Predicting Obsolescence Patterns in DMSMS for Critical Systems

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Abstract

Diminishing Manufacturing Sources and Material Shortages (DMSMS) threaten the sustainment of defense-critical systems. Using 1,821 procurement records (2009–2019), regression models forecast obsolescence risk. Key drivers include vendor consolidation, technology refresh cycles, and supply chain instability. The framework enables proactive sustainment planning, reducing lifecycle costs and improving readiness.

Methods

Dataset: Naval Supply Systems Command (**NAVSUP**) procurement records (2009–2019)

Approach: Ordinary Least Squares (**OLS**) regression with category and year controls

Focus Systems: SPY-6 radar and Navy Multiband Terminal (**NMT**) components

Variables:

- **IMEC** – Item Mission Essentiality Code
- **AMC** – Acquisition Method Code
- **LBY** – Last Buy Year
- **LCI** – Life Cycle Index
- **MSD** – Material Supply Date

Obsolescence Risk Across Regression Models

		(1)	(2)	(3)
Item Mission Essentiality Code	1	0.2145	0.0906	0.1078
	2	-0.0627	-0.0463	-0.0496
	4	0.0802**	0.0757**	0.0827
	5	0.1729	0.1230	0.1148
	-	0.3124	0.4091	0.4137
Acquisition Method Code	1	-0.0115	-0.0262	-0.0221
	2	-0.2731	-0.1930	-0.2142
	4	-0.3181	-0.2630	-0.2636
	5	0.0909***	0.0811***	0.0831***
Life Cycle Integration	1	-0.5332	-0.4765*	-0.4885**
	2	-0.6401	-0.2823***	-0.2731***
	3	0.1849	0.1521	0.1589
	6	-0.1693	0.0714	0.0762
Adjusted for Category		X		X
Adjusted for MSD			X	X
Adjusted for IMEC		X	X	X
Adjusted for AMC		X	X	X
Adjusted for LBY		X	X	X
Adjusted for LCI		X	X	X

Obsolescence Risk by Component Category Across Regression Models

Category:	(1)	(2)	(3)
Valves and Regulators	-1.8200*	-0.0860	-0.0935*
Sensors and Transducers	-0.9700	-0.0437	-0.0473
Power Supply and Relay Batteries	0.7000	0.0499	0.0408
Circuit Protection, Fuses, and Breakers	-2.6500***	-0.1697***	-0.0555
Switches and Relays	-0.7300	-0.0607	-0.0049
Connectors and Adapters	-1.1000	0.0120	0.0400
Fasteners, Screws, Nuts, Washers	1.9900**	-0.0768	-0.0112
Cooling and Heating Components	1.0000	0.0432	-0.0142
Computing Hardware and Network Equipment	-4.3400	-0.1688***	-0.0057
Lighting and Indicators	-2.6800***	-0.1947**	-0.0847
Filters Electrical and Air	-0.1200	-0.0295	-0.0144
Cables and Wiring	13.3100	0.1409	-0.0058
Displays and Interfaces	-0.9300	-0.1393*	0.0031
Hydraulic and Pneumatic Hardware	4.1600	0.1092*	-0.0914**
Mechanical Tools and Accessories	-0.5000	-0.1752***	-0.1137**
Waveguide	7.6600	0.0798**	-0.0149
Other	17.1200	0.1849	0.0412
Adjusted for Category	X	X	X
Adjusted for MSD			X
Adjusted for IMEC		X	X
Adjusted for AMC			X
Adjusted for LBY			X
Adjusted for LCI			X

Notes:
***= Statistically Significant at the 1% level
**= Statistically Significant at the 5% level
*= Statistically Significant at the 10% level

Results & Impact

Lower obsolescence risk: Valves/Regulators; AMC 1 (full and open competition); IMEC 4 (mission-essential items)

Higher obsolescence risk: Hydraulic/Pneumatic hardware; AMC 5 (restricted to government sources)

Lifecycle insight: Early LCI integration improves longevity

Impact: Predictive analytics shift sustainment from reactive to proactive, cutting costs and preserving mission readiness

Future Research

Expand dataset beyond 2019 for broader scalability

Integrate machine learning and AI for higher precision forecasting

Apply framework across diverse platforms and supply chains

Explore contractual strategies and industrial base resilience to mitigate DMSMS risks

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