# Deploying Technology to Facilitate Service Coordination: Making it Work

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## 1. Introduction

At the 2016 National Conference on Rural Public and Intercity Bus Transportation in Asheville, NC, the MSAA Knowledge and Technology Transfer team distributed a questionnaire regarding transportation agencies' deployment of technology to facilitate coordinated transportation to identify how customer needs are being integrated into the Travel Management Coordination Center (TMCC) development process and the resulting system.

The questionnaire contained questions regarding:

- Characteristics of responding agency/organization;
- Challenges faced by the agency in terms of service coordination;
- Technologies deployed;
- How needs and requirements for technology were determined prior to and validated after implementation;
- How the technology was procured;
- Characteristics and level of automation in stages of the service provision;

The survey focused on the processes agencies are using to reflect user needs in technology deployment.

This paper describes the characteristics of the respondent agencies, service-related challenges they face and the technologies and characteristics of the nine service stages.

## 2. Characteristics of Respondent Agencies

Twenty-nine agencies responded to the survey. Not all questions were answered by each agency, making it challenging to compare percentages across charts. Additionally, specific types of charts are used to show results based on the nature of each question. Pie charts are used to display the results of questions with only one possible answer. Bar charts were used to display the results of questions with multiple answers possible.

Figure 1 shows the types of agencies that responded to the survey. Most respondents were public transportation agencies, and the next most prevalent category was "Other." "Other" agency types included a contract operator with human service agencies and other agencies, a private intercity bus operator, consultants, county department of social services, a university research/technical assistance center, and a state department of transportation (DOT).

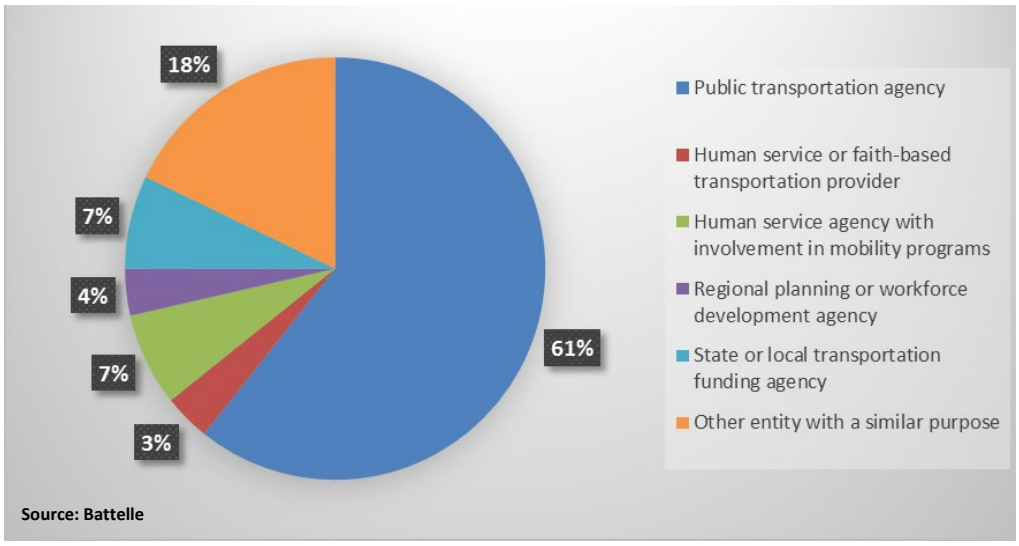


**Figure 1. Type of Organization Responding to Survey**

To get a sense of the relative size of the respondent's agencies, we asked them to note the total number of vehicles in each agency fleet. As shown in Figure 2, the top four fleet sizes, which cover over half of the respondents are 11 to 15 vehicles (29%), six to ten vehicles (17%), and 16 to 20 vehicles (13%) tied with 51 to 100 vehicles (13%).

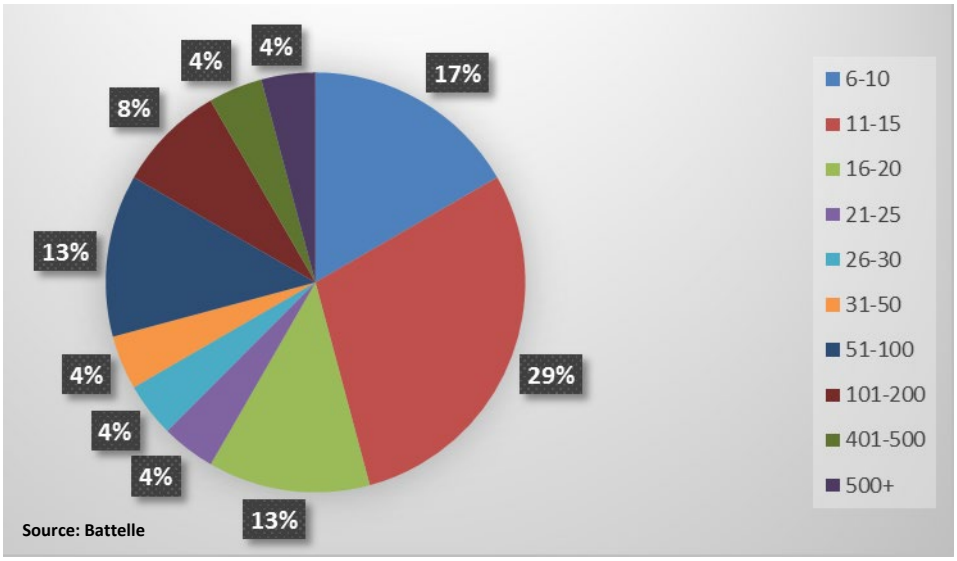


**Figure 2. Number of Vehicles in Respondent Agencies**

Figure 3 shows the types of services provided by the respondent agencies. Almost half of the agencies provide demand-response service. The responding agencies cover a very wide spectrum of ridership - approximate annual ridership for agencies ranged from 7,000 one-way trips to 27.4 million one-way trips.

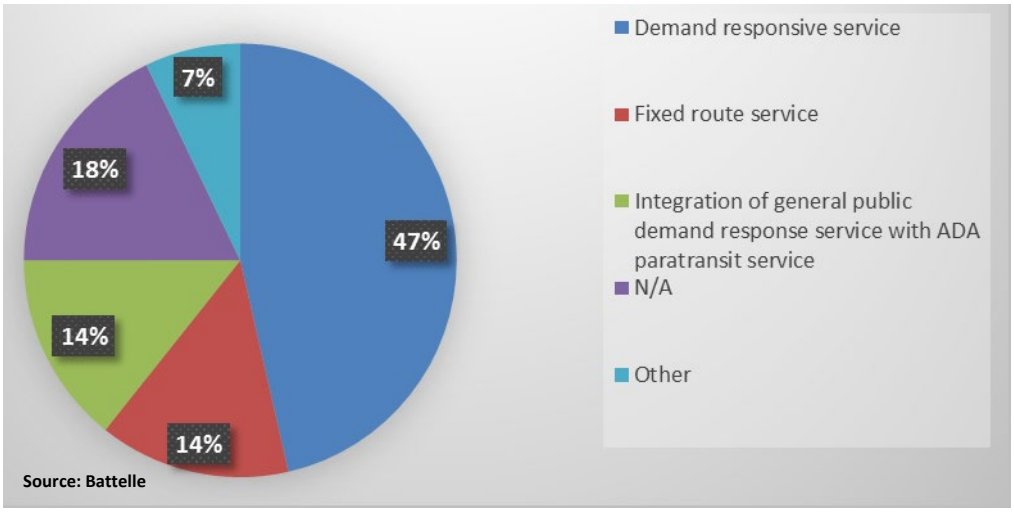


**Figure 3. Services Provided by Respondent Agencies**

We wanted to determine the staffing levels of the respondent agencies – both full-time and part-time. Even though nearly half of agencies have fleets of 20 or less vehicles, nearly half have over 25 full-time employees. Further, the number of part-time staff varies across agencies, with one to five part-time employees being the most utilized.

Two-thirds of respondents did not have agency staff specializing in technology and/or systems engineering. However, 57% of responding agencies had access to a staff member who is specialized in technology and/or systems engineering in a different department or agency.

Finally, funding directly affects technology deployment, so we asked whether technology research and deployment was covered in each agency's budget. 70% of respondents do not have a separate line item in their budget for technology research and deployment; 19% have a budget for these activities, but it is not a separate line item; and 11% do have a separate line item for these activities.

## 3. Service-related Challenges, Technologies and Characteristics of Service Stages

### 3.1 Challenges

USDOT's newly released *Reference Manual for Planning and Design of a Travel Management Coordination Centers (TMCC)*, notes that "the lack of transportation coordination creates many barriers to ensuring the mobility of transportation-disadvantaged persons." Further, many of the original MSAA "demonstration sites found that the lack of transportation coordination created similar challenges for their customers." So, we wanted to know which challenges were faced by the agencies that participated in the survey.

As shown in Figure 6, the top three challenges are as follows:

- Limited service area and hours (63%)
- Limited coordination exists among human service transportation providers (56%)
- Unmet demand for human service transportation (44%)

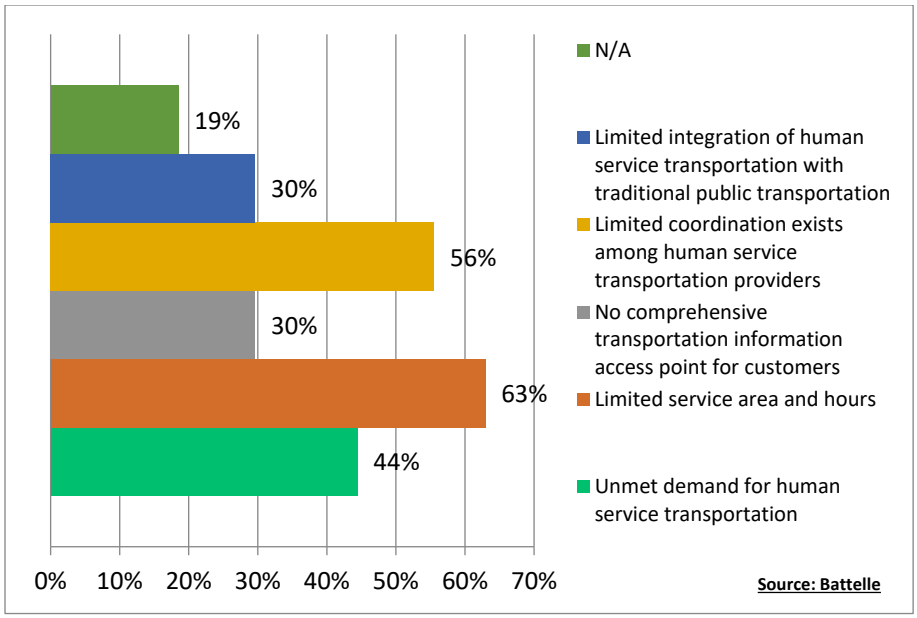


**Figure 4. Service Coordination Challenges Faced by Respondent Agencies**

### 3.2 Technologies

After identifying these challenges, survey respondents identified the technologies that have been deployed by the respondent agencies. As shown in Figure 7, the most prevalent technologies are automatic vehicle location (AVL) (70%), vehicle communications (70%) and scheduling and dispatching systems (67%). These same technologies match the most prevalent technologies in general in the transit industry[1].

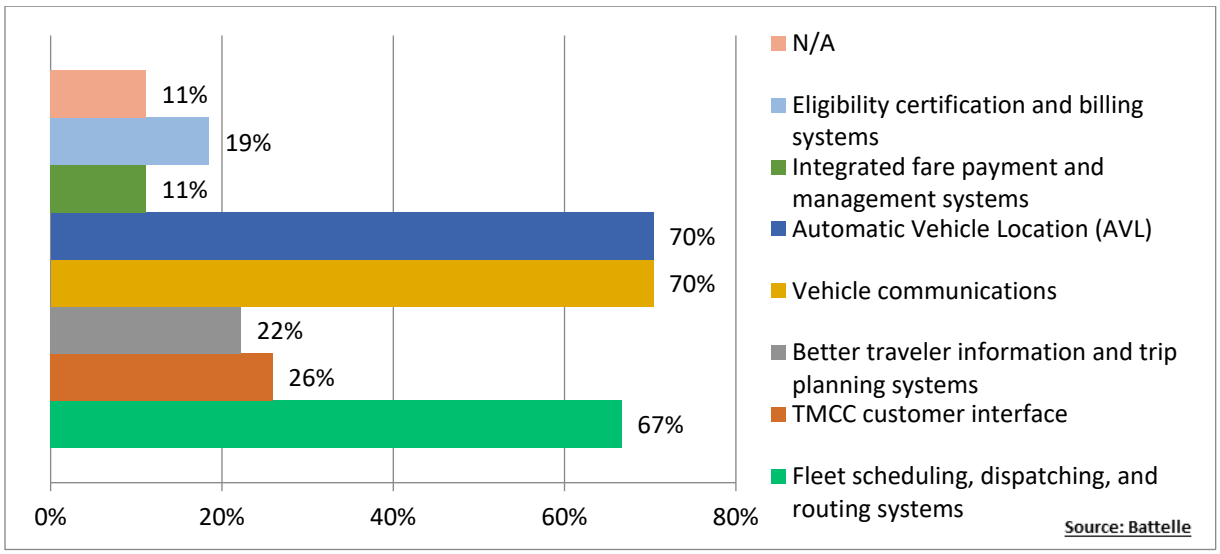


**Figure 5. Types of Technologies Deployed by Respondent Agencies**

[1] Carol Schweiger, ***ITS ePrimer - Module 7: Public Transportation***, prepared for the ITS Professional Capacity Building (PCB) Program, https://www.pcb.its.dot.gov/eprimer/documents/module7.pdf

### 3.3 Needs

Recognizing that the successful design and deployment of technology is based on user needs, we asked the agencies to describe how the need for these technologies was determined. As shown in Figure 8, 63% of respondent agencies determined the need for technology internally and 30% determined the technology based on seeing it at a tradeshow. The latter response highlights the importance of providing guidance and MSAA knowledge and technology transfer (KTT) products to agencies as to how best to determine the need for technology. One example of how to determine user needs to decide what technology(ies) should be deployed can be found in the Generic Concept of Operations (ConOps) located in https://www.its.dot.gov/research_archives/msaa/TMCC_ConOps.htm. Also, other sample ConOps can be found on the MSAA website (https://www.its.dot.gov/research_archives/msaa/msaa_project_overview.htm ). The "other" responses included several agencies that worked in cooperation with state departments of transportation (DOTs) to determine the needs.

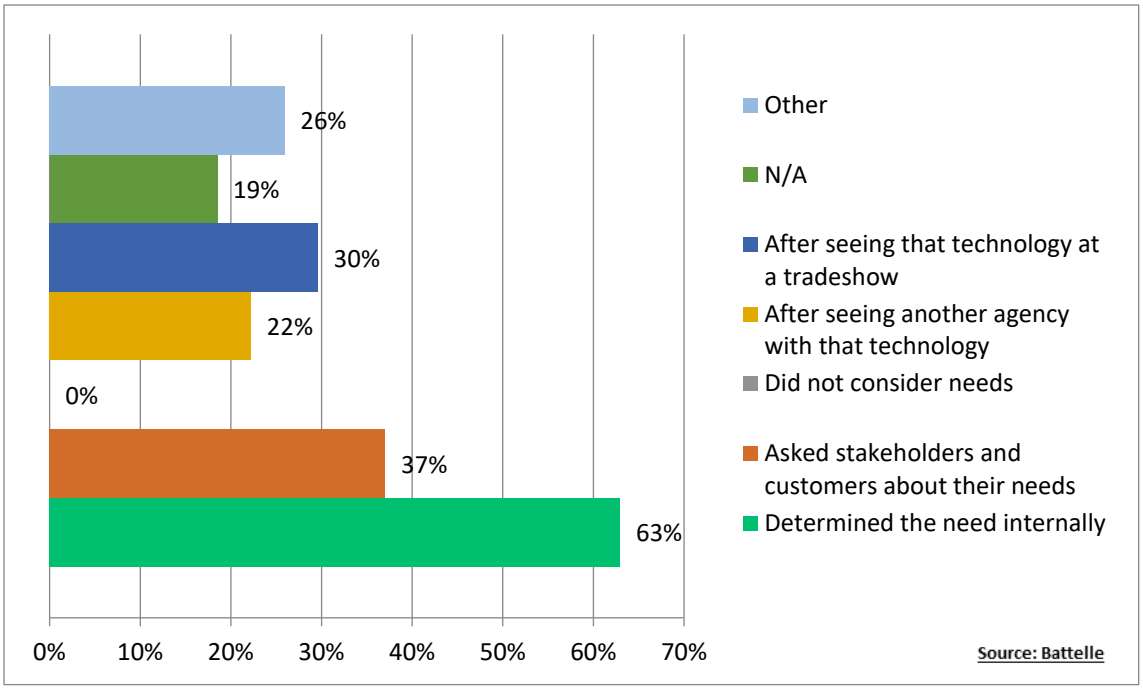


**Figure 6. How Respondent Agencies Determined the Need for Technology**

### 3.4 Requirements

Once technologies are identified for deployment, they are either procured or developed internally. In either case, requirements that define what (not how) each technology must achieve are developed. As shown in Figure 9, 46% of respondents developed requirements internally, followed by 29% who asked customers and stakeholders, 25% who used requirements from another agency, and 25% who used requirements provided by a vendor. The "other" responses include agencies who worked with state DOTs to determine the requirements. The responses indicating that requirements were determined internally or were obtained from a vendor strongly reflect the need for more guidance regarding requirements development, particularly for functional performance requirements. Using requirements from another agency is appropriate when the other agency has similar characteristics and customers.

However, these requirements should not be copied verbatim without considering the agency customers' specific needs. Using vendor-supplied requirements may result in a system not being capable of what an agency desires and expects. Further, sometimes requirements can be developed internally, but if the system will be used by external stakeholders, they should validate the requirements. Finally, if an agency does not have the appropriate expertise in-house to develop requirements (using a structured approach), it is strongly encouraged that an agency find and hire (if funding is available) resources that have this experience and expertise.

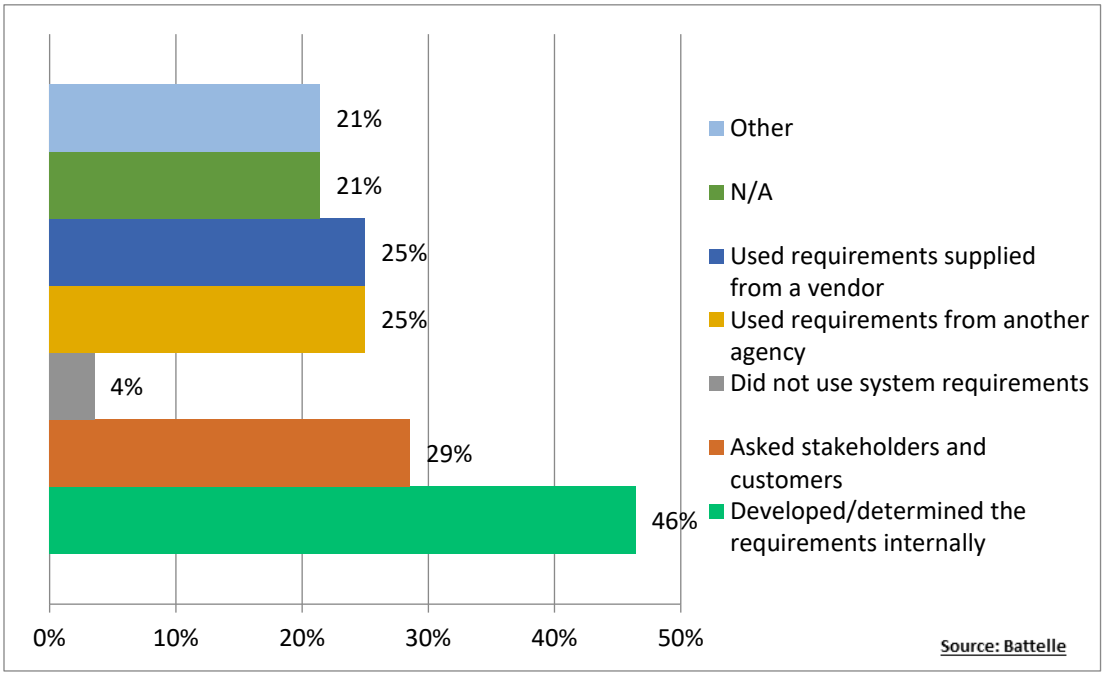


**Figure 7. Methods for Determining the Technology Requirements that a System Must Meet**

### 3.5 Procurement

At this stage of a project, technologies/systems may be procured from a vendor. In examining the procurement methods used by respondents, the survey results (as shown in Figure 10) indicated that 39% used a competitive request for proposals (RFP). No respondent agencies used an invitation for bid (IFB), which reflects the challenges associated with defining technical requirements for these types of technologies vs. using functional requirements that describe what the technology or system must do. Further, one of the "other" responses that may be of interest to agencies in the procurement stage is a "proof of concept" – an approach in which vendors who respond to an RFP must demonstrate the technology in a pilot before completion of the RFP process. Yet another "other" response of interest is piggybacking on an RFP being issued by a neighboring agency to procure the same technologies. Finally, another approach indicated by a respondent is procurement through a State DOT procurement. State DOT procurements may be used if a particular technology or system will be deployed statewide.

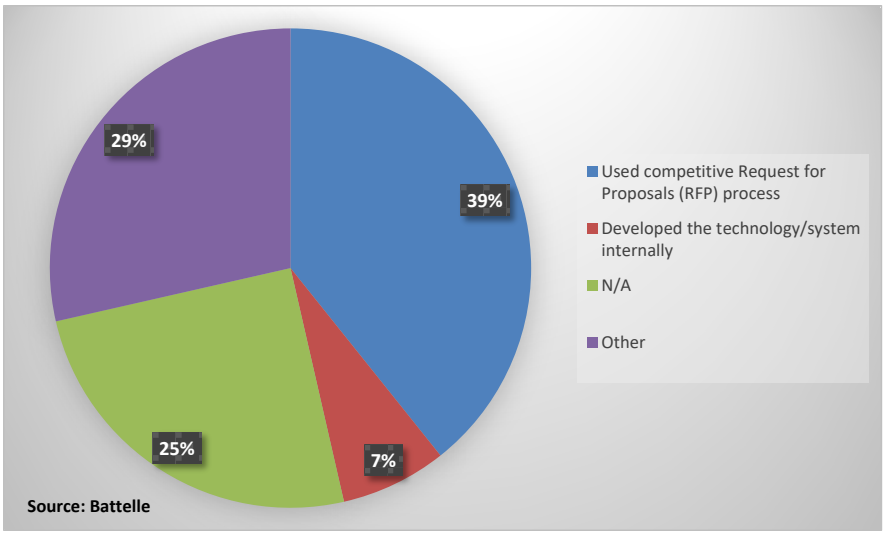


**Figure 8. Technology Procurement Process**

### 3.6 Implementation

Once the procurement is completed, the next step in the process is implementation. One critical part of this process is testing to determine if the requirements have been met by the system being procured. Survey respondents indicated that several approaches were used in this stage, as shown in Figure 11. However, the response percentages for each approach is quite low, and the approach with the highest response (39%) which is "not applicable" and not shown in the chart. This indicates that a structured approach is not being used as much as possible at this stage of the implementation process.

One "other" response of note is that one of the respondent agencies "followed the fundamentals of a systems engineering approach, but it was much more iterative and nimble than the traditional approach." Please note that a systems engineering or structured approach is indeed iterative – this particular respondent modified the approach to suit the needs of their stakeholders.

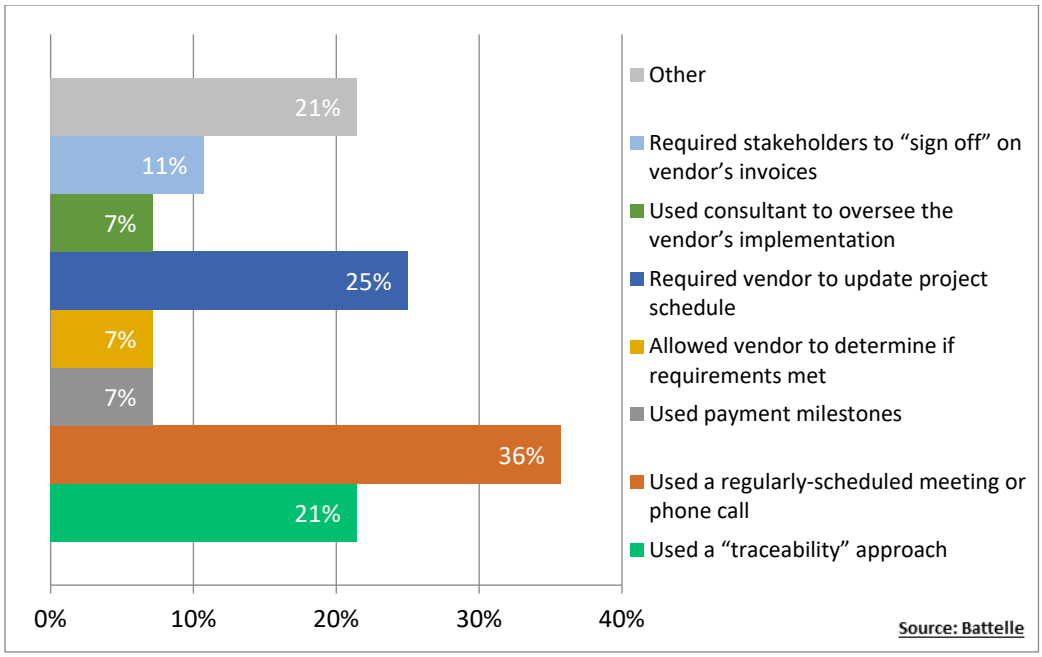


**Figure 9. Process Used to Ensure that System Requirements are met by the Technology/System**

### 3.7 Service Provision Path

The TMCC Reference Manual "defines nine key stages of the service provision path that starts at the point when a customer wishes to make a reservation, and ends when the final reporting and billing for the trip have been made."[2] The survey explored "the role of technology and the degree of shared resources for each of these stages"[2] as follows:

1. Customer Access Mechanisms
2. Trip Request Classification
3. Scheduling / Routing
4. Booking and Confirmation
5. Dispatching
6. Vehicle Management
7. Fare Management
8. Data Management
9. Reporting / Billing

In terms of **customer access mechanisms**, a very small number of respondent agencies are using technology for customer access to the reservation system: telephony with interactive voice response (IVR) (18%), web portal (11%) and kiosks located at key locations (4%). Further, special customer interface features that are used include Telecommunications Device for the Deaf (TDD)/ Teleprinter/ Teletype/Teletypewriter (TTY) (42.3%) and multi-lingual capability for automated systems (7.7%).

As shown in Figure 12, 43% of responding agencies use manual centralized means for customers to access trip reservations (e.g., by telephone). This means that the customer talks to a live customer

[2] Brendon Hemily, Reference Manual for Planning and Design of a Travel Management Coordination Center (TMCC), ITS America, 2018, https://www.transit.dot.gov/research-innovation/reference-manual-planning-and-design-travel-management-coordination-center-tmcc

agent through centralized access (such as a single toll-free number or directing all access telephone numbers to a central call center).

Only 14% use some type of automated means – 11% have centralized automated access and 3% have hybrid automated access. In the case of centralized automated access, "TMCC stakeholders decide to pool their resources and centralize the access point for the customer through a single automated point (most typically a toll-free number, but can be combined with other means, such as internet or kiosks, but decide to use technology (typically telephony in combination with Interactive Voice Response-IVR) to automate the access into the next stage."

The hybrid automated access is where "TMCC stakeholders decide to retain their own individual customer access means, but to create a centralized access point as well. This enables a 'no wrong number' approach to customer convenience whereby the customer gains access to the same support for requesting a reservation regardless of the number called. At the same time the TMCC stakeholders decide to use technology (typically telephony in combination with IVR) to automate the access into the next stage."

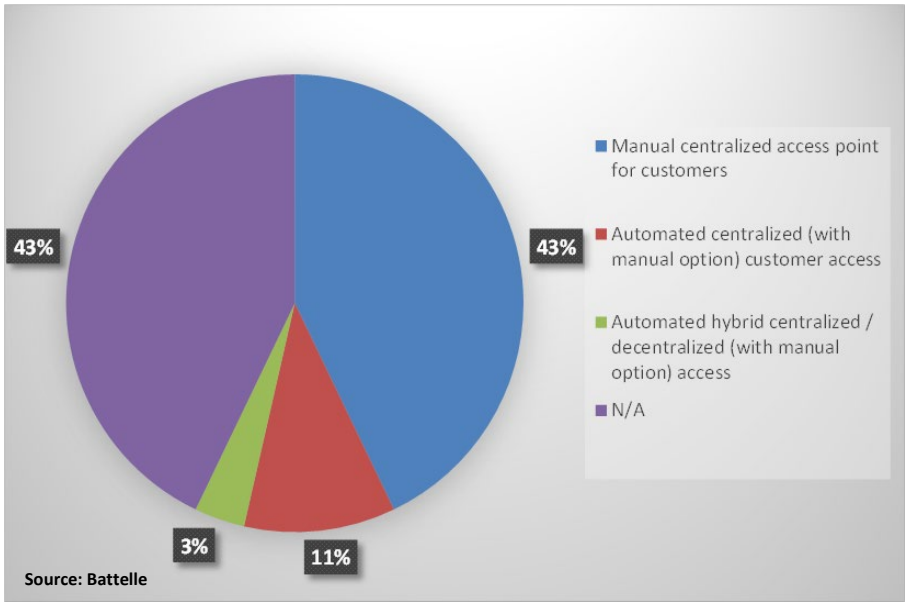


**Figure 10. How Customers Access Trip Reservation Request Process**

In terms of Trip Request Classification, we examined the use of technology in the trip eligibility process[3]. As shown in Figure 13, nearly half of the responding agencies are not using automated means. Only 7% are using some form of automation and another 7% (the "other" responses) are using a partially automated approach. These responses are expected given that most eligibility processes have not been

[3] In some cases, eligibility for a requested trip must be validated prior to scheduling a trip. There may be restrictions on who can use a demand-response services due to the rider's funding source; geographic boundaries; Americans with Disabilities (ADA) paratransit requirements; type of customer served (e.g. workshops for persons with disabilities); or other considerations. (adapted from Brendon Hemily, Reference Manual for Planning and Design of a Coordination Center (TMCC))

automated because there is usually a portion of the process that requires a medical assessment (and this cannot be automated).

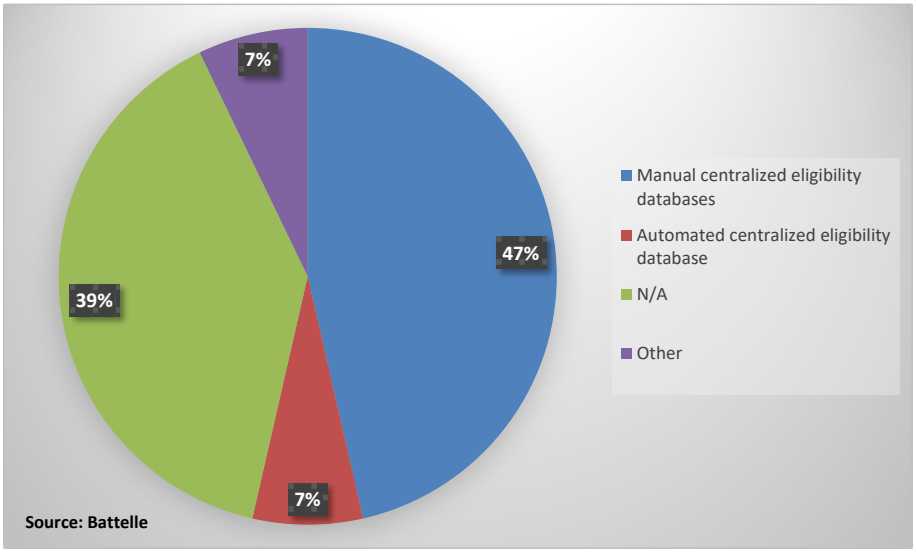


**Figure 11. Approach for Defining Trip Eligibility Determination**

19% of responding agencies report that they have a manual centralized look-up trip eligibility database. In this case, "eligibility certification remains under the control of each respective TMCC stakeholder, and they maintain their own eligibility databases. However, they jointly create a centralized look-up database, which is updated frequently so that new eligible customers become incorporated and have access to request a trip reservation." 8% report having a unified eligibility process and database, meaning that "TMCC stakeholders pool their resources to create a unified certification portal and process that recognizes the distinct eligibility rules of the different service providers."

Also, we examined the use of technology in conducting eligibility screening. Only 11% of responding agencies use an automated web-based screening tool.

In terms of **scheduling and routing**, 27% of respondents are using some form of automated scheduling. 15% of those have a single centralized scheduling system, 4% have a shared scheduling platform with shared coordination and 8% have decentralized scheduling with a common trip planning interface.

Further, in assessing how a customer-requested trip is **booked and confirmed**, 27% of responding agencies use automated centralized scheduling and booking and 4% use computer-assisted decentralized trip request-sharing and booking with separate confirmation. No responding agencies use the third approach in which "TMCC stakeholders are decentralized with respect to the control of their scheduling, and operate on independent system platforms, but are linked through a common real-time trip-planning interface that is fully automated."

In terms of **dispatching**, the survey results show that nearly half of the responding agencies are not using technology to dispatch trips. Seven percent use automated decentralized dispatch in which "TMCC stakeholders decide to retain their own individual operational control in the field, but decide to use technology in the field operations such as dispatching, vehicle management, etc." Another seven percent use an automated centralized approach in which "TMCC stakeholders decide to pool their

resources and acquire a centralized system for operational control of the vehicles in the field, including dispatching and vehicle management."

One-third of the respondents use a manual decentralized approach to **vehicle management**. 30% use automated methods as shown in Figure 14: 15% use an automated centralized approach, 4% use an automated decentralized approach that allows with potential transfer of operational control responsibility under conditions selected by stakeholders, and 11% use an automated centralized approach. In the latter approach, "TMCC stakeholders decide to pool their resources and acquire a centralized system for operational control of the vehicles in the field." The "other" responses include using vendors for vehicle management.

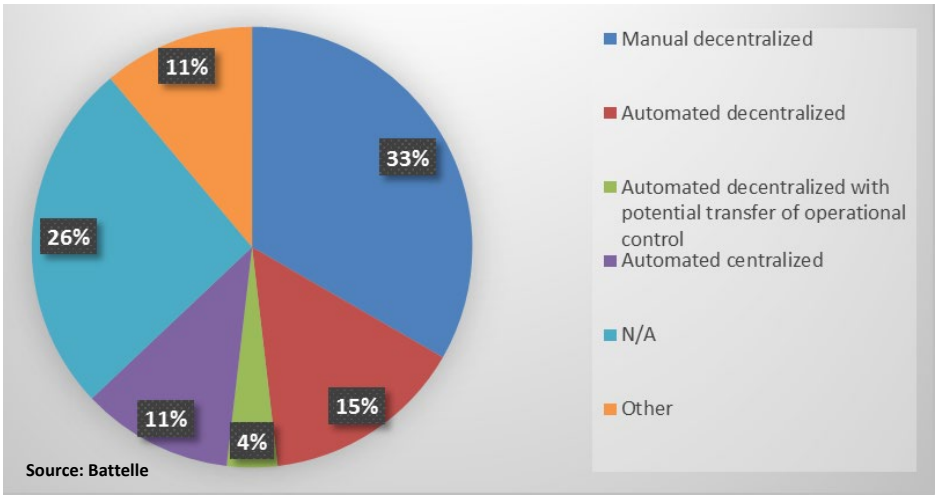


**Figure 12. Vehicle Management Approach**

The functionality included in the respondents' vehicle management systems is shown in Figure 15.

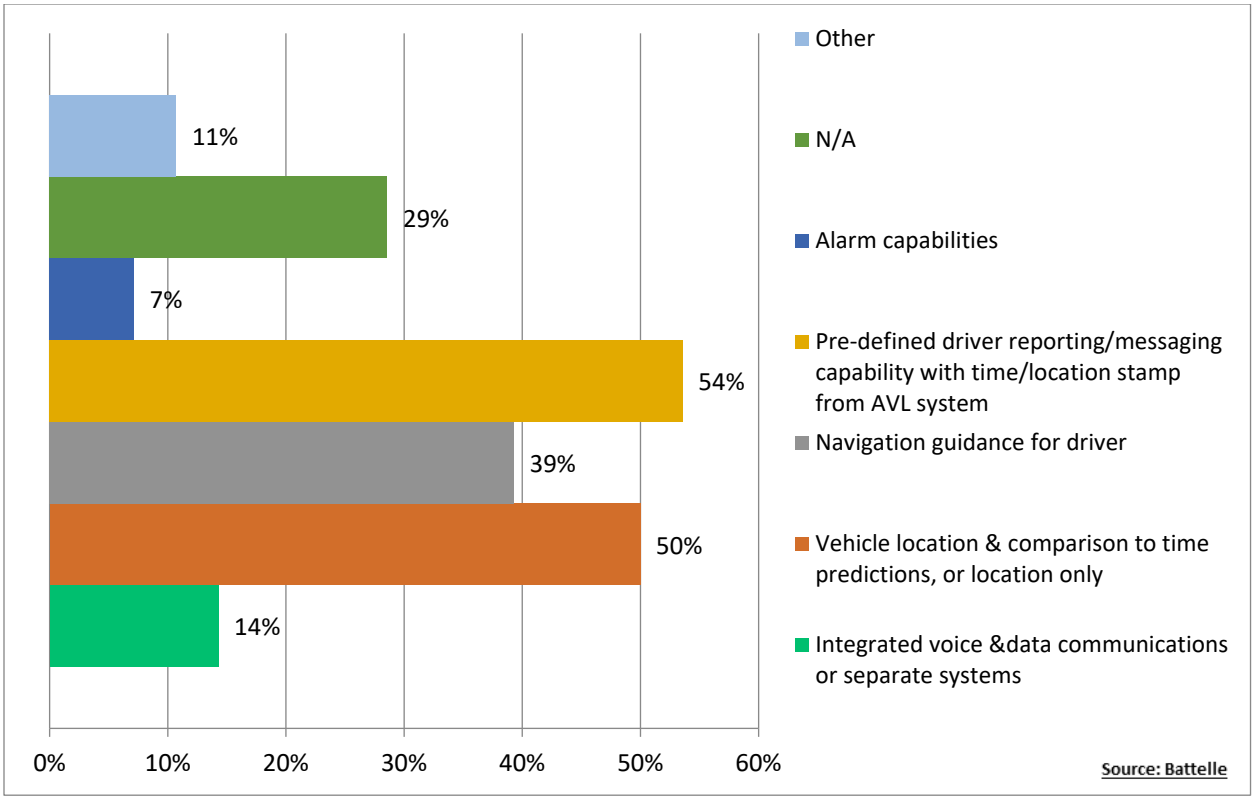


**Figure 13. Vehicle Management System Functionality**

In terms of **fare management**, just under half of the respondents use a manual approach to fare collection. Only a total of 11% use automated fare collection: 7% have an automated commercial decentralized fare collection system and 4% have an automated centralized system. The automated commercial decentralized system is one in which "TMCC stakeholders decide to retain total control of their individual fare management systems, but decide to jointly procure a common fare technology by using a commercial financial institution credit card / debit card and / or mobile payment solution." The automated centralized system is one in which "TMCC stakeholders decide to pool their resources and acquire an automated and centralized fare management system."

Further, only 15% have a customer billing capability that enables the creation of an account for each customer, and the billing, or collection from a pre-authorized bank account, of fares after the trip has taken place.

There are a wide variety of approaches to overall data management. The survey results, as shown in Figure 16 indicate that half of the responding agencies use an automated decentralized approach and 21% use a manual approach.

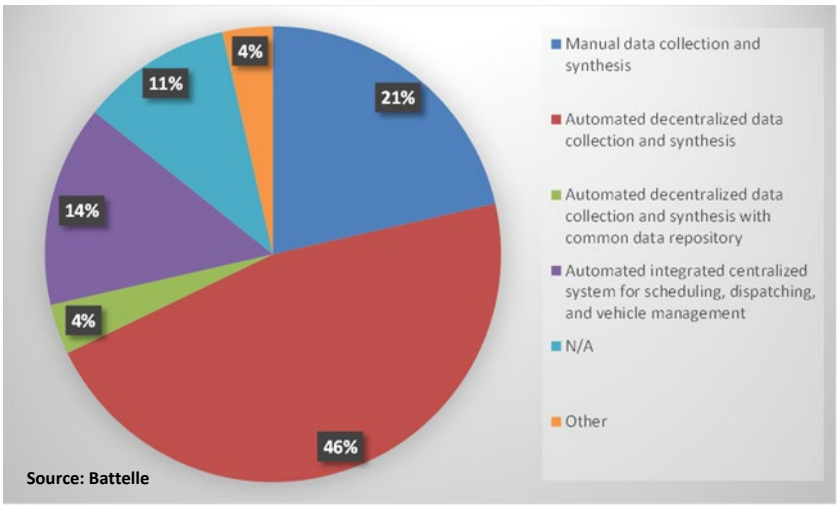


**Figure 14. Data Management Functionality**

The ninth and final stage defines how data on service provision is organized and processed for **reporting and billing**. As shown in Figure 17, nearly half of responding agencies have automated, but decentralized reporting and billing processes. Just over a quarter of respondents use a manual process. 7% have a common repository "designed to enable automated reporting and billing using common formats required by funding agencies." 7% have an integrated centralized system in which reporting and billing processes include data collected by the centralized scheduling, dispatching, and vehicle management systems as well as automated "reconciliation between the billing and fare management systems."

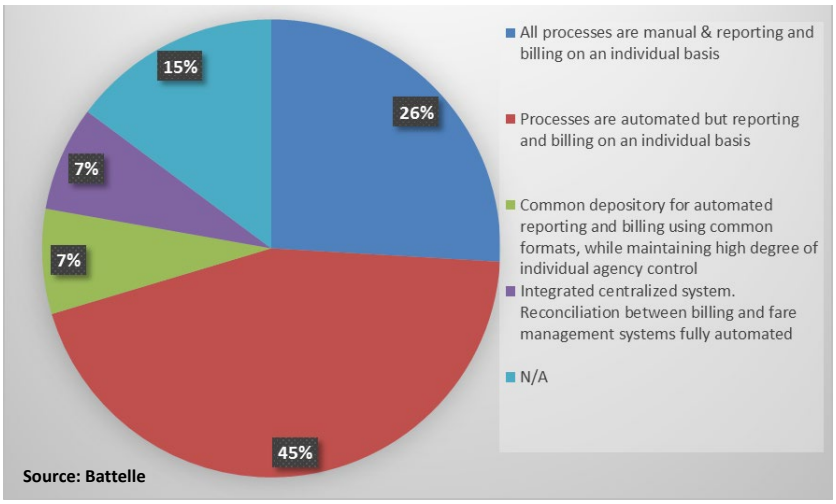


**Figure 15. Service Provision Data Organization and Processing for Reporting and Billing**

## 4. Overall Results and Conclusions

The survey results indicate that while there has been a fair amount of technology deployment by the responding agencies, several processes that could improve service coordination are still not automated. Further, user needs are not always being considered in determining the need for technology as well as

the development and validation of requirements. Finally, there is an opportunity for agencies to improve their internal processes being used to deploy technology.

The reasons for the survey results are well-known in the industry: primarily an overall lack of specifically skilled staff; lack of funds to provide the necessary resources; political forces that wish to accelerate deployment (meaning that critical parts of a structured process are not performed); and lack of understanding of a structured process that will lead to successful technology deployment. Several resources that describe these issues in more detail can be found at the National Aging and Disability Transportation Center (NADTC) website in the Technology Blog area http://www.nadtc.org/news/blog/topic/technology/.

There has been a lot of discussion in the industry over the past ten years about how best to disseminate the tools that facilitate technology deployment. The documents developed as part of the MSAA KTT initiative directly address these needs. Fortunately, the current MSAA grantees are using exemplary processes to determine needs and requirements and deploy technology, so the documentation they are producing as part of their projects can be used to supplement the KTT products. The KTT products, including fact sheets, presentations, case studies and another journal article, can be found on the MSAA website (https://www.its.dot.gov/research_archives/msaa/index.htm ).

There are four conclusions that can be drawn from the survey results:

- There is still a need for agencies to understand the technology tools available to improve service coordination. This emphasizes the importance of the MSAA KTT materials, as well as the potential development of training that focuses on agencies attempting to address the issues hindering service coordination.
- Within the process of determining the need for technology, it may be helpful if agencies reference concrete examples of other agencies that have successfully elicited user needs from stakeholders. One of the more recent MSAA projects, conducted by United Cerebral Palsy of San Luis Obispo County/Ride-On Transportation, has prepared information regarding their stakeholder engagement that can be found on the MSAA website (https://www.its.dot.gov/research_archives/msaa/msaa_research_results.htm).
- One item that was not addressed in the survey was the potential need for staff to be trained to utilize technology. This continues to be an issue in the industry, particularly in smaller and more rural transportation and health and human service agencies. Training will continue to play a role in the success of technology implementations, specifically those that address coordinated transportation. Related training resources are described in the MSAA Fact Sheet #3 which can be found on the MSAA website (https://www.its.dot.gov/research_archives/msaa/index.htm).
- The USDOT's Mobility on Demand (MOD) Initiative builds on several foundational activities, including MSAA. MSAA and MOD share a common goal of promoting mobility for all. We need to ensure that knowledge and technology transfer materials from the MOD program are widely distributed, particularly covering health and human service organizations, which often are not aware of these types of resources. More information on MOD can be found on the MOD website (https://www.its.dot.gov/research_archives/msaa/index.htm) and the MOD Sandbox website (https://www.transit.dot.gov/research-innovation/mobility-demand-mod-sandbox-program.html).