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Federal supply chain operations

Time and motion study

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The Federal Government continues to experience significant change and is primed for further transformation. Changing customer demands, progressive regulation, rapid technology advancement, and overall demand for efficiency are creating a unique environment for Agencies to adapt. The Agencies must transform their operating models, business processes, and technologies to manage the complex landscape of customer service.

Additionally, the relationship of suppliers and customers has created a demand for leading performance and health measurement with an eye for reduced variation in the delivery of services. This expansion is occurring as a result of a mindset of increasing customer satisfaction, increasing the speed of processes, and improving the overall yield of the organization. This approach is crucial as the shift continues towards efficiency and effectiveness of operations.

Agencies are responding by realigning their operating models—"What are my requirements?"; "How long should and does it take to complete my requirements?"; "How effective (Yield) is my output?"; "How much risk can I support in my operations?" Measurement and workforce/process management is the next level of engagement to achieve these results.

One noted example—a large Federal Agency comprised of Field Operations and Field Offices utilized a workload analysis model combining case inventory and flow (with related characteristics) and the amount of time required to complete case subtasks. In 2014, a Time and Motion Study (TMS) was completed to develop better values for the level of effort required to complete cases at the subtask level. This 2018–2019 TMS and subsequent data analysis findings will provide the ability to update the level of effort values for staffing, budget, performance, and cost models of the field investigative process. Additionally, this study led to the creation of a Workforce Management Strategy tool to perform workload distribution what-if analysis by case type, risk parameters, etc.

From the completion of the first TMS to the initiation of this TMS, various factors have been introduced and incorporated into case processing and Field Operations, necessitating the new study:

- General continuous process improvement
- Case-level tiers were introduced, creating new or modified requirements at each tier
- New methods for handling and managing in-progress cases
- Hub and surge field investigative operations
- Creating/expanding video teleconference and phone use
- Other investigative requirements/process policy changes.

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Initial analysis of alternatives

Crucial element of the strategy to understand the performance of the enterprise and completing efficient tasks.

Data plan strategy

The data planning team evaluated multiple courses of action regarding what agents to sample, how many to sample, how to collect data, how long to collect data, and many other variables. Each variable was carefully considered and the pros/cons of each were evaluated against each other.

Course of action	Description	Pros	Cons
Random sample of 35 percent of investigators from all offices	— Sample 100 percent of offices and a specific percentage of headcount from each office (35 percent – based on statistical calculations on slide 4; rounded up from 32 percent) — Sample population will be chosen at random and validation will occur after sample is chosen to ensure sample is representative of the office — Validation of random sample will compare efficiency between sample and office population to ensure consistency	— Accounts for unique geographic differences and circumstances at each office location — Accounts for issues that are not consistent across customer base — Random sampling accounts for differences in agents — Random sampling removes all bias from agent selection	— Increases the number of samples as compared to 100 percent offices with agent cross-section and representative sample
100 percent of office with agent cross-section	— Sample 100 percent of offices and a cross-section of agents (i.e., one high-performing, average, and underperforming agent from each office)	— Accounts for unique geographic differences and circumstances across customer base — Accounts for issues that are not consistent across customer base — Accounts for differences in skill, productivity, GS level, and other factors across agents	— At levels desired for the analysis (confidence level and margin of error), this COA would not be statistically significant
Representative sample	— Sample offices and Federal Agents that are representative of the larger workforce (i.e. one large, medium, small population center based on population and population density)	— Lessens workload and time to complete based on smaller amount of data to collect — Easier to replicate on the future	— While it may be representative on criteria such as population, it does not take into account unique customers or issues unique to certain areas (i.e., drug use in California versus foreign contacts in DC)
100 percent/ 100 percent	— Sample 100 percent of offices and 100 percent of federal agents	— Ensures sample is representative of the entirety of the United States both in geography, customers, and agents	— Significantly longer timeline to complete — Resource requirements are much larger — Deviates from the assumption of sampling and measures for the entire population

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Communications plan

Thoroughly communicating the plan, process, and desired results to more than 1,800 agents proved to be critical to the success of the TMS.

Focus groups

Within the TMS Planning Phase, focus groups were conducted to solicit feedback from previous collection efforts and discuss other potential methodologies. Additionally, the group wanted to gather insight into how the TMS team could implement an effective communications strategy, understand how a new TMS would be perceived by the field, and to otherwise include active field participation. In this regard, the team conducted four focus group sessions, which included Special Agent in Charge (SACs), agents who participated in the previous study, agents who did not participate in the previous study, and a mixed group of SACs and agents. Major results included:

- SACs wanted to be involved in the TMS process. The TMS team organized multiple conference calls to update SACs as the TMS effort got underway and included SACs in participant review.
- Agents believed that their data inputs during the last time study were questioned by leadership, which had an impact on the data submitted. The data collection was designed to not require agents to attach their identification to each data entry as was done with the previous study.
- Both SACs and agents were concerned about the accuracy of the data and level of detail required. The data collection effort was designed to maximize the amount of data extracted from PIPS.

There was concern that the agents selected to participate in the study would not accurately reflect the breadth of experience and performance levels in the field. The TMS team randomly selected agents with an availability review by SACs. To ensure that all levels of agents, including both grade and performance, were included in the study, current grade and 2018 Total Productivity were reviewed for the random selection.

Agent guide

The TMS team, spearheaded by the government leads, created a document to clearly define the methodology that agents should follow throughout the study as it did not always align to current guidance. The guide also ensured that a standard approach to time collection was followed by those participating in the study.

FAQ

SACs and agents indicated the need for a consolidated list of frequently asked questions with detailed answers to create additional clarity regarding the ongoing TMS. Created was a list of general questions, troubleshooting and support questions, and accurate time recording questions to provide additional support in executing TMS.

Sampling strategy

Ensuring a diverse sample of agents (skill, geography, customer base, and case types) was required to test the boundaries and variation of the current state.

Participant sampling

The TMS Data Team, after the evaluation of multiple courses of action, decided that the sampling of 100 percent of the field offices was required for geographically representative data. Having agents from each Field Office would help ensure that all unique differences and variations, to include geography and customer, were accounted for in the study.

Using data provided by HR, the TMS Data Team decided on a 35 percent sample of the 1,612 federal field agents. This 35 percent sampling would be applied to each office based on office headcount. International TDY agents were excluded.

Using the master list of all federal agents, the TMS Data team assigned each agent a random ten-digit number to ensure there were no repeats. The master list was then filtered by Field Office, and then sorted by random number, smallest to largest. The required number of agents was then chosen from this list starting from the top. For example, Field Office A had 17 agents assigned to that office. Once the randomization was completed, the first six names were chosen as participants. FY 2018 Total Productivity data was added to the roster (by name) to ensure a representative sample of higher and lower producers was participating in the collection effort.

The list containing all selected agents was disseminated to each SAC for review and approval. SACs evaluated agent availability as well as removed trainees or employees on a performance improvement plan. If a replacement participant was required, then the next agent on the random number sorted list was designated for the time study. Due to some attrition and rounding at the Field Office level, 528 agents (32.7 percent) of the population participated.

Random #	Last	First	SID	FY18 Productivity (Total)	Grade	Step	S-Org
0.108233546				125.66%	11	1	
0.236047972				107.91%	12	5	
0.271822703				115.04%	12	2	
0.351215314				84.28%	12	2	
0.367643297				132.13%	12	2	
0.461482862				97.79%	12	6	

Figure 1: *A screenshot from the Excel workbook used to randomly select participating Investigators from each Field Office based on sample size determinations.*

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Sample size analysis

The TMS Data Team conducted a robust analysis of sample sizes to ensure that the data was collected across tiers, case types, items, etc., and any associated analysis could be considered accurate and representative of the entire federal field population.

Prior to the sample size analysis, the TMS Data Team generated a "population" for each of the "buckets" of data. Using historical data, the TMS Data Team was able to generate the FY18 population by case type, item type, tier type, and any combination of the three (e.g., T4R ESI or T5 EDUC – P). After the population size was defined, the TMS Data Team used a sample size calculator with a population defect rate of 0.12 and precision of 0.03 to determine the target sample size. This sample size analysis proved invaluable as the team was able to determine which "buckets" would take an unusual amount of time to "fill" and could be combined with like items to generate insight.

Data collection plan

The data collection strategy required enough detail to enable the analysis but to not burden the agent with an overwhelming data entry set of requirements.

Collection methodology

The TMS Data Team defined, reviewed, consolidated, and "bucketed" the items and tasks that an agent completes (in part or whole) over the course of regular business. The TMS Data Team attempted to create data collection categories to be mutually exclusive and collectively exhaustive. The finalized list of data collection categories were:

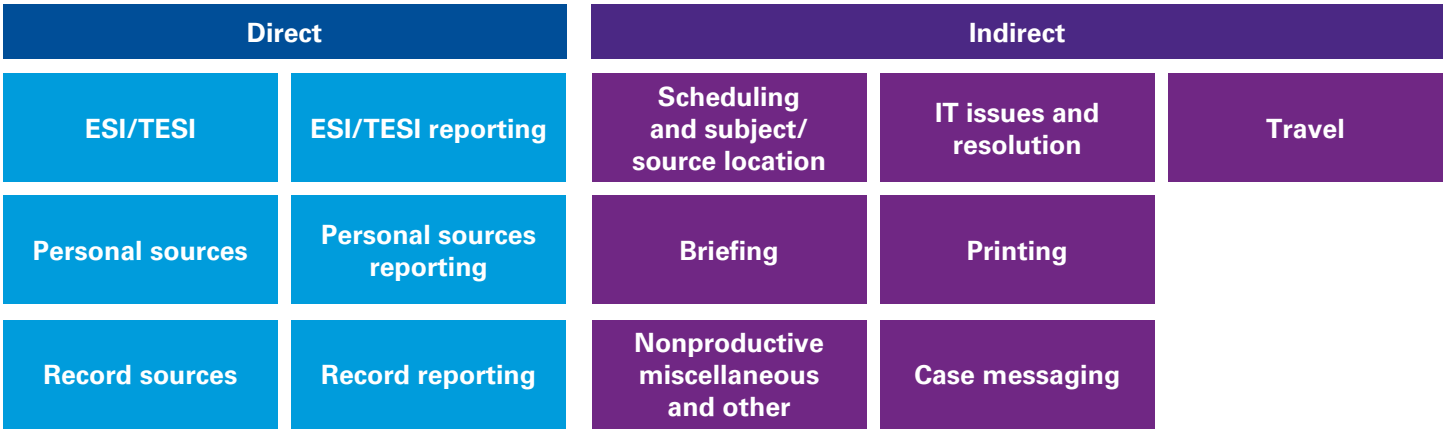

Figure 2: *Based on business rules from Field Operations, the TMS team identified 13 categories of time to be captured throughout the study and aligned the tasks by a previously defined "Direct" or "Indirect" categorization, which was subsequently re-evaluated as the TMS progressed.*

- **Direct time:** All direct investigative task (production) time recording would include case number and item number to support linking to other attributes thought to be drivers of the level of effort associated with field investigative work. Interview and record review time data was collected separately from their associated report writing times to allow deeper analysis, but were linked (by case number/item number) to computer final estimated man-hour times for those tasks. All direct task times were to be entered as they were completed to help determine accurate reporting.
- **Indirect time:** More detail was included in this time collection effort compared to the 2014 TMS. In 2014, indirect tasks (production support) were aggregated and reported in total as were daily travel times. For 2018–2019, we requested specific subdividing of the indirect task times into briefing, case messaging, printing, and scheduling/source locating and we tracked travel time associated with home station vs. TDY. Additional data was also collected on miscellaneous nonproduction/ other tasks and information technology down time to get a better feel for field overhead. (Note: a separate analysis using PIPS time data was accomplished in conjunction with this TMS data to give more fidelity on types of "other" time.) Indirect time subtask times and travel times were to be aggregated and submitted once at the end of each business day because these tasks occur frequently throughout the business day and are less attributable to particular item-level investigative components.

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Technology strategy

A mobile, flexible, and consistent approach to data collection established ease for agent input "on their schedule" and limited the need for "end of day" administrative requirements.

Evaluation of vendors

The TMS team evaluated multiple options for a data collection tool to include commercial off the shelf, Microsoft Office built products, and various commercially available iPhone/Android applications. Because the client was constrained on cost and federal government procurement restrictions, the TMS Team chose SurveyMonkey based on its relatively low cost, functionality, and current licenses on hand.

Data collection tool

The TMS Data Team created, tested, and piloted a SurveyMonkey-based data collection tool. This particular tool allowed access via a mobile device or laptop computer. It provided drop-down menus to reduce data entry errors and key strokes. The system included a user-friendly administrative dashboard to administer and monitor the survey in real time and allowed for the direct export of individual responses into Microsoft Excel and Tableau for analysis and visualization.

The participating agents were provided a user guide and were given a "free-use" period to enter notional data in older to familiarize themselves with the functionality of the data collection tool.

Pilot and go/no-go decision

A proof of concept and pilot was a vital planning milestone to ensure data collection tool functionality, clarity of communications material, and quality of input data.

Field office pilot

Prior to the live launch of the TMS, the TMS Data Team conducted a 3.5-day pilot and proof of concept. The desired end state was to solicit actionable feedback from actual agents on the functionality of the data collection tool, data collection categories, daily burden and interference with daily activities, and general feedback. The selected Field Office supported the pilot and provided four agents with various levels of field experience and technological skill. The pilot was conducted over a 3.5-business-day period with one day of orientation, background, data tool familiarization, and Q&A followed by two days of actual data input. The group convened to conduct an after-action review and solicit feedback from the agents. The feedback provided by the Agents directly impacted the functionality of the tool and changes were made prior the full-field launch.

The TMS was initiated across the continental United States in a phased approach to ensure any field operational, volume issues, or questions could be addressed.

Steady state monitoring and collection

The real-time monitoring and analysis of data collected from the field allowed the TMS Team to accurately communicate to the client the current collection status, the sample sizes, and preliminary results.

Dashboard overview and orientation

The TMS developed a series of Tableau dashboards to track progress of data collection, help better understand the data being submitted, and meet specific requests from field operations. Tableau dashboards are meant to be interactive, which means that the full capability can only be realized within the Tableau Reader application and not in the images below. The dashboards created are as follows:

1. **Metrics collection progress report:** Tracks the raw data being submitted to SurveyMonkey at the national, regional, and Field Office levels. Provides aggregate-level data for total time and number of data entries across each of the 13 defined tasks.
2. **Data merge metrics collection progress report:** Tracks the data pulled from PIPS connected to Production or "Direct Time" activities, including Tier Type and Item Type.
3. **Statistical dashboard report:** Allows the user to produce box plots and statistical analysis for both production activities and production support activities with various filter options. Production activities can be further examined by Item Type, Case Type, and Field Office. The statistical analysis calculates the Average, Standard Deviation, Median, and the 85th Percentile.
4. **Histogram dashboard for production and production support activities:** Allows the customer to view histograms of production activities broken out by Task Type, Tier Type, and Seriousness Code. Each histogram dashboard allows the user to sort by Case Type, Task Type, Item Type, TDY (Y/N), Item Method, Highest Seriousness Code, and the number of issues (for production activities; production support activities have fewer relevant filters).

Data clean and data join with MS Access dashboards

The TMS Data Team remained closely synchronized throughout the data collection period to ensure accurate cleaning, reporting, and compilation of the data. Prior to the start of the data collection period, a Microsoft Access database was created to store the previous 12 months running of case data from PIPS. During the weekly data administrative tasks, this Microsoft Access database would be used to complete the data set.

Prior to combining data sets, the SurveyMonkey extract would be cleaned and standardized to ensure the value and utility of the data. After scrubbing, just over 23,500 individual entries were removed from the data set. Approximately 95 percent of these removals were associated with incomplete data entries (missing a required field or fields), the case number did not match a live

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case, inconsistencies existed within the entry (e.g., ESI reported but item number was for RESI), or obvious human error. The remaining approximately 5 percent of entries were removed due to an inability to determine the intent of the agent's entry (e.g., "4" in the hours and "100" in the minutes). Overall, the "toss-out" rate was approximately 13 percent.

On a weekly basis, the data from the previous seven calendar days was extracted from SurveyMonkey. This weekly data set would be sent to the Microsoft Access database custodian. The weekly data set would be added to the Microsoft Access database and would be joined based on case and item number, completing the data set.

Data set completion

After data was joined on case number in the Microsoft Access database, it was input into two Tableau dashboards used to visualize the current state of the data collection process as well as to compute interim statistics and examine for trends or anomalies. Figure 3 depicts the attributes that the TMS would generate in connection to the Direct Task times submitted. Data categories above the dotted line between "6.f.iv: Honesty" and "7. Age of case" indicates data included in the current analysis. Data categories below the line indicate data that has been collected but is not included in the current analysis.

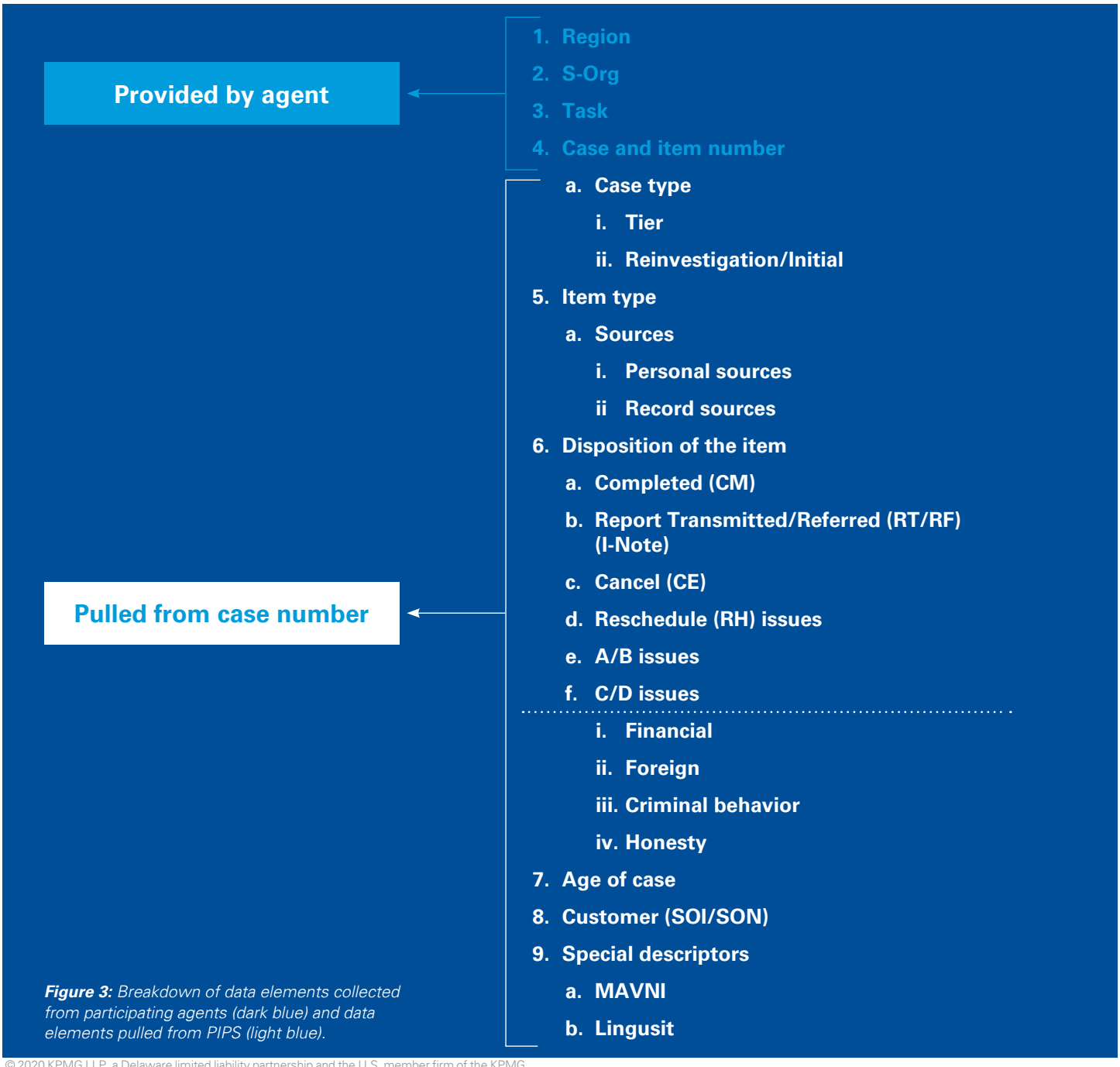

Figure 3: *Breakdown of data elements collected from participating agents (dark blue) and data elements pulled from PIPS (light blue).*

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Data validation

Over the course of the TMS, the TMS team conducted site visits in each of the three regions. These site visits took place in participating field offices with large numbers of participating Agents to include Chicago, San Diego, and Dallas.

These visits focused on communicating the intent of the TMS, its value to the business and the individual agent, and the value to leadership. The TMS team facilitated question-and-answer sessions and dispelled rumors or misinformation. These site visits were paramount in continuing to refresh agent-level buy-in and ensure project momentum continued.

Design review

A design review allowed for a baselining of expectations for the analytical outputs and an agreed-upon approach for both the client and the TMS team.

The power in the model and analytics was reflected in the way each operating scenario was evaluated (direct and indirect time inclusive of each subcategory). In addition, traditional levers were evaluated (mean, median) to ensure influencers within the data were properly identified:

- Geography
- Field office
- Case type.

Although the data yielded a vast amount of insight, there were common drivers within the analytics that required additional analysis with Subject Matter Experts (SMEs) within the client team. The TMS team convened a working group to perform a 75 percent design review of the project to ensure the final analysis yielded the expected comprehension of the data anticipated:

- **Started with the data.** The key to modeling the future for game-changing insights is understanding what is available to model. The quality of the data will determine the confidence level that leadership will have in the results from the analysis. Leaders who understand the deficiencies in data are prepared to adopt strategies that overcome incomplete data sets from disparate systems.
- **Focus on the data collection and resources in the sampling.** The skills required to conceptualize potential models, understand the data feeds into the models, and interpret the results are not easily established. Ensuring the resources in the data collection team understood the "Bigger picture" and were consistent in their output was key to completing this gate review.
- **Build the operating model.** With the SMEs assembled and the data/data collection validated, the focus shifted to how the leadership t eam will utilize its analytics capabilities in addressing the trade-offs to be able to address customer needs and operational cost reduction targets. During this step, analytics processes need to be defined to create a repeatable and consistent method that can be institutionalized and rolled out to the broader organization. Beyond data management and model management, processes are needed to understand how external influencers (e.g., case type) are tracked and how internal changes in operational priorities (e.g., hubs and surges) influence the process. Ultimately, the organization's methods of working will be the determining factor in how well initial value is sustained over time.

This design review proved to be key. Data and analysis interpretation was level-set and a common view of the data output was established. Additionally, the analysis methodology was synchronized, providing a common data picture for the recipient organization – Operations, Finance, and Quality.

Final analysis

Multiple iterations of final statistical analysis were conducted with the completed data set to ensure validity of results, agreement among leadership and stakeholders, and the determination of final time values.

Sample size analysis

The TMS Data Team conducted a robust analysis of sample sizes to help that the data collected across tiers, case types, items, etc., and any associated analysis could be considered accurate and representative of the entire federal field population.

Prior to the sample size analysis, generated a "population" for each of the "buckets" of data. Using historical data, the TMS Data Team was able to generate the FY18 population by case type, item type, tier type, and any combination of the three (e.g., T4R ESI or T5 EDUC – P). This sample size analysis proved invaluable as the team was able to determine which "buckets" would take an unusual amount of time to "fill" and could be combined with like items to generate insight.

Test for normality

The TMS data analysis was conducted to determine "average" time values for field investigative components as a function of the final result of that component and its statistically significant subordinate characteristics. Because variance exists between agents and cases, that variation and normality of data collected had to be measured. Based on varying factors (both internal and external) influencing time captured during the data collection phase, it is natural for this type of variation to occur as it relates to the type of work being conducted. Both normal variance and statistically significant variation were present in nearly all of the data collected for this study, indicating the presence of special cause variation in the time required to complete case work. The TMS Data Team used statistical validation parameters (measure of central tendency) to first determine if data sets were normal or non-normal.

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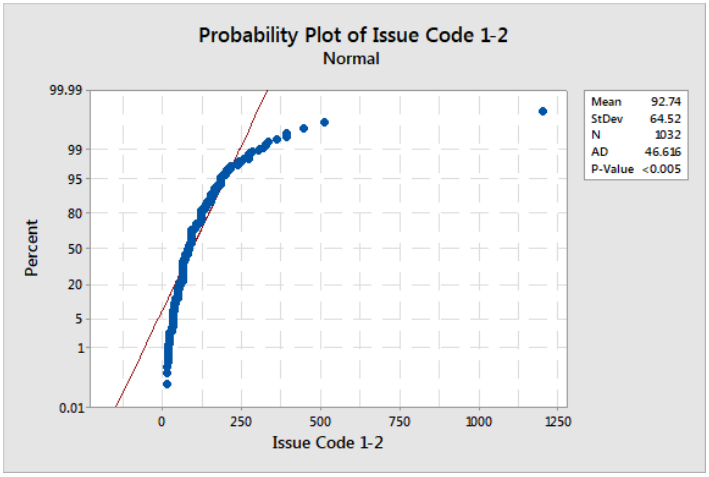
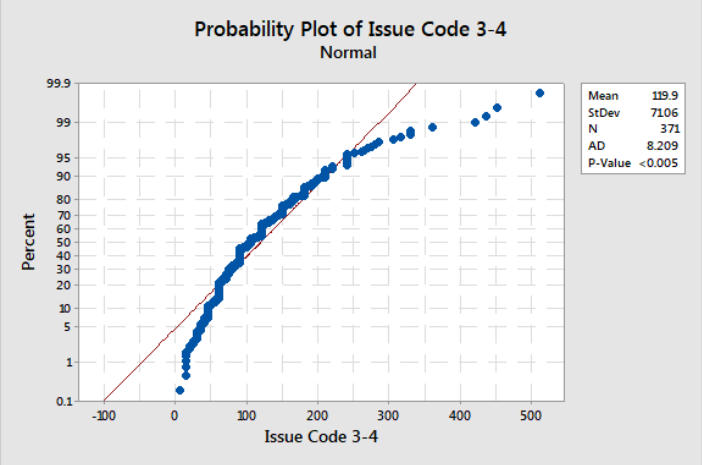
Ultimately, due to the data being non-normal (even to the significant factor level), careful consideration was taken to proceed with using the median values calculated in this study to represent the time needed to complete the field investigative components.





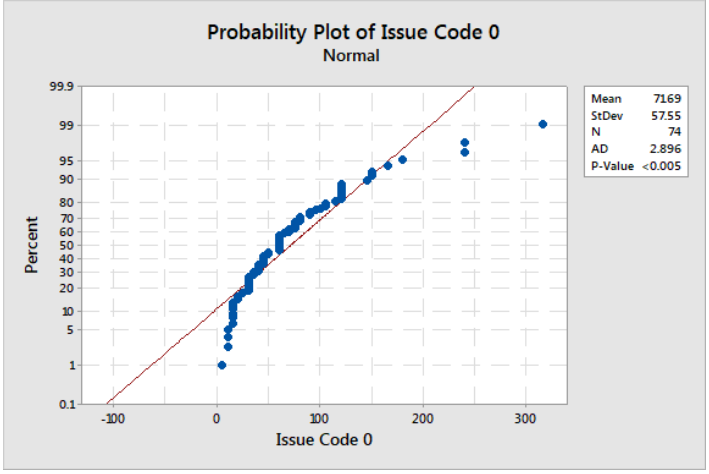


Figure 4: *The above figures represent samples of the normality analysis. These samples were conducted on T3 TESIs by Seriousness Code.*

Analysis to derive finalized time values

Means and median tests were conducted to reach the final values after pairing field tasks with the associated reporting tasks to compute the total time required to complete the task for a single data observation, then analyzing summary statistics. The process used by the TMS data team is as follows:

Data cleaning/validation

1. To be a valid data point for a direct task, both fieldwork (interview/record review) and typing (ROI time) must have been present in the data set. We'll refer to this as a task pair.
2. Task pairs were matched by common but unique 13-digit codes to their accompanying data elements contained within the client database.

Calculations and statistical testing

1. Calculations were made at the individual item level, then parsed by hypothesized significant factor (or dimension) for testing.
2. For a particular data subset (e.g., case type/item type), the values and distribution of time observations was examined to compute the mean, median, mode, and distribution percentiles. Confidence intervals were computed and means testing conducted.
3. Pair-wise comparisons were made to determine whether statistically significant differences existed.

Methodology for analysis

Direct

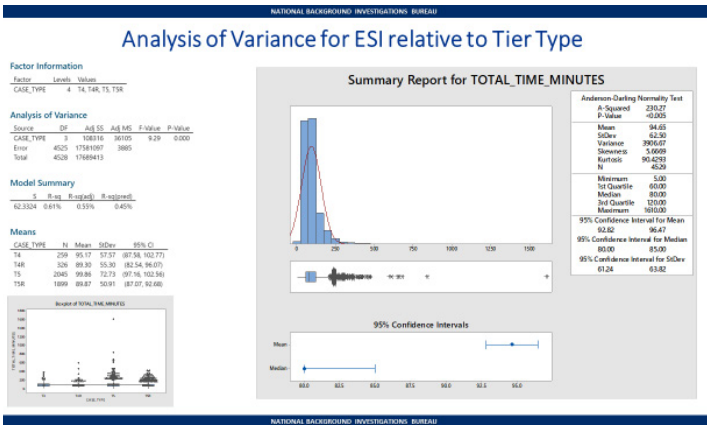


Figure 5: *This demonstrates the process by which the Production Activities were statistically analyzed (example ESI relative to Tier Type).*

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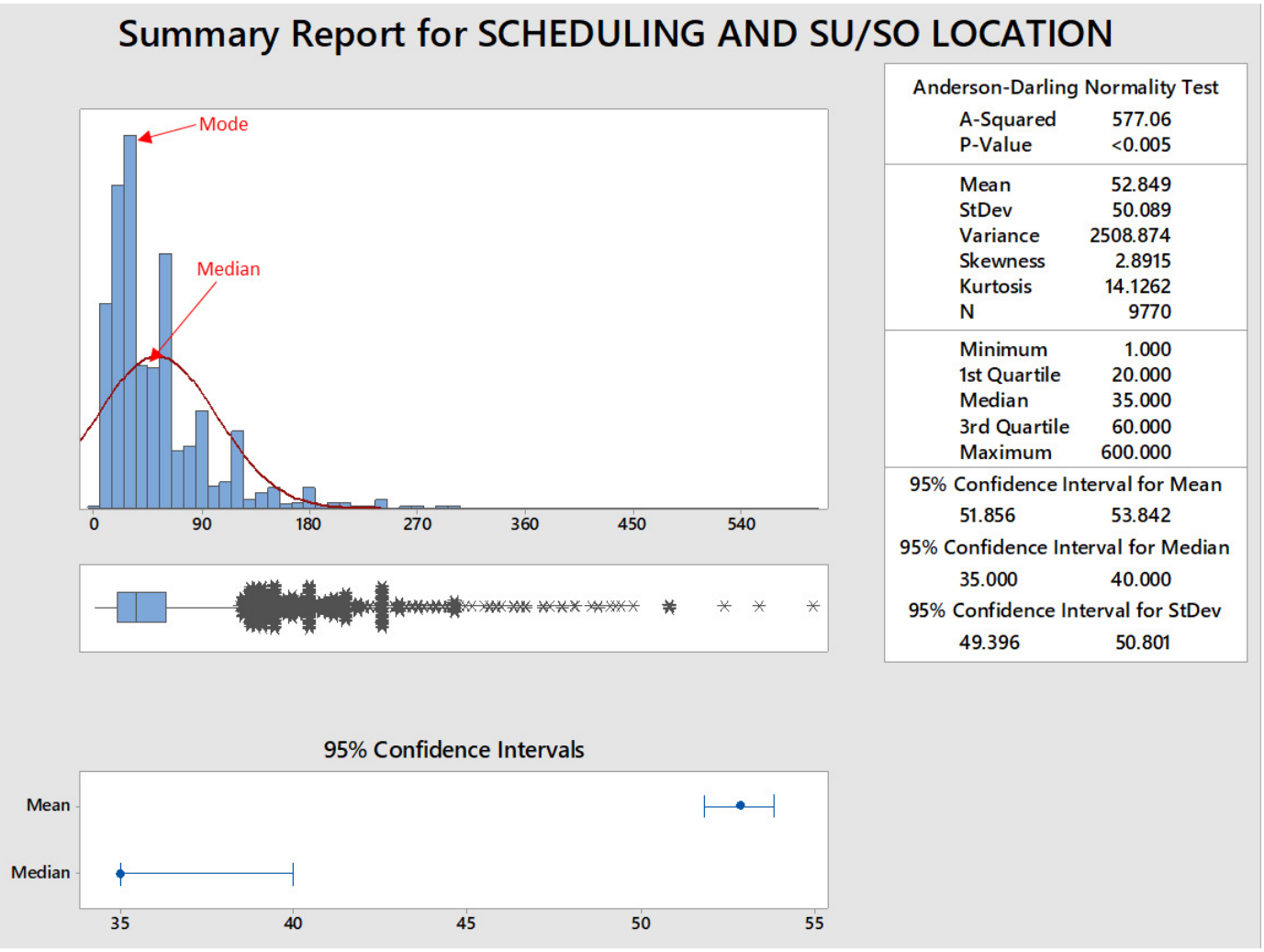
Tier	Item Type	Classification	Average	Median	25th Percentile	75th Percentile	# Unique Items with TMS Reported Data
T4	ESI	No Issues	127.08	102.50	73.75	180.00	40
T4	ESI	1-2 Issues (No C/D)	154.65	135.00	95.00	195.00	57
T4	ESI	3+ Issues (No C/D)	247.77	185.00	152.50	307.50	91
T4	ESI	C/D Issues	288.18	280.00	215.00	342.50	11
T4R	ESI	No Issues	136.03	125.00	80.00	195.00	39
T4R	ESI	1-2 Issues (No C/D)	146.90	150.00	120.00	165.00	84
T4R	ESI	3+ Issues (No C/D)	178.91	162.50	120.00	195.00	138
T4R	ESI	C/D Issues	398.33	265.00	233.75	288.75	6

Figure 6: *This demonstrates the process by which the sample sizes for T4/T4R ESI items were analyzed. The small sample sizes and similarity between tiers and item necessitated and allowed for consolidation to generate large samples.*

Tier	Item Type	Classification	Average	Median	25th Percentile	75th Percentile	Std. Deviation	# Unique Items with TMS Reported Data
T4/T4R	ESI	No Issues	131.49	110	75	183	72.12	79
T4/T4R	ESI	1-2 Issues (No C/D)	150.04	145	105	180	62.71	141
T4/T4R	ESI	3+ Issues (No C/D)	206.28	170	130	240	121.70	229
T4/T4R	ESI	C/D Issues	327.06	280	220	325	228.00	17
T4/T4R	ESI		180.99	155	120	205	113.62	466

Figure 7: *This illustrates the consolidated sample sizes for more accurate analysis for T4/T4R ESI items.*

Indirect



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Applicability to other clients and areas of opportunity

Time and motion studies, while commonly associated with manufacturing, are applicable to nearly all repeatable, standardized processes. The insight yielded from a time study is a significant value-add.

This type of TMS has a wide range of applicability across many industries and agencies. Key questions we typically ask when evaluating feasibility:

Question 1	Question 2	Question 3	Question 4
How can I maximize the efficiency of the resource within this process?	**How do I decide which processes have a high amount of variation?**	**What do I need to improve in order to reach my required levels of service?**	**How can I ensure that what is performed is actually needed and creates value?**
Can I reduce the cost of this process through measuring and re-engineering?	**How can new technologies be used to reduce process variability?**	**What is the impact of continuing with the current method of processing and its associated costs?**	**What are the lifecycle needs and costs of this process?**
What is the total cost of ownership?	**How do I show compliance to the overall agency?**	**Should my business be aligned with specific regulations and how do I assess the gaps?**	**How can I trust the quality of our data; how do we make decisions regarding optimizing our processes?**

The outcome of this analysis will inform next steps. However, a list of typical process candidates from past projects includes:

- **Transportation routes:** Delivery, short- and long-haul channels
- **Warehouse operations:** Receipt, store, and issue of assets
- **Repetitive operations:** Interviews, policy revisions, acquisition tasks.

All agencies and industry segments typically have some form of the operations described and lend themselves to variability reduction and improvement in efficiency through the deployment of a TMS.

How KPMG can help

KMPG's approach to a time study is tested and industry recognized.

We assist clients to establish line of sight between all workforce management decisions and business objectives—helping organizations to understand their demand on their resources, investment in time to operationalize these requirements, increase performance, lower total cost of operations, maintain safe and compliant operations, and devise enhanced value.

Why now?

Developments in technology and analytics mean we can make better and faster decisions that create a competitive edge in performance and cost of new and existing requirements. A Time and Motion Framework is being demanded by governments to provide assurance that organizations are appropriately sending money to manage their agencies' business.

Data driven. We consider all facets of a client's business model and align with their value framework, operational context, and risk management.

Full coverage. We cover all operational management subject areas, from requirements planning to workforce measurements and alignment.

Data knowledge. Our team have specialist skills in strategic planning, systems engineering, data analytics and performance measurements, organization, and workforce design.

Transformational change. We provide the understanding and insight to help our clients navigate transformational change.

Want to learn about KPMG's Federal Supply Chain capabilities? Learn more **here**.

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