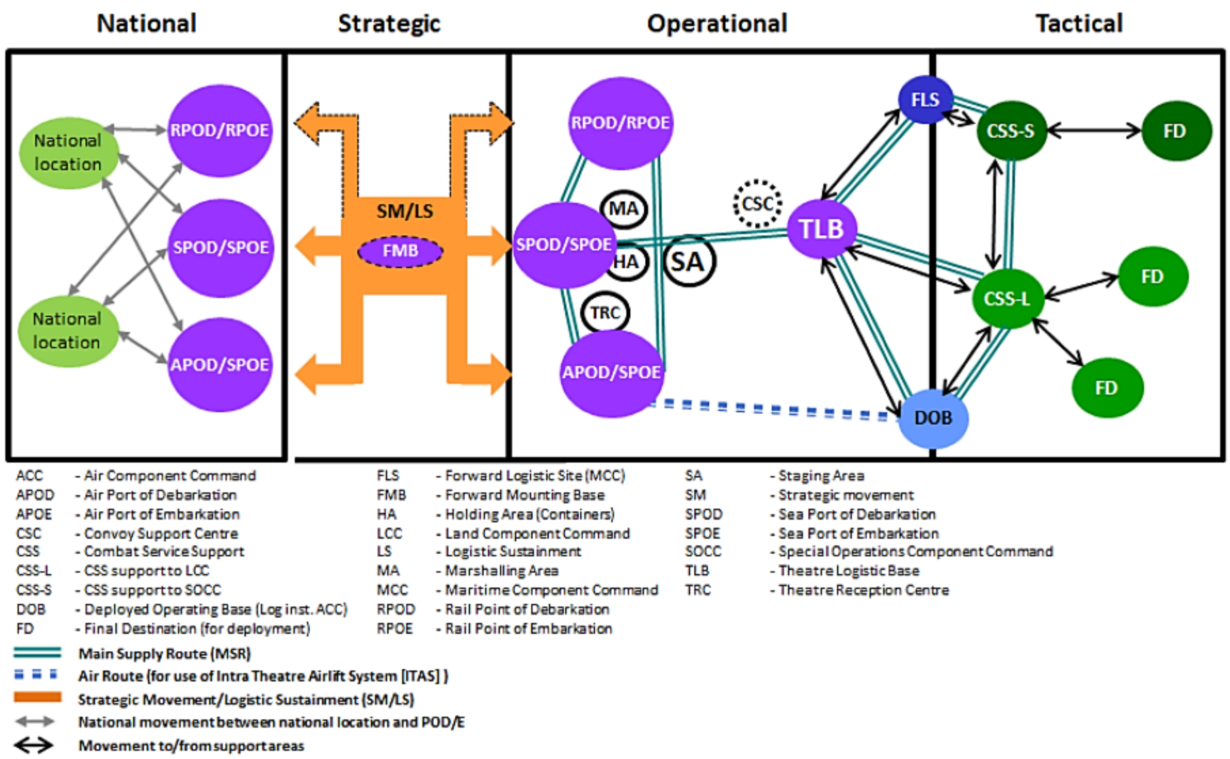

Fig. 1: Typical movement support network [4].

Methodologically, the paper combines doctrinal analysis with analytical synthesis. Publicly available NATO and US Army doctrines define the operational context [1-4]. Literature on intelligence support to sustainment provides the conceptual basis for treating intelligence as a multiplier [5, 6]. Recent studies of Russian sabotage and hybrid activity in Europe justify the explicit inclusion of a disruption factor [7, 8]. Finally, the model retains the fighting power perspective as a bridge between structural capability and achievable output [9].

The non-physical and multi-domain character of the operating environment also increases the volume, heterogeneity and temporal sensitivity of information reaching the JLSG. For that reason, the model keeps a specific volume term with a transparent adequacy score.

3. Model of Logistic Effectiveness

The model defines logistic effectiveness (LE) as the output that the JLSG can realistically achieve in a given period after the effects of fighting power, intelligence support and hybrid disruption have been considered. LE keeps the same physical unit as the planning ceiling, for example convoy-equivalent movements per day, tonnes delivered per day, or completed resupply cycles per day.

$$LE = LPmax \times FPwr \times ISF / HDF \qquad (1)$$

LPmax is the planning ceiling for the assessed period. FPwr is normalized to the interval 0-1. ISF is a dimensionless multiplier scaled around 1. HDF is a dimensionless degrading factor constrained to values of 1 or more. When ISF = 1 and HDF = 1, the equation collapses to ordinary output constrained only by the JLSG's own fighting power.

3.1 Fighting Power and Logistics Performance

Fighting power (FPwr) is decomposed into the conceptual component (CC), moral component (MC) and physical component (PC). The revised paper retains the multiplicative weighting from the draft because it preserves the idea that a serious weakness in one component cannot be fully compensated by strength in another [9].

$$\text{FPwr} = \text{CC}^{0.30} \times \text{MC}^{0.20} \times \text{PC}^{0.50} \tag{2}$$

The weighting gives the highest influence to the physical component because JLSG performance is materially determined by available transport, handling assets, communications, protected infrastructure, interoperability and organic support capabilities [1, 4]. The conceptual component captures doctrine, planning quality, procedures and command understanding. The moral component captures cohesion, leadership, discipline and resilience under pressure. Each component is scored on a 0-1 scale against the reference force.

Organic intelligence capacity is treated as part of the physical component. This includes the enduring readiness of intelligence personnel, tools, architectures, connectivity, training and standing procedures. By contrast, current intelligence-processing performance is not embedded in FPwr; it is placed in the intelligence support factor. The separation prevents double counting and makes the model more measurable.

3.2 Intelligence Support Factor

The intelligence support factor (ISF) represents how effectively the JLSG turns available data, information and intelligence into actionable decision support in the current phase of the operation. It uses a weighted geometric aggregation because this preserves multiplicative logic while remaining easy to calculate without logarithmic transformation.

$$\text{ISF} = \Pi(S\_i\text{^}\alpha\_i) \times S\_VOL\text{^}0.10, \text{ where } \Sigma\alpha\_i = 0.90 \tag{3}$$

The proposed initial weights are shown in Table 1. They are expert-informed starting values rather than immutable constants and may be adjusted by the commander or planning staff when the operational phase changes.

Table 1.

Intelligence-support subcomponents and proposed initial weights

Component	Weight	Example operational indicator
S_TCN-INT	0.05	Timeliness and coverage of TCN intelligence updates.
S_TCN-TRANSIT	0.15	Completeness and latency of transit and RSOM reporting.
S_JLSN	0.25	Freshness and reliability of JLSN node status data.
S_HN-TESSOC	0.05	Validated host-nation TESSOC reporting.
S_JTF	0.10	Relevance and timeliness of JTF intelligence support.
S_TCN-AO	0.05	Area-of-operations feedback from deployed TCN units.
S_ENABLERS	0.10	Data availability from civilian and commercial enablers.
S_INT-PROC	0.15	Latency, throughput, triage success and command uptake.
S_VOL	0.10	Volume adequacy relative to need and capacity.

Each intelligence subcomponent is scored around a neutral baseline. For practical use, the following five-band scale is sufficient: 1.10 = clearly better than baseline; 1.05 = slightly better; 1.00 = baseline; 0.95 = slightly worse; 0.90 = significantly worse. The score should be linked to one observable indicator, such as timeliness, completeness, freshness, validation rate or command uptake [5].

The volume term S_VOL is intentionally simplified. Instead of a Gaussian penalty, the revised model uses a direct adequacy assessment: 1.05 when incoming reporting is close to the optimal volume and remains within processing capacity; 1.00 when the volume is acceptable but not optimal; 0.90 when reporting is clearly insufficient; and 0.80 when the inflow exceeds processing capacity and produces overload. This reformulation removes the need for logarithms and exponential functions while preserving the substantive point that both scarcity and excess reduce utility.

3.3 Hybrid disruption factor

The hybrid disruption factor (HDF) translates external risk into a direct reduction of achievable output. It is derived from a risk register that includes hostile action, technical failure and environmental disruption. Relevant scenarios include sabotage against rail or port infrastructure, cyber-attack against movement-control systems, electromagnetic warfare or navigation warfare against movement, contractor outage, route denial, misinformation affecting coordination, and severe weather or infrastructure failure [4, 7, 8].

For staff use, HDF is best assigned through a simple five-level scale rather than a complex mathematical transformation. Table 2 provides a practical mapping.

Table 2.

Practical mapping of disruption risk to the hybrid disruption factor

Risk level	Typical manifestation	HDF
Negligible	No relevant disruption expected during the assessed planning period.	1.00
Low	Localized friction, minor cyber or infrastructure disturbance, limited effect on throughput.	1.10
Medium	Credible sabotage, cyber or EW threat against routes, nodes or data flows.	1.20
High	Repeated disruption or concentrated threat activity affecting multiple critical nodes or routes.	1.40
Very high	Sustained or multi-vector disruption with serious effect on continuity of support.	1.60

4. Practical Application Without Logarithmic Transformation

The model is intended for comparison, prioritization and discussion rather than for false numerical precision. A simple five-step procedure is sufficient. Step 1: determine LPmax for the exact planning period and scenario. Step 2: score CC, MC and PC and compute FPwr. Step 3: score the ISF subcomponents using the agreed baseline bands. Step 4: determine HDF from the current disruption register. Step 5: compute LE and compare courses of action or phases of the operation. Table 3 illustrates the procedure for one notional planning day.

Table 3.

Illustrative application of the model for one planning day

Parameter	Value	Comment
LPmax	120	Planning ceiling in convoy-equivalent movements per day.
CC	0.80	Doctrine, planning and procedures assessed against the reference force.
MC	0.75	Leadership, cohesion and resilience under current conditions.
PC	0.85	Material assets, protected infrastructure, interoperability and enduring organic capability.
FPwr	0.814	Computed from Equation (2).
LP	97.7	LPmax x FPwr.
ISF	1.026	Illustrative scores: 1.03, 1.05, 1.08, 0.95, 1.04, 1.00, 0.98, 1.06, 0.90.
HDF	1.20	Medium disruption environment.
LE	83.5	Computed from Equation (1).

In the example, the JLSG planning ceiling is 120 convoy-equivalent movements per day. Fighting power reduces this ceiling to approximately 97.7 movements. Intelligence support is slightly positive overall, but a reporting-volume penalty remains because the staff is close to overload. A medium disruption environment then reduces the final result to about 83.5 movements per day. The practical value of the model lies in showing where the loss occurs. In this case, the commander can attempt to improve volume discipline, protect critical nodes, or lower disruption through risk-reduction measures rather than merely demanding greater throughput.

5. Discussion

The formulation above has four advantages. First, it preserves the central proposition of the team of authors: intelligence does not create logistic output independently, but multiplies or reduces what the JLSG can achieve through its fighting power. Second, it keeps the crucial distinction between enduring intelligence capacity and current intelligence-processing performance. Third, it incorporates hybrid disruption explicitly, which is doctrinally consistent with contested logistics and empirically justified by recent activity against European infrastructure [4, 7, 8]. Fourth, it can be executed without difficult mathematical transformation, statistical software or specialized analytical support.

The model nevertheless has limits. The scores remain partly expert-based and are therefore best suited to comparative analysis between options, time periods or sectors of the joint logistic support network. They do not replace commander judgment. The proposed weights are initial values and should be refined by back-testing against observed throughput, delay, node availability and incident data. Future research may also disaggregate HDF by threat type or integrate the model into a digital planning dashboard.

Even with these limitations, the developed approach is still usable for operational staffs. It allows rapid sensitivity testing: a small increase in S_INT-PROC, a reduction in overload, or a lower HDF can be immediately translated into expected gain in logistic output. That is precisely the type of transparent trade-off a JLSG headquarters requires during contested deployment and sustainment planning.

6. Conclusions

This paper formulated a multiplicative model of logistic effectiveness that can be applied without advanced mathematical skills. The model preserves the analytical logic, but converts it into a form suitable for routine planning, staff dialogue, course-of-action comparison and simple spreadsheet-based assessment. In this formulation, logistic effectiveness remains a function of four interacting determinants: planning capacity, fighting power, intelligence support and hybrid disruption. This is important because contemporary sustainment is executed through a network rather than a single headquarters, and because the JLSG must coordinate RSOM across a JLSN exposed to observation, interference and attack. The proposed model therefore makes explicit what is often only assumed in practice: intelligence is not merely a background enabler, but a variable that can improve prioritization, route selection, protection, sequencing and decision-making, while hybrid disruption acts as a measurable degrading factor that reduces achievable output.

The main contribution of the paper is therefore practical rather than purely theoretical. The model offers commanders and staffs a transparent way to visualize the role of intelligence in contested logistics, compare support options under similar conditions, and identify where marginal improvements can produce the greatest operational benefit. At the same time, its simplicity does not preclude further development. On the contrary, the framework is deliberately structured so that indicators, weights and scoring bands may later be refined through exercises, operational data and empirical validation. In this sense, the model serves both as an immediately usable staff tool and as a foundation for future research. It contributes to a more rigorous assessment of logistic effectiveness at the level of the JLSG and the JLSN and supports more informed sustainment decisions in the contemporary operational environment.

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