EXPLORING THE HEART OF LOGISTICS

User Perceptions of Intransit Visibility Architecture Utility

Charles W. Ward, USA, 3d Sustainment Brigade
Sharon Gibson Heilmann, PhD, USAF, USAAF
William A. Cunningham, III, PhD, USAF, AFIT

Background

During the buildup of Operation Desert Shield, the Saudi Arabian ports of Ad Dammam and Al Jubayl were congested with tens of thousands of military and commercially leased containers.[1] The containers were required to transport the vast amount of equipment to the region in preparation for the liberation of Kuwait. The problem, in essence, was threefold:

- Delivering the containers to the various ports
- Knowing what was in the containers
- Knowing who owned them once they arrived

Of the 40,000 containers in the port, 25,000 required opening to determine the owner and their contents, carrying an associated price tag of $1B.[2] According to the former director of logistics for United States Transportation Command, General Walter Kross,

> During the Gulf War, we simply did not have good information on almost anything. We did not have good tracking; we had no real asset visibility. Materiel would enter the logistics pipeline based on murky requirements, and then it could not really be tracked … when it got to the other end we had to deal with the consequences … we lacked the necessary priority flows to understand where and when things were moving.[3]

The consequence that had to then be dealt with was the possibility of delayed missions resulting from not knowing the whereabouts of essential organizational equipment. This issue, along with many other supply chain issues, was collected and analyzed in the years following Desert Storm, yet some of the same issues with equipment and container management found their way into Operation Iraqi Freedom (OIF). These continuing logistical challenges forced the Army to revamp its distribution management process for tracking commodities and equipment. Commanders needed more accurate information, they needed it faster, and they needed the information in as near real time as possible. The previous methods of military shipping labels, bar codes, and radio frequency identification tags (RFID) were not providing the data commanders needed to conduct their missions. This was the case at the beginning of OIF prior to the Army's logistics transformation.

The Army's logistics transformation began with the development of the Unit of Employment (UE) concept. The UE concept redesigned and redistributed support units to support mission sets and made modular deployment easier (deployment of preconfigured and predetermined combat and support assets).[4] Existing logistical support and management organizations were combined in an effort to reduce staff levels and reduce redundancy in the distribution process. As retired Lieutenant Colonel James Henderson, deputy commander for the 13th Corps Support Command Corps Distribution Command, states in his book, *The Process of Military Distribution Management,* "In order for the Army's Logistics Transformation to be able to improve the timely and accurate distribution of supplies, logisticians must incorporate proper velocity management techniques."[5]

A key velocity management technique is intransit visibility (ITV).

Article Acronyms

AIT – Automatic Identification Technology
BCS3 – Battle Command Sustainment and Support system
DoD – Department of Defense
EIS – Enterprise Information System
GAO – Government Accountability Office
GCCS – Global Command and Control System
GTN – Global Transportation Network
ITV – Intransit Visibility
KMO – Kaiser-Meyer-Olkin
MSL – Military Shipping Label
MTS – Movement Tracking System
OIF – Operation Iraqi Freedom
PEO – Program Executive Officer
POC – Point of Contact
RFID – Remote Frequency Identification
RQ – Research Question
SME – Subject Matter Expert
TAV – Total Asset Visibility
TIS – Transportation Information Systems
UE – Unit of Employment

To support the logistics transformation effort, the Army uses intransit visibility. ITV is an automated capability designed to improve the ability of commanders and personnel to obtain real-time information on the location, quantity, and movement of equipment through the logistics pipeline.[6] ITV should not be confused with total asset visibility (TAV). TAV reports the status of production, commodity inventory, repair status, requisition, and stockage levels. ITV is the tracking of assets as they pass through a node or while enroute. However, TAV is dependent upon ITV. As Lieutenant Colonel Beth Rowley, Joint-Automated Identification Technology Program Manager stated, "ITV is not a single system, but rather a collection of automatic information systems, procedures, systems interfaces, and application technologies."[7]

In December 2003, the Government Accountability Office (GAO) released a preliminary report on the observations and effectiveness of logistic activities during OIF.[8] The report stated the problem with ITV was Army logisticians could not see all the requirements on the battlefield, and the customers (supported units) could not see the supplies coming their way. The inability to track supplies encouraged soldiers and commanders to order the same item several times because they had no confidence that support was enroute. Current attempts to solve these dilemmas consist of Web-based, data-integrated ITV components that feed into 21 Department of Defense (DoD) logistics systems. These 21 DoD ITV systems provide data to track commodities at their last known location (nodal tracking), and to see in near real time the physical location of the equipment or commodity enroute. A portion of the 21 DoD ITV systems provide real-time asset visibility which allows commanders to see the current location of their assets and gives them the ability to divert the assets while enroute. However, which of the 21 DoD ITV systems does the commander and his or her staff use? Which system does the commander's customer use? If the ITV system the organizations will use while deployed varies from the system or systems used in garrison, will the organizations be able to educate themselves on a new system in a timely manner in order to reap the benefits of the unfamiliar system? It is apparent there are still too many choices for military organizations when it comes to ITV. This observation is prevalent in a majority of the papers written on ITV. Lieutenant Colonel Nicholas J. Anderson observes that the multitude of ITV systems available makes it difficult to provide systematic training at any of the combat service support schools.[9]

Purpose

There are multiple ITV systems available for DoD personnel to use. Authorized personnel have access to the Global Transportation Network (GTN), Battle Command Sustainment and Support System (BCS3), Global Command and Control System (GCCS), and the ITV Network Server to name a few. However, which system is the best? The answer to this question depends, to a degree, upon whom you ask. Currently, the four systems previously identified were the most widely used during OIF and Operation Enduring Freedom, but duty location and level of command will determine the system used. By providing a single ITV platform for use in garrison and combat, users will experience a more fluid transition and possibly a better knowledge base of ITV.

Research Questions

The following research questions (RQ) will be addressed.

- RQ 1: How successful do commanders and users perceive the current ITV architecture in terms of its utility and tracking capability?
- RQ 2 (A): Is there a relationship between a user's knowledge of ITV in general and ITV reducing duplicate commodity ordering?
- RQ 2 (B): Is there a relationship between a user's knowledge of ITV in general and its ability to provide the data required to do his or her job?
- RQ 3 (A): Is there a relationship between the user's knowledge of individual ITV systems and the system's ability to reduce duplicate orders?
- RQ3 (B); Is there a relationship between the user's knowledge of specific ITV systems and its ability to provide the data required to do his or her job?

Data were specifically collected and analyzed from an Army ITV perspective. Weber stated that data from a familiar branch of Service is more easily interpreted than data from other Services.[10] In his research of turnover in military organizations, Bluedorn used data that was specific to his Service branch, the US Army.[11] Therefore, the data used for this research is Army-centric, based on one author's familiarity with the Army and its ITV systems and architecture.

In order to understand ITV, an explanation of the types of automatic identification technology (AIT) with respect to ITV's primary goal and how ITV contributes to total asset visibility is required. ITV is fed by multiple AIT sources. The DoD uses many types of AIT, to include barcodes, RFID, and the Movement Tracking System (MTS).

Barcodes provide item identification for individual items and shipments by document number. Military shipping labels (MSL) and barcodes are used when individual items are consolidated into a larger container. The MSLs and barcodes can be read using a hand-held interrogator or portable data terminal. The data can then be loaded into the RFID tag and attached to the individual piece of equipment or to its shipping container or pallet. The second component of the RFID tag is the interrogator. The interrogator can be either fixed or handheld and reads the coded data within the RFID tag and reports the date and time the RFID tag passed by the interrogator. To ensure positive control, interrogators are normally set up in locations where commodities and equipment change hands. For example, to track equipment movement, interrogators are set up at the ingress and egress of vehicle marshalling yards, warehouses, as well as air and seaports.

Within ITV, the real-time movement of commodities and equipment is tracked using the MTS. MTS provides an operational link to assets sent out on missions to maintain command discipline. MTS is a satellite tracking and text message system that provides command and control over distribution assets. One central host that fuses data from RFID tags and MTS is called the BCS3. BCS3 is an *end-to-end* cargo and equipment tracking management system. Operators can constantly monitor movement of assets via terminal servers that can be loaded on most laptop computers. This conglomeration of automatic

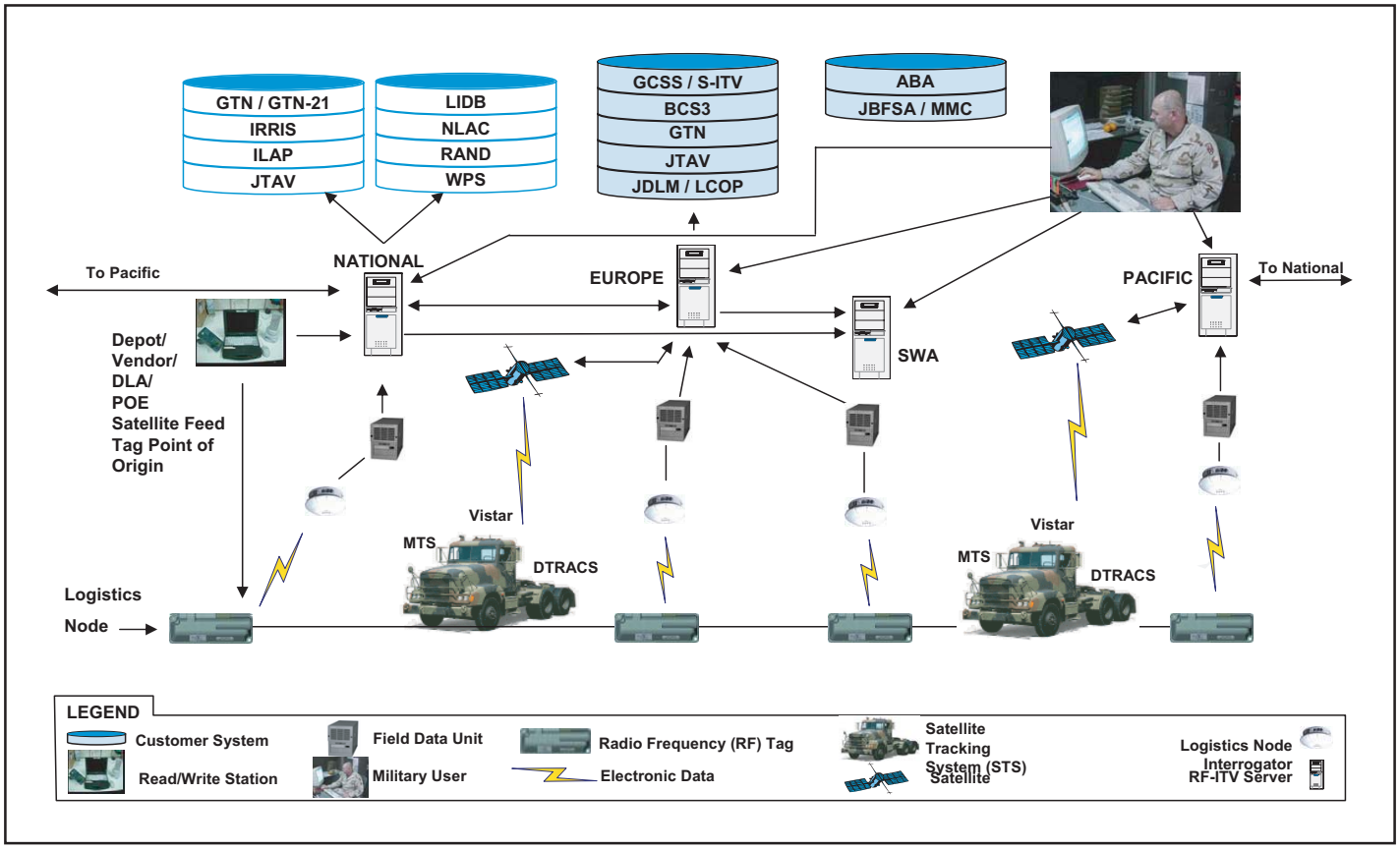

Figure 1. RF-ITV Operational View

information systems provides the framework for the ITV architecture. Other systems that provide end-to-end tracking capabilities are the GTN, GCCS, and the ITV Network Server. Refer to Figure 1 for an operational view of ITV and the various user interface systems.

Procedures

Since existing measures were not available to address the research questions, measures were created based on interviews with ITV subject matter experts (SME) to include program managers. SMEs were questioned as to the types of data ITV should provide the user. The same SMEs were asked what information would help determine if a specific ITV system was outperforming all others and if this information could benefit planners and program managers with developing a single ITV user interface. In addition, SMEs stated that ITV should give the user confidence in the distribution process and that having the ability to track an order from the time it is pulled from the shelf to the time the consignee takes possession should provide the user that confidence.

A 55-item survey entitled, *Commander and User Perceptions of the Army's ITV Architecture*, was developed, pilot tested, and then disseminated via Web-link to transportation organizations that, for the most part, had some familiarity with the functionality and use of ITV systems. The survey Web-link was sent to respondent points of contact (POC) which included two transportation battalion commanders located outside the continental United States and program managers of various ITV departments at the US Army Combined Arms Support Command. Respondent POCs received advanced notification of the online survey in the form of an e-mail that indicated the survey's intent and to solidify participation in the research. Respondents were then contacted via e-mail from the respondent POCs. Respondent POCs asked the respondents to complete the online survey and answer the questions in a way that best described their feelings on a specific ITV system. Respondents were requested to complete the survey within a 3-week timeframe. At the end of 3 weeks, a followup e-mail was sent to the respondent POCs requesting they send a reminder to their respondents.

To increase the sample size, the researcher conducted a second administration of the survey at the Army Logistics Management College at Fort Lee, Virginia, to the students enrolled in the Combined Logistics Captains Career Course and the Logistics Executive Development Course. The response rate from this administration of the survey was 95 percent.

Participants

For both administrations, the survey population (n = 213) included members of the US Army, Air Force, Marines, Navy, and civilian DoD personnel. A total of 124 surveys were usable (38 online and 86 hardcopy, respectively). Of the 169 respondents returning the hard copy survey, 42 indicated they had not used any ITV system, 22 indicated they used multiple systems (thus eliminating analysis on their knowledge of a specific system), and 19 surveys had a majority of the data missing, resulting in 86 respondents that provided usable data for analysis. Data from the hard copy surveys were coded by the researcher. After completion of every 10 survey entries, the researcher verified each entry to ensure accuracy.

In terms of sample demographics, 46 respondents (37 percent) indicated they were either in a command billet or had previously commanded, and 61 respondents (49 percent) had no command

experience. Seventy-four respondents (60 percent) answered the survey in terms of their personal training and experience of the ITV systems, 8 personnel (6 percent) answered with regards to personnel under their supervision on training and experience, and 26 respondents (21 percent) answered the survey in terms of both their training and experience, and that of their subordinates. Refer to Table 1 for information pertaining to respondent rank, time in service, and deployments over the last 4 years.

Measures

The survey was comprised of 55 items, including the following:

- Fourteen questions were asked in the first part of the survey to assess satisfaction with a particular ITV system
- Five items were used to evaluate supply ordering habits and daily ITV usage
- Nine items addressed the user's familiarity with all ITV systems
- Sixteen items were used to evaluate training on the ITV systems
- Eleven items were used to determine demographic information

Factor Structure and Reliability Estimates

A factor analysis was used to determine the underlying factor structure of the 14 survey items in Part 1. Preliminary analysis indicated the data were appropriate for factor analysis. The analysis included:

- Inter-item correlation matrix
- Off-diagonal of the anti-image covariance matrix
- Bartlett's Test of Sphericity
- Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy

The inter-item correlation matrix should result in a positive relationship between each of the items. Items with a correlation at or above .90 were analyzed to ensure the items were not measuring the same factor.[12] Small values on the off-diagonal and anti-imaging matrix further indicate the data are a good fit for factor analysis. The Bartlett's Test of Sphericity indicated the correlation matrix was an identity matrix as well (significant at $p < .001$), and all diagonal terms had a value of 1 while off-diagonal terms were 0. The KMO measure of sampling adequacy reflects the homogeneity among the variables and serves as an index for comparing the magnitudes of correlation coefficients to partial correlation coefficients. KMO values at or exceeding .70 are considered desirable (KMO = .92).[13]

The survey was analyzed using the Component Factor model, Principal Axis Factoring. Several methods are available when deciding the number of factors to retain, to include eigenvalues and scree plots. However, using only one method may result in the use of too many or too few factors. As Conway and Huffcutt recommended, methods used in conjunction with one another provide a stronger argument for factor retention and deletion.[14] Therefore, factors with eigenvalues greater than 1 and scree plots were used to determine the factor structure. The eigenvalue results produced a 2-factor solution that explained 67 percent of the total variance.

Normally, items loading on factors with a value greater than or equal to .30 are utilized.[15] Once factor loadings were determined, inter-item correlations and Cronbach Alpha Coefficients were measured in order to determine the internal consistency of the factors. According to Nunnally, factor structures are satisfactory with an alpha value greater than or equal to .70.[16] The factor analysis process resulted in the extraction of 2 factors: Factor 1 named *utility*, and Factor 2 named *tracking*. Refer to Table 2 for utility and tracking factor loadings, reliabilities, and means.

The most common ITV systems were listed in section 2 of the survey. Using a scale anchored by 1 (not at all) and 5 (to a very large extent), respondents were asked to categorize their knowledge of the following systems: BCS3, GTN, GCCS, RFID, Deployed Asset Visibility System, ITV Network Server, other, none, and ITV in general.

Section 3 involved training received by the respondent or by the subordinates of the respondent. Using a scale anchored by 1 (strongly disagree) and 6 (agree), respondents were asked how sufficient was the training received. Respondents also provided demographic information, to include military occupation code or branch, total time deployed, location of deployment, DoD status, branch of Service, time in grade, highest level of education, and command status.

Descriptive Information

In all, the survey had 124 respondents. The predominant ITV system was the BCS3 (n=42), followed by GTN (n=23); GCCS – Army (n=8); the ITV Network Server (n=22); *other* (n=20), which

Rank	N	Percentage	Avg Time in Service*	Avg Number of Deployments over Last 4 Years
First Lt (O2)	7	6	13**	2
Captain (O3)	64	52	9	3
Major (O4)	18	15	16	2
Lt Colonel (O5)	9	8	21	2
Chief Warrant 4	1	<1	30	3
Specialist (E4)	1	<1	4	no data
Sergeant (E5)	4	3	6	2
Staff Sergeant (E6)	1	<1	14	1
Sergeant First Class (E7)	1	<1	14	1
DoD Civilian	7	6	16	1
DoD Contractor	3	2	29	no data
No Data	7	7	na	
	123	99***		
*In Years				
**High avg. due to Reserve Soldiers ***Does not equal 100 due to rounding				

Table 1. Demographics by Rank, Time-in-Service, and Average Number of Deployments

Factor / Item	Item Nomenclature	Factor Loading
Factor 1	ITV Utility = .94, n = 103, M = 4.9, SD = 1.2	
Item 1	I feel the ITV system I am currently using is easy to use.	.601
Item 4	I feel the ITV system I am currently using produces the data I need to do my job.	.811
Item 5	I feel the ITV system I am currently using provides enough data for me to make decisions.	.895
Item 6	I feel the ITV system I am currently using gives me a greater ability to plan.	.854
Item 8	I feel the ITV system I am currently using provides me the ability to track my equipment and supplies while en route.	.813
Item 10	I feel the ITV system I am currently using allows me to do my job more efficiently than other ITV methods.	.741
Item 11	I feel the ITV system I am currently using increases my confidence in supply chain management.	.817
Item 12	As a result of the ITV system I am currently using, I can better predict when supplies will arrive.	.814
Item 14	I feel the ITV system I am currently using enhances my ability to plan in support of my current mission.	.874
Factor 2	ITV Tracking Ability = .82, n = 103, M = 4.4, SD = 1.1	
Item 2	I feel the ITV system I am currently using reduces wait time when ordering CL II and CL IX.	.674
Item 3	I feel the ITV system I am currently using has limited duplicate ordering.	.662
Item 7	I feel the ability to track equipment and/or supplies while en route gives me more confidence in the distribution chain.	.554
Item 9	I feel the ITV system I am currently using gives me the opportunity to fix misdirected shipments.	.787
Item 13	The improved usability of my current ITV system reduces the amount of spare parts I order.	.762

Table 2. Factor Loadings and Reliability Estimates

included systems such as MTS, Blue Force Tracker, and Logistics Information Warehouse (LIW).

Research Question One

The first research question (RQ1) involved sorting the respondents based on the most current ITV system they used. The four primary ITV systems; BCS3, GTN, ITV Network Server, and GCCS were in individual categories while the remainder of the ITV systems were grouped into other ITV Systems. Independent sample t-tests were used to address this question. Specifically, the users' mean scores on utility and tracking were calculated by ITV system. The users' mean score for all ITV systems were then compared to determine if a specific system was identified more frequently than other systems. Refer to Table 3 for independent sample t-tests for the results.

Comparing the means of the individual ITV systems and the factors, utility and tracking, only two system comparisons, GCCS and ITV Network Server, produced significant mean differences indicating a difference in the perception of utility and tracking between GCCS and ITV Network Server exists such that respondents preferred ITV Network Server to GCCS (t=-2.7, p<.01). It is noteworthy that the GCCS users are all field grade officers with experience at echelons above corps staff, suggesting GCCS may have more of an operational function for the users versus a tactical function like that of the ITV Network Server.

Though the independent sample t-test comparison only produced one statistically significant result, there were consistent trends in the mean scores of the ITV systems. The ITV Network Server had a larger mean score for both utility (M = 5.3) and tracking (M = 4.9), indicating that users slightly agree that ITV Network Server provides better utility and tracking over the other ITV systems tested. Refer to Table 3 for ITV Network Server mean score.

Research Question Two

Research question 2 (RQ2) was considered in two parts. The first part of RQ2 (A) was addressed via bivariate correlations between mean scores in an effort to determine significant relationships between user knowledge of ITV in general, and ITV's ability to reduce duplicate commodity ordering. The second part of RQ2 (B) was also analyzed via bivariate correlations between mean scores to assess the relationship between user knowledge of ITV in general, and its ability to provide the data commanders and users need to do their jobs. Results of the relationships between user knowledge of ITV in general, and the relationship between its ability to reduce duplicate commodity orders and provide data required for the user to do his or her job are provided in Table 4.

Correlational analysis results indicated no significant relationship between ITV use and the perception that ITV use limited duplicate commodity orders (r=.15). However, ITV in general does appear to provide users and commanders the information needed to do their job (r=.25, p<.01).

Research Question Three

Research question 3 (RQ3) was considered in two parts. The first part of RQ3 (A) sought to determine whether a relationship existed between user knowledge of an individual ITV system, to include RFID, and the system's ability to reduce duplicate orders. The second part of RQ3 (B) sought to determine whether a relationship existed between user knowledge of an individual ITV system and its ability to provide the user the data needed to do his or her job. Results of individual ITV systems abilities to reduce duplicate ordering and providing users with the data required to do their jobs are presented in Table 5.

Correlational analysis results for the first part of RQ3 (A) indicated no significant relationship between a specific ITV system and the perception that the use of an individual ITV system limited duplicate commodity orders. Thus, the perception was that individual ITV systems did not appear to reduce duplicate commodity ordering.

For the second part of RQ3 (B), results supported user perceptions that the use of RFID and the ITV Network Server provides the user with the information and data needed to do his

	FACTOR 1 - UTILITY						FACTOR 2 - TRACKING			
	N	M	t	sig.			N	M	t	sig.
BCS3	38	4.8	.03	0.97		BCS3	38	4.5	1.2	.23
GTN	21	4.7				GTN	19	4.1		
BCS3	38	4.8	-2	0.06		BCS3	38	4.5	-1.5	.14
ITV NETWORK SERVER	20	5.3				ITV NETWORK SERVER	20	4.9		
BCS3	38	4.8	1.3	.2		BCS3	38	4.5	1.7	.1
GCCS	9	4.1				GCCS	9	3.9		
BCS3	38	4.8	-1.1	.27		BCS3	38	4.5	-.47	.64
OTHER ITV SYSTEMS	18	5.1				OTHER ITV SYSTEMS	20	4.6		
GTN	21	4.7	-1.8	.08		GTN	19	4.1	-2	.06
ITV NETWORK SERVER	20	5.3				ITV NETWORK SERVER	20	4.9		
GTN	21	4.7	1.1	.27		GTN	19	4.1	.41	.68
GCCS	9	4.1				GCCS	9	3.9		
GTN	21	4.7	-1	.31		GTN	19	4.1	-1.3	.2
OTHER ITV SYSTEMS	18	5.1				OTHER ITV SYSTEMS	20	4.6		
GCCS	9	4.1	-2.7	(.01*)[1]		GCCS	9	3.9	-2.3	(.03*)[1]
ITV NETWORK SERVER	20	5.3				ITV NETWORK SERVER	20	4.9		
GCCS	9	4.1	-2	.06		GCCS	9	3.9	-1.8	.09
OTHER ITV SYSTEMS	18	5.1				OTHER ITV SYSTEMS	20	4.6		
ITV NETWORK SERVER	20	5.3	.8	.43		ITV NETWORK SERVER	20	4.9	.86	.37
OTHER ITV SYSTEMS	18	5.1				OTHER ITV SYSTEMS	20	4.6		
[1] Research Question 1 *Results significant between .05 and ,001 (2 - tailed)						*Results significant between .05 and ,001 (2 - tailed)				

Table 3. Independent Sample T-Tests Factor Comparison of ITV Systems

or her job ($r = .21$, $p<.05$ and $r=.32$, $p<.01$, respectively). Refer to Table 5 for RFID and ITV Network Server results.

Summary

Research Question 1 results indicated respondents preferred GCCS and ITV Network Server for both utility and tracking. This may be due, in part, to the fact that more users have access to the ITV Network System. Since GCCS must be accessed via secure communication, requiring a minimum secret clearance, not all users have the security clearances required to access GCCS. GCCS as an ITV tool, may be more beneficial for commanders and higher echelons of strategic and operational staffs because of its ability to provide secure messaging, tracking, and intelligence for planners and commanders. On the other hand,

Item	1	2	3
1	1		
	(n=106)		
2	.15	1	
	(n=103)	(n=112)	
3	.25*	.38**	1
	(n=105)	(n=111)	(n=114)

Table 4. Correlations for ITV Knowledge, Duplicate Order Reduction, and Data (Note: *p<.05 [2-tailed]; **p<.01 [2-tailed]; 1 User's overall knowledge of ITV in general; 2 ITV limits duplicate ordering; 3 ITV produces the data I needed to do the job)

Item		BSC3	GTN	GCCS	RFID	ITV Network Server	Other ITV	3	4
BSC3		1							
		(n=113)							
GTN		.14	1						
		(n=110)	(n=112)						
GCCS		.02	.29**	1					
		(n=110)	(n=112)	(n=112)					
RFID		.21*	.52**	.22*	1				
		(n=108)	(n=110)	(n=110)	(n=110)				
ITV Network Server		.31**	.35**	.05	.68**	1			
		(n=109)	(n=109)	(n=109)	(n=107)	(n=109)			
Other ITV		-.03	.03	.05	.28(*)	.10	1		
		(n=78)	(n=78)	(n=78)	(n=78)	(n=76)	(n=79)		
3		.12	-.07	-.07	.04	.15	-.16	1	
		(n=110)	(n=109)	(n=109)	(n=107)	(n=106)	(n=77)	(n=112)	
4		.17	.13	-.06	.21(*)[1]	.32(**)[1]	.20	.38(**)	1
		(n=112)	(n=111)	(n=111)	(n=109)	(n=108)	(n=78)	(n=111)	(n=114)
*Correlation is significant at the 0.05 level (2-tailed).									
**Correlation is significant at the 0.01 level (2-tailed).									
3. ITV limits duplicate ordering									
4. ITV produces the data I need to do my job. [1]Answers RQ3(B)									

Table 5. Correlations Between ITV Systems, Duplicate Order Reduction, and Data

the ITV Network System may have greater benefit for users since a majority of the users are mainly concerned with tracking the status of equipment and commodities at the tactical level.

Surprisingly, users did not perceive ITV use in general or any specific ITV system as a tool to limit duplicate ordering. Based on RQ 2 (A) and RQ 3 (A) analysis, 65 respondents indicated they continued to duplicate commodity orders for fear of not getting what they need. As all 65 of the respondents used an ITV system to track visibility of their equipment and commodities, results suggest users still do not see ITV as a tool of confidence when it comes to supply chain management.

Study Limitations

The primary study limitation involved the representativeness of the sample. Expanding the survey field to include other US Army educational programs, to include the Combined General Staff College and the US Army War College, might result in increasing the respondents in command positions. Responses from a larger command population would show how ITV has benefited, or fallen short of benefiting users from a commander perspective. The commanders could also provide feedback on what initiatives could be taken to improve the information from ITV systems. By addressing a larger command population, commanders could express to the program managers ideas or desires that would help provide information or data from the ITV systems that would, for example, limit duplicate ordering. For example, if an ITV system could produce military shipping labels, organize equipment, and produce organizational equipment lists, then transportation information systems (TIS) such as Transportation Coordinator Automated Command and Control Information System and the transportation Coordinator's Automated Information for Movement System, Version II could be streamlined. Since at most installations, TIS are aggregated at a central location and not as readily available as most of the ITV systems, users could update and manage equipment densities with less difficulty.

Implications for Future Research

Possible future research could be conducted to assess the relationship between the training location, type of training, and length of training to focus resources, training time, and attention in order to better train personnel on the ITV systems currently used.

Additional research could be conducted on the individual ITV systems presented in this study. Researchers could focus on a

specific system and conduct controlled experiments with the users of the respective systems. This type of research could provide more detailed data for program managers responsible for ITV implementation. Program managers could further this study to analyze all costs associated with training for multiple systems in an effort to determine if monetary savings exist with a single system.

A 2006 article from the Program Executive Office, Enterprise Information Systems (PEO EIS) referenced the impact of RF-ITV on areas such as customer wait time and duplicate requests.[17] In the 8 months following the inclusion of RFID within tactical business process, the Marine Corps was able to reduce their customer wait time from 28 to 16 days. The monetary result was a reduction in $47M of inventory and a retrograde savings of $17M.[17] This indeed is one of the intents of ITV. However, what type of study was conducted that produced these results? Were there factors other than ITV that influenced the reduction in inventory, such as reduced storage facilities? A future effort could involve incorporating Marine Corps study metrics with this research effort and be expanded to include all ITV systems to assess whether similar results could be obtained. In addition, further research could evaluate which ITV systems users perceive to reduce customer wait time.

Conclusion

The overall purpose of this research was to determine if there was a specific ITV system users preferred. Although there were no significant differences between the individual systems, a recurring theme was observed from the respondents—there are too many systems. There should be one system used in garrison that we can take and also use while deployed. This leads to the question of whether one ITV system can replicate the capabilities of all other ITV systems as a single interface for commanders and users? By analyzing the expectations and requirements of the ITV system, program officials may be able to ascertain whether a single system is viable.

Another common theme noted was that respondents indicated ITV is seldom used while in garrison to monitor the flow of commodities in the supply chain. This may have some influence on why there were no significant relationships between ITV use and limiting duplicate commodity orders. If commanders and users use the same ITV system when deployed as used in garrison, they may develop more confidence in the distribution process. Increased emphasis on in-garrison training and use of the ITV systems could increase commander and user confidence in the distribution process.

Notes

1. Clark Hall and Vincent Bernhard, *Container Management During Desert Shield/Storm: An Analysis and Critique of Lessons Learned,* US Army War College study project, Doc. call no.: M-U 39080-83 H174C, Carlisle Barracks, PA, April 15, 1993.
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Major Charlie Ward *is currently the Deputy Support Operations Officer for the 3d Sustainment Brigade from Fort Stewart, GA. At the time of the writing of this paper, Major Ward was a student in the Graduate Logistics Management program at the Air Force Institute of Technology, Wright-Patterson Air Force Base, OH.*

Major Sharon Gibson Heilmann, PhD, *is currently the Director of Research and assistant professor of management in the Department of Management, United States Air Force Academy, CO. At the time of the writing of this paper, she was a faculty member in the Department of Systems and Engineering Management, Graduate School of Engineering and Management, Air Force Institute of Technology, Wright-Patterson AFB, OH.*

William Cunningham, PhD, *is currently a professor of logistics management and Program Director for the Graduate Logistics Management Program in the Department of Operational Sciences at the School of Engineering and Management at the Air Force Institute of Technology, Wright-Patterson AFB, OH.*

…instant history [was] invariably shallow history.

—Anthony Cordesman