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Avoiding the "I'll know It when I see it" Pitfall: Furthering a Choice-Based Conjoint (CBC) Model for Government Source Selections

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Abstract

The Department of Defense (DoD) current source selection methods are at an increased risk of experiencing sustained bid protests. During source selections, the government frequently contradicts itself between its advertised stated order of importance for acquisition evaluation criteria (pre-award) and its actual choice behavior during source selections (Butler, 2014). This paper provides a summation of research, conducted from 2021 to 2022, that explored the following research objectives: 1) Determine the degree of disconnect between stated preferences during pre-award acquisition phase and actual choice behavior in defense acquisition source selections, 2) develop a deep understanding of quality attributes in evaluating logistics-based service acquisitions, 3) provide a Choice-Based Conjoint (CBC) framework that the DoD could utilize to enhance source selection criteria development in both logistics and further categories of government spending. The research utilized methods such as interviews and spend analysis techniques to identify quality attributes of logistics-based acquisitions that would best discriminate as evaluation factors for award. Later, these attributes were used to develop a CBC exercise that enabled us to calculate attribute utilities and relative importance for each attribute. The summarized research in this paper provides a way forward to empirically deduce the relative importance for source selection evaluation factors, potentially reducing bid protest occurrences in future source selections.

Introduction

In its annual letter to congress, the U.S. Government Accountability Office (GAO) repeatedly reports that one its most common reasons for sustaining a bid protest: government agencies continuing to unreasonably evaluate technical, past performance, and cost or price evaluation factors during source selections (GAO, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021). Such unreasonable evaluations persist, and agencies cannot follow their own solicitation's evaluation criteria, ensuring a flawed source selection decision and increased chance of a GAO bid protest.

Additionally, the MITRE Corporation further substantiates the same issue in competitive source selections and evaluations, with its Contract Protest Diagnostic Tool (CPDT). The CPDT uses a heatmapping visual technique to show the exposure to protests within each phase of the federal acquisition phases (MITRE Corporation, 2022). Two of the most historically problematic "hot spots" indicate that the U.S. federal government is regularly exposed to protests because its agencies do not (1) perform fair and consistent evaluations that are consistent with the evaluation procedures described within solicitations or 2) solicit with evaluations factors in a

properly weighted relative order of importance that matches how these same factors are evaluated during the source selection process.

Procurement agents throughout the DoD aim to deliver "quality and timely products and services to the Warfighter and the Nation at the best value to the taxpayer" (DoD, 2016). While source selections and their procedures offer a structured approach to these agents to obtain best value, the increased risk of bid protests created by these procedures means implicit consequences for the DoD. When faced with bid protests, the DoD must utilize valuable, finite resources to resolve said protests. In a time of increasingly varied global change and threats, losing valuable resources to preventative consequences places the DoD in a precarious predicament.

Past research conducted by one of this paper's contributors finds further fault in current source selection procedures. In the graduate essay on "Perceived Service Quality and Perceived Value in Business-to-Government Knowledge-Based Services," researchers argue that government agencies use Lowest Price Technically Acceptable (LPTA) procedures in an increased effort to avoid the risks of exposures such as those described in the above paragraph (Finkenstadt, 2020). The study goes on to provide some unique insights into the Business-to-Government (B2G) buyer and their choice behavior in simulated source selections by leveraging conjoint methods. For example, individuals often rely on theoretical deduction, or an a priori judgment, to predict the ordered importance of price and non-price factors instead of utilizing empirical reasoning (Finkenstadt, 2020). When presented evaluation factors in list form, individuals also have a difficult time in properly shaping the relative order of importance because a list does not provide them an opportunity to consider these nonprice and price factors when presented in a full set of offers or grouped together (Finkenstadt, 2020).

The following paper offers initial insights into how the DoD can address the illustrated disconnect between stated preferences during pre-award acquisition phase and actual choice behavior. These findings support the issues revealed in MITRE's CPDT tool, GAO sustained protests, and past research. By quantifying the disconnect and better understanding how the DOD acquisition workforce and its customers evaluate products to meet their needs, there can be a subtle, yet significant shift in how the organization can better utilize its finite resources. Furthermore, the research summarized in this paper offers better understanding on how the DoD evaluates perceived attributes of logistics-based services. While these findings were supplemental in nature to the overall agenda of the research, such information has the potential to enhance future evaluation criteria in source selections for these logistics-based services. Finally, the insights offered from the research described in this paper may reduce the risk of acquisition protests, as it provides knowledge of perceived preferences, subconscious or otherwise, for these services. All ensure that acquisition professionals can better prioritize evaluation criteria during the contract pre-award phase ensuring the right solution, at the right time, and for the right customer.

Issues with Source Selection Methods

As outlined in FAR Part 15.3, source selections procedures enable acquisition professionals to determine which contractor proposal provides the best value, or "the expected outcome of an acquisition that, in the Government's estimation, provides the greatest overall benefit in response to the requirement," to the government (DoD, 2016). While the procedures provide a structured approach to obtain best value, the way source selections procedures stand now jeopardize the three goals of government procurement: transparency, value for money, and meeting requirements (Finkenstadt & Hawkins, 2016). This is because the procedures do not provide a way in which to state what really matters to the government and how best to quantify it. Instead, source selections teams are often left to define evaluation factors and an a priori

ranking for those factors based on presumed importance. In short source selection guidance does not offer an empirical method to acquisition personnel that allows for both effective evaluation factor determination and their order of importance. Conjoint analysis, and more specifically, choice-based conjoint analysis can be that method.

Conjoint Analysis

Conjoint analysis is a tool that enables managers, companies, and acquisition personnel alike to "model the factors that underlie and drive consumer choice" (McQuarrie, 2016) through utilization of a product or service's "separate (yet conjoined) parts" (Orme, 2020). Through conjoint analysis, a product or service's attributes can be purposefully varied while respondents' reaction to the variability can be statistically deduced and these scores, or utilities and part-worths, for each attribute can help to define the value of the service (Orme, 2020). For reference, part-worths are fully defined as "the utility associated with a particular level of an attribute" and utility, in reference to conjoint analysis, "refers to a buyer's liking for (or the desirability of) a product alternative" (Orme, 2020).The advantage of conjoint analysis over other standard marketing techniques, like surveys, is that it is a "back door" method to develop insight into subconscious choice behavior when respondents are presented full product or service profiles (Orme, 2020). Figure 1 demonstrates further beneficial features of conjoint analysis.

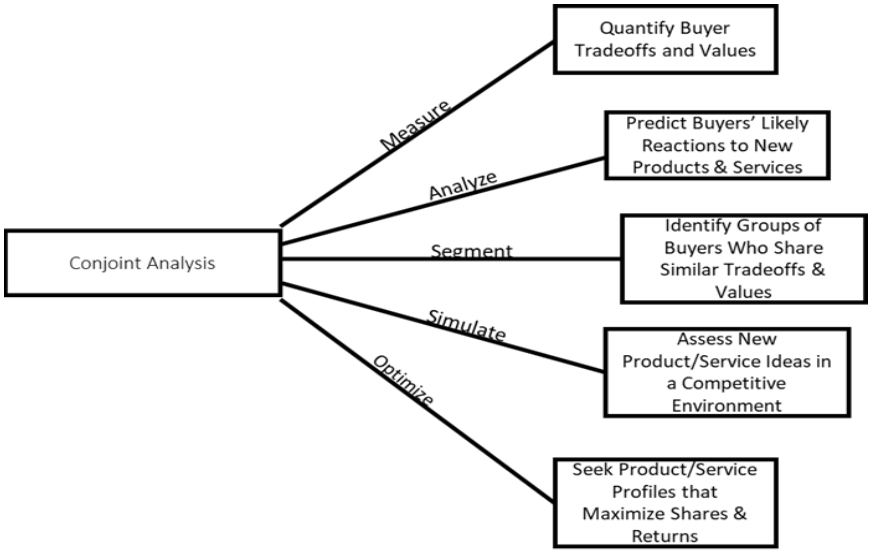

Figure 1. Features of Conjoint Analysis. (Thompson, 2022, as adapted from Rao, 2014).

While conjoint analysis offers far superior methods in terms of discovering consumer choice behavior, the simulated, hypothetical environment built from its use imposes a lack of real-life consequences to the respondents, preventing analysts from collecting the most realistic preferences and data from respondents (Ding et al., 2005). To help combat the consequences of a simulated environment, the incentive-aligned consequence of "expert scrutiny" was incorporated within this research's conjoint analysis exercise. This meant that respondents who participated in the choice exercise are "told to answer realistically because an expert in public procurement will analyze their responses for reasonableness prior to including it in any decision to change public acquisition methods or policy. This mimics the formal source selection review process found in many public agencies" (Finkenstadt, 2020, p. 101). Figure 2 displays what respondents for the CBC observed to add expert scrutiny to the exercise.

USTRANSCOM spends over $4.4 Billion a year on supplies and services enabling their logistic-focused mission. Many of its programs with industry partners are thoroughly tracked and publicly advertised by USTRANSCOM. Each contract value ranges from hundreds of thousands of dollars to hundreds of millions of dollars. Furthermore, much of the contract activity USTRANSCOM TCAQ initiates includes high spend activity that requires the best possible solutions for the taxpaying public and the warfighter.

With that, please treat the following survey as a real-world example. Make your choices as realistic as possible and answer to the best of your ability. Due to the impact the results will have in potentially changing DoD acquisition methods or policy, the results from your survey will be evaluated by public procurement/acquisition experts to determine response reliability.

Figure 2. CBC Expert Scrutiny Choice Exercise Condition

Finkenstadt (2020) discovered that expert scrutiny worked as well as other typical incentive-aligned CBC prompts for government acquisition personnel during an exercise in which over 600 personnel were randomly assigned to various prompt conditions. Though the outside option utility was much smaller in a Bayesian-truth serum condition, it was determined that it did not skew the relative importance ranking of factors (Finkenstadt, 2020). Finkenstadt recommends expert scrutiny due to its lower costs and time to employ. Therefore, this study settled on the use of expert scrutiny as the incentive-alignment prompt for respondents.

Software advancements have allowed conjoint analysis to expand in terms of its approaches and data that it gathers. What started as a method utilizing handwritten cards for product profiles in 1971 is now conducted on advanced statistical software that offers a multitude of options to its users depending on their research and what outcomes they hope to measure (Orme, 2020). Each conjoint analysis approach can be divided among the tactics researchers use within their exercise. A ratings-based approach has respondents ranking full-profile products, while choice-based conjoint techniques allow respondents to choose or trade-off among different product profiles. Other approaches utilize some form or combination of both techniques. Figure 3 details the types of conjoint analysis, but for the purposes of this research, CBC analysis and Sawtooth© Choice-Based Conjoint Software were utilized.

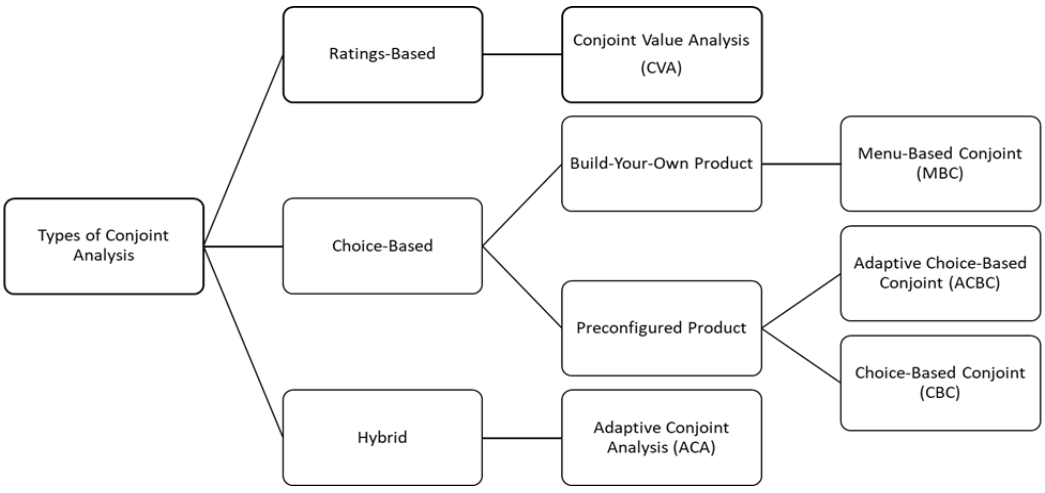

Figure 3. Types of Conjoint Analysis in Marketing. (Orme, 2020).

Choice-Based Conjoint

CBC presents a series of choice tasks, or questions, that ask respondents to choose from three to five product profiles (Orme, 2020). What sets CBC apart from other conjoint analysis techniques is that it provides respondents an option to choose none of the product profiles, as consumers realistically can choose none of the product alternatives when presented options in a real market environment. CBC utilizes several analytical methods to estimate respondent preference; however, for this research, Hierarchical Bayes (HB) analysis was utilized. HB estimation offers a model to estimate the part-worths at an individual-level, by iteratively collecting data from multiple respondents and finding a point of convergence (Orme, 2020). Figure 4 shows one of the 12 choice tasks presented in the CBC exercise for this research. The relative levels of each attribute displayed below are further explained within the methodology section of this paper.

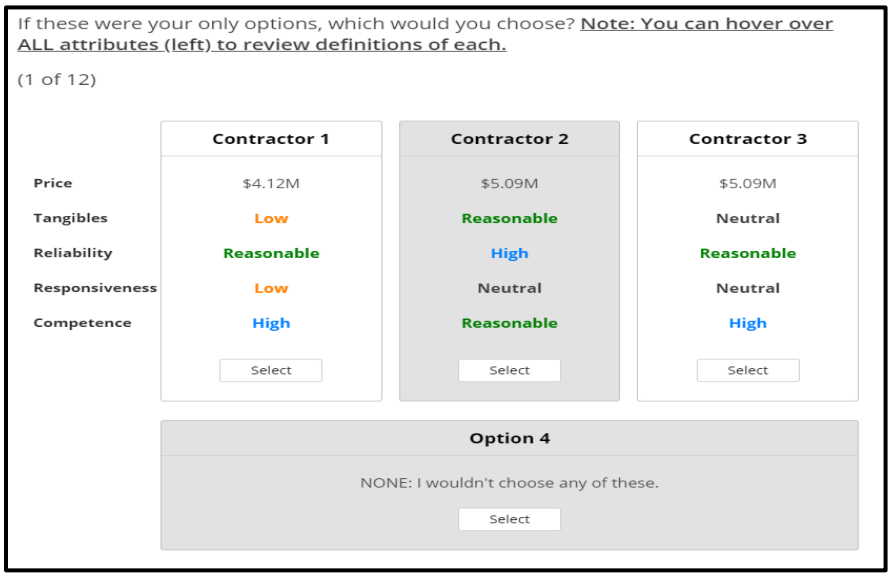

Figure 4. CBC Choice Scenario Example.

Real Property Maintenance

For conjoint analysis to be successful, it must only include a limited number of attributes per product/service profile; otherwise it risks unnecessary difficulties for respondents and possibly jeopardizing the results of the CBC. Ensuring the proper number of attributes and attribute levels is one of the most critical aspects in designing a successful CBC (Orme, 2020). To secure proper design of the CBC then, no more than eight attributes and five or fewer levels of attributes should be used (Orme, 2020). With that, the research presented in this paper determined that only *one* Product Service Code (PSC), under the Transportation and Logistics Service federal category of spend, would be used to determine the limited scope and attributes for the CBC scenario.

In order to select one specific PSC, spend and data analysis techniques were utilized in order to discover a PSC associated with the highest dollar spend under the Transportation and Logistics spending category level one. The U.S. Air Force Installation Contracting Center's (AFICC) Business Intelligence tool, AFBIT Lite, provided the spend data required to find this specific PSC. Within the category one level of spend, it was determined that among all 25 PSCs under that category, it was PSC R706 – Support Management: Logistics Support, that held the highest dollar spend at approximately $18.6 billion (AFICC, 2022).

There are many services associated with PSC R706, and so it was then decided that for the CBC to have the proper number of attributes, further narrowing of the PSC was necessary. Researchers concluded that only one service under that PSC would be the focal service that helped to develop the CBC exercise employed. To narrow it down from one PSC to a particular service associated with that PSC, the DoD's Project Management Resource Tools (PMRT) Enterprise Analytics (EA) application CON-IT application was used. Like the process utilized with AFBIT Lite, the service with the highest usage for the DoD was sought. This ensured the impact this research had was greater than if completed for a service not often utilized or contracted out for. Through a thorough examination of over 17,831 relevant Contract Line-Item Numbers (CLIN) data, Real Property Maintenance (RPM) was chosen as the selected service for the CBC exercise. The maintenance of real property is defined as "the upkeep of property only to the extent necessary to offset serious deterioration; also, such operation of utilities, including water supply and sewerage systems, heating, plumbing, and air-conditioning equipment, as may be necessary for fire protection, the needs of interim tenants, and personnel employed at the site, and the requirements for preserving certain types of equipment" (Real Property Policies, 2022). Real property can include "any interest in land, together with the improvements, structures, and fixtures located, and appurtenances thereto, under the control of any Federal agency" (Real Property Policies, 2022).

Methodology

Several steps were taken in advance to ensure the conjoint analysis techniques used in this research were properly conducted and represented a hyper-realistic situation that respondents could possibly encounter if participating in a DoD source selection. First, a literature review was conducted to educate, inform, and build a foundation for the study. Topics such as DoD source selection procedures, logistics, conjoint analysis and its use in the Business to Consumer (B2C), Business to Business (B2B), and Business to Government (B2G) markets were explored.

Second, once an initial backbone of knowledge was built, the researchers moved forward by interviewing logistics personnel and acquisition experts that aided in the determination of service quality attributes for logistics service. The six interviews conducted were with government personnel that had acquired logistics-based services and/or commodities, had a military logistics background, or participated in source selections for a logistics-based service. Questions proposed to interviewees focused on their organization's acquisition of logistics-based services, factors considered important when evaluating a contractor's proposal, and essentially, what was important to government customers, acquisition personnel, and logistics personnel when it came to a logistics-based service. Despite the diverse backgrounds of each interviewee, certain trends and patterns emerged among the responses provided to the researcher. Upon conclusion of the interviews, it was determined that the same evaluation considerations interviewees consistently mentioned were those indicators attributed to SERVQUAL, a popular model that aids in measuring the perceived quality of a service (Parasuraman et al., 1985). Five concise dimensions of service quality perception are highlighted through the SERVQUAL model:

Tangibles:	Appearance of physical facilities, equipment, personnel, and communication materials
Reliability:	Ability to perform the promised service dependably and accurately
Responsiveness:	Willingness to help customers and provide prompt service
Assurance:	Knowledge and courtesy of employees and their ability to convey trust and confidence

Empathy: Caring, individualized attention the firm provides its customers. (Parasuraman et al., 1985)

Interviewees consistently indicated that four of the five SERVQUAL service quality dimensions were important. These four dimensions were modified to represent the four attributes, besides price, that the CBC would include for the simulated logistics-based source selection. Table 1 displays the four attributes, besides price, utilized in the CBC.

Table 1. Selected Choice Exercise Attributes Modified from SERVQUAL Dimensions. (Parasuraman et al., 1985)

Attribute	Explanation from Interviews	Description to Respondents
Competence	Multiple interviewees stressed the importance that contractors needed to demonstrate capability and they have the capacity to perform the required service.	Real Property Maintenance firm's employees applied existing best practices to execute requirements on past contracts.
Reliability	Multiple interviewees stated they seek contractors that perform how they state they [contractors] can perform.	Real Property Maintenance firm demonstrated an ability to perform dependably and accurately on previous contracts
Tangibles	Multiple interviewees stated they need contractors that can accurately and demonstrably provide the manpower and materials required to perform the needed service.	Real Property Maintenance firm demonstrated they have the facilities, equipment, personnel, and communication materials needed to complete the service.
Responsiveness	Multiple interviewees stated that contractors chosen through LPTA evaluations failed to provide the needed qualitative, technical capabilities. Interviewees now aim to find those firms that understand the requirement and will take their service to the next level to meet that requirement, even if that means a higher price.	Real Property Maintenance firm demonstrated willingness to help customers and provide prompt service on previous contracts.

Third, and as mentioned in previous portions of this paper, a specific service was chosen through a tailored spend and data analysis utilizing AFBIT Lite and PMRT. This analysis helped narrow the scope of the CBC from a category of spend to the selected service highlighted within the CBC, RPM. Along with providing a high-use, high-spend service this analysis also enabled the determination of realistic prices to be used in the CBC as the fifth and final quality attribute of the RPM service. Through PMRT CLIN data, the average price per month for RPM services equated to $74,885.62. Once an average price was determined, a pivot table utilizing RPM CLIN monthly prices was created, and the average price previously determined was taken to identify four other price points to utilize in the CBC. Figure 5 represents that process and Table 2 shows all five of these prices when they were increased to reflect the price of a firm-fixed price contract with a 12-month base period, four 12-month option periods, and a 6-month extension of service clause if necessary.

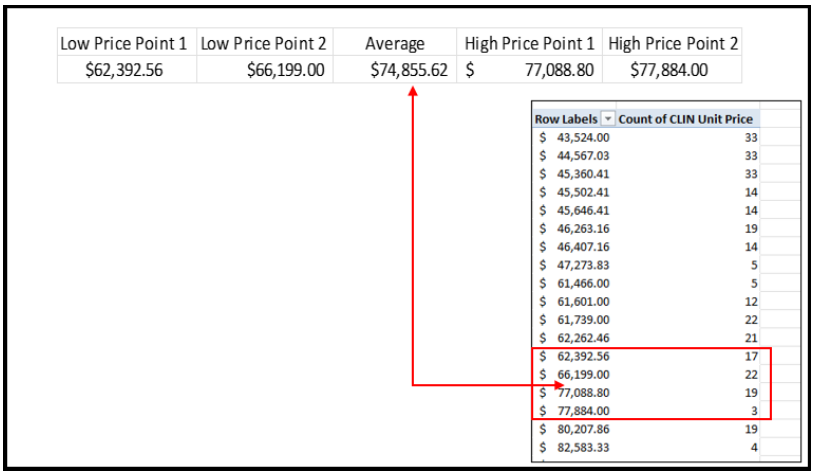

Figure 5. Price Point Pivot Table and Price Determination

Table 2. CBC Price Attribute Levels

Attribute Levels	Total Contract Price with 6-Month Service Extension [Description to Respondents]
Low Price (1)	$4.12 Million
Low Price (2)	$4.37 Million
Average Price	$4.94 Million
High Price (1)	$5.09 Million
High Price (2)	$5.14 Million

Finally, after the above steps were completed, the CBC was designed to provide 12 random choice scenarios to respondents utilizing the five attributes and price points determined through this research's additional methods of discovery. Along with the five attributes, four levels per attribute were created utilizing Table 3's scale ratings that were adapted from current DoD source selection procedures.

Table 3. CBC Attribute Level Ratings. (DoD, 2016).

Streamlined Scale Rating	**Adjectival Rating from DoD Source Selection Guide Table 5**	**Description to Respondents**
High	Substantial Confidence	Based on the offeror's recent/relevant performance record, the Government has a high expectation that the offeror will successfully perform the required effort.
Reasonable	Satisfactory Confidence	Based on the offeror's recent/relevant performance record, the Government has a reasonable expectation that the offeror will successfully perform the required effort.
Low	Limited Confidence	Based on the offeror's recent/relevant performance record, the Government has a low expectation that the offeror will successfully perform the required effort. [**NOTE**: A low rating does not mean the offer is unacceptable]
Neutral	Neutral Confidence	No recent/relevant performance record is available, or the offeror's performance record is so sparse that no meaningful confidence assessment rating can be reasonably assigned. The offeror may not be evaluated favorably or unfavorably on the factor of past performance.

CBC respondents included those government personnel that had held the role of contracting officer, contracting manager/administrator, contracting officer representative, quality assurance personnel, program manager, customer, and other positions directly involved with government acquisition. Respondents were guided to assume that all contract offers observed within each random choice task were technically acceptable, the prices provided were realistic, and the final evaluation determination they were selecting was based on the contractor's past performance and generated through a trade-off decision-making process between the price of the contract offer and the four service quality attributes (Finkenstadt, 2020).

The CBC was designed using Sawtooth© Choice Based Conjoint Software, tested for functionality at the National Contract Management Association (NCMA) Conference in July 2022, and finally released to collect data in August 2022. Along with the 12 random choice tasks presented to respondents (see Figure 4), respondents were also asked demographic questions regarding their experience in government acquisition and were also guided to rank order attributes of logistics-based services. These attributes represented the same as those presented in the CBC choice tasks; however, respondents were provided only the definition of these same attributes, and asked after the CBC choice tasks, to minimize the opportunity to "game" the system and memorize their choices in the CBC and match their rank ordered items similarly. Figure 6 displays the rank order choice exercise presented.

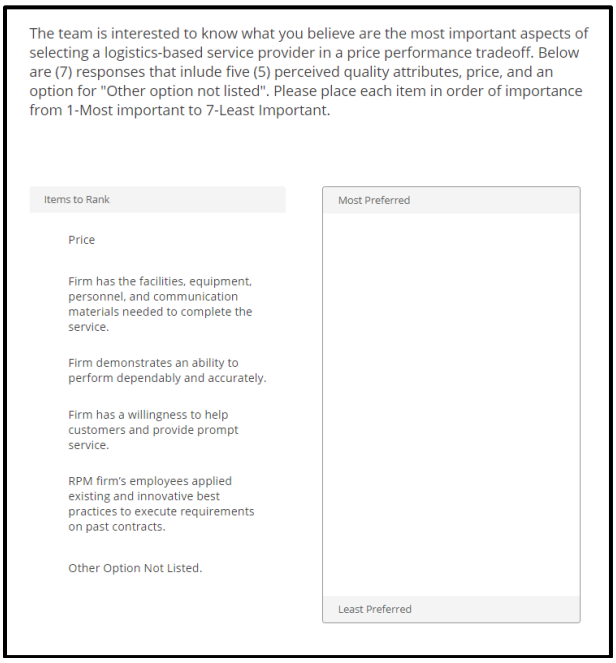

Figure 6. Rank Order Choice Exercise Question

Overall Findings and Contributions

The CBC choice exercise was open to respondents from August 1, 2022, to September 15, 2022. 30 respondents completed the choice exercise, meeting the standards "for investigational work and developing [a] hypotheses about a market" (Orme, 2020). The experience of those that completed the choice exercise varied in terms of the role held and their years of experience in said role. Each respondent was asked to select one or more of the acquisition-focused roles they had held and how many years they held that role. Table 4 and Table 5 show the experience demographics collected from the 30 respondents. The totals aggregate to greater than 30 as some respondents had multiple position experiences.

Table 4. Choice Exercise Experience Demographics

Position Held	Totals
Contracting Manager/Administrator/Specialist without RPM or Logistics-Based Services Experience	12
Contracting Officer without RPM or Logistics-Based Services Experience	11
Contracting Manager/Administrator with RPM or Logistics-Based Services Experience	5
Customer without RPM or Logistics-Based Services Experience	5
Other without RPM or Logistics-Based Services Experience	5
Contracting Officer with RPM or Logistics-Based Services Experience	4
Program Manager without RPM or Logistics-Based Services Experience	4
COR without RPM or Logistics-Based Services Experience	3
Contracting Officer Representative/Quality Assurance Personnel with RPM or Logistics-Based Services Experience	1
Other with RPM or Logistics-Based Services Experience	1
Program Manager with RPM or Logistics-Based Services Experience	0
Quality Assurance Personnel without RPM or Logistics-Based Services Experience	0

Table 5. Choice Exercise Experience Years

Role	Years of Experience
Other: NPS Faculty	32
Customer	28
COR Program Manager Customer	19
Program Manager	18
Contracting Officer Contracting Manager/Administrator/Specialist COR Program Manager Customer	18
Contracting Officer Customer	16
Other: Assistant Research Professor	15
Contracting Officer and Contracting Manager/Administrator	11
Contracting Officer Contracting Manager/Administrator/Specialist	11
Contracting Officer Contracting Manager/Administrator/Specialist COR	10
Contracting Officer	9
Other: Senior Lecturer	8
Contracting Manager/Administrator	7
Contracting Officer and Contracting Manager/Administrator	6
Contracting Officer Contracting Manager/Administrator/Specialist Program Manager	6
Contracting Manager/Administrator/Specialist	6
Other: OSI Agent	4
Contracting Officer Contracting Manager/Administrator/Specialist	4

Role	Years of Experience
Contracting Officer Contracting Manager/Administrator/Specialist Customer	4
Contracting Officer Contracting Manager/Administrator/Specialist	4
Other: Ship Division Officer	4
Contracting Officer	3
Contracting Manager/Administrator	3
Contracting Officer Contracting Manager/Administrator/Specialist	3
Contracting Officer Contracting Manager/Administrator/Specialist	3
Other: Company Commander	2
Contracting Manager/Administrator/Specialist	2
Contracting Officer Contracting Manager/Administrator/Specialist	2
Contracting Manager/Administrator	1
Contracting Officer Representative/Quality Assurance Personnel	1

Respondent's data was validated, in terms of response quality, utilizing several methods Sawtooth Software provides its researchers. Visual inspection of repeated choice patterns, review of completion times, and computation of the Root Likelihood measure were the three chosen methods used to validate quality. As a note, the Root Likelihood (RLH) is "an intuitive measure of how well the solution(s) fit the data. … [It] is an intuitive probability expression of how successful the utility scores are in predicting which items respondents pick" (Sawtooth Software, 2022). All three validation methods indicated that none of the 30 respondent's choices appeared randomly selected.

Research Objective I

In order to determine the degree of disconnect between stated preferences and actual choice behavior, the data collected from both the CBC and ranked preference exercise was compared for each of the 30 respondents. The CBC data offered individual importance scores for each attribute, while the ranked preference exercise allowed respondents to directly input what they believed to be most important to least when acquiring RPM services. Table 6 and Table 7 represent the collected data that was then compared against each other, while Figure 7 is a visual example of the comparison of stated and observed choices for one respondent.

Table 6. CBC Individual Importance Scores Per Respondent

Respondent	Price	Tangibles	Reliability	Responsiveness	Competence
1	15.35437	13.95127	26.18789	15.77734	28.72914
2	38.77005	14.19632	22.80028	6.8724	17.36095
3	20.34852	23.82053	19.7129	14.53701	21.58104
4	6.1063	17.51175	24.67448	26.1377	25.56978
5	23.19053	20.56684	27.44157	11.28664	17.51443
6	20.58427	22.19826	23.52144	14.5261	19.16992
7	7.72683	14.49259	28.9684	23.7424	25.06978
8	17.26002	15.67074	25.00742	16.16383	25.89799
9	28.85697	20.0963	21.16121	11.76638	18.11915
10	20.78097	28.06142	19.80186	13.71696	17.63879
11	11.41264	16.30745	21.56323	27.34676	23.36991
12	14.07932	13.28963	25.42101	16.69622	30.51382
13	21.07294	16.46564	20.89432	15.83543	25.73168
14	7.46573	9.06788	29.68934	24.47462	29.30243
15	22.47177	15.43122	23.63169	16.1193	22.34602
16	4.90415	14.53434	28.06384	30.51748	21.98018
17	8.15209	11.98993	26.55606	24.62871	28.67321
18	27.89499	20.61131	21.58292	11.01287	18.89791
19	6.48874	15.41981	26.19325	23.85643	28.04177
20	25.34969	23.40266	20.70524	8.7042	21.8382
21	21.06862	20.30179	24.06359	10.83193	23.73406
22	19.49001	14.73438	25.86596	17.39287	22.51678
23	21.73412	16.35209	28.65789	18.1412	15.1147
24	3.90716	16.17451	27.25348	26.2906	26.37425
25	24.26609	19.10173	24.00935	17.14051	15.48232
26	26.22331	21.61195	22.88639	10.1777	19.10064
27	6.91567	5.10399	33.39819	25.99038	28.59176
28	11.11214	13.50383	29.19329	20.76542	25.42532
29	14.24861	17.7801	22.91868	17.1422	27.91042
30	7.35924	15.18506	25.91598	23.41337	28.12635

Table 7. Stated Preferences of Choice Exercise Respondents

Respondent	1	2	3	4	5	6
1	Competence	Price	Reliability	Tangibles	Responsiveness	Other
2	Price	Reliability	Tangibles	Responsiveness	Competence	Other
3	Responsiveness	Tangibles	Price	Reliability	Competence	Other
4	Competence	Responsiveness	Price	Tangibles	Reliability	Other
5	Reliability	Responsiveness	Price	Competence	Tangibles	Other
6	Responsiveness	Price	Reliability	Tangibles	Competence	Other
7	Competence	Responsiveness	Tangibles	Reliability	Price	Other
8	Price	Tangibles	Responsiveness	Competence	Reliability	Other
9	Responsiveness	Reliability	Price	Competence	Tangibles	Other
10	Responsiveness	Price	Tangibles	Reliability	Competence	Other
11	Reliability	Tangibles	Price	Responsiveness	Competence	Other
12	Competence	Responsiveness	Tangibles	Reliability	Price	Other
13	Reliability	Responsiveness	Price	Competence	Tangibles	Other
14	Responsiveness	Reliability	Price	Competence	Tangibles	Other
15	Reliability	Competence	Price	Tangibles	Responsiveness	Other
16	Competence	Price	Tangibles	Reliability	Responsiveness	Other
17	Competence	Responsiveness	Reliability	Tangibles	Price	Other
18	Price	Tangibles	Reliability	Competence	Responsiveness	Other
19	Competence	Responsiveness	Price	Reliability	Tangibles	Other
20	Responsiveness	Competence	Price	Reliability	Tangibles	Other
21	Competence	Price	Tangibles	Responsiveness	Reliability	Other
22	Tangibles	Reliability	Price	Responsiveness	Competence	Other
23	Reliability	Responsiveness	Price	Tangibles	Competence	Other
24	Responsiveness	Competence	Tangibles	Reliability	Price	Other
25	Tangibles	Competence	Price	Reliability	Responsiveness	Other
26	Price	Tangibles	Reliability	Responsiveness	Competence	Other
27	Competence	Tangibles	Price	Reliability	Responsiveness	Other
28	Reliability	Responsiveness	Competence	Tangibles	Price	Other
29	Tangibles	Price	Reliability	Responsiveness	Competence	Other
30	Reliability	Responsiveness	Tangibles	Price	Competence	Other

Respondent 2	1	2	3	4	5
CBC	Price	Reliability	Competence	Tangibles	Responsiveness
Rank	Price	Reliability	Tangibles	Responsiveness	Competence
# Matched	2 of 5	Position(s) Held: Program Manager w/out RPM or USTRANSCOM-Related Svc. (18 Years)			
% Match	40%				

Figure 7. Stated Ranked Preferences vs. CBC Choice Behavior

Once all 30 respondents' stated preferences and CBC behavior was reviewed and match compared, the inverse of their match rates (the disconnect rate) could then be determined on an individual and aggregate level. The average match rate accumulated (as seen in Table 8) through all respondent match rates was 23%, leaving the average disconnect rate at 77%. In summation, in this simulated source selection, the disconnect between the stated preferences of respondents and actual choice behavior could be confirmed and measured at over three times the rate at which respondents, and their stated level of attribute importance, matched their choice behaviors.

Table 8. Match Rate Trends Among CBC Choice Behavior and Stated Preference

Overall Match Rate Trends:
0 of 30 Respondents got 100% Match Rate (5 of 5 Matches)
0 of 30 Respondents got 80% Match Rate (4 of 5 Matches)
5 of 30 Respondents got 60% Match Rate (3 of 5 Matches)
5 of 30 Respondents got 40% Match Rate (2 of 5 Matches)
10 of 30 Respondents got 20% Match Rate (1 of 5 Matches)
10 of 30 Respondents got 0% Match Rate (0 of 5 Matches)

In addition to analyzing exact match rates for respondents, the researchers also analyzed the collected data for the inclusive proximal match rate. This match rate reviewed choice behavior from both exercises and searched among all respondents as to if their CBC choices were off by one or two ranks in comparison to their stated ranked preferences. Simple 'if/then' formulas were utilized in Microsoft Excel to conduct this comparison process that not only checked for an exact match but also to examine whether the ranked attribute matched one ranking above or below that same attribute in the CBC choice behavior. Figure 8 displays the proximal match rate comparisons by attribute, with the green 'Yes' representing an exact match, the red 'No-Yes' representing the number of inclusive proximal matches, and the blue 'No-No' indicating a no match whatsoever. While there was an increase in match rate when utilizing the proximal match process, the rate at which respondents still presented no match was approximately 40%.

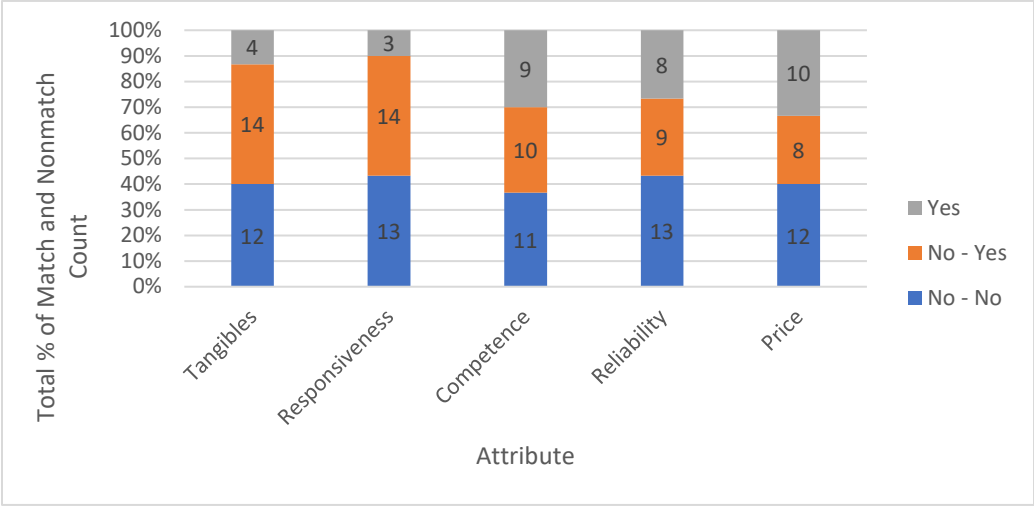

Figure 8. Inclusive Proximal Match Comparison by Attribute

Research Objective II

To develop a deep understanding of quality attributes that government buyers perceive when evaluating logistics-based service acquisitions, a series of semi-structured interviews were conducted with government personal that held various positions but had related experience in purchasing logistics-based services. These interviews highlighted several service quality indicators not associated with current measures and standards utilized in programs like the Contractor Performance Assessment Reports System (CPARS) or in guidance for Performance-based Logistics (PBL). Instead, the research offered some valuable insight into a

potential issue regarding a dissonance between how the DoD is measuring the performance of logistics-based services versus how government personnel truly value the service itself and what they are looking for in terms of the contractors who provide it. With that, the research also provided four quality attributes (as seen in Table 1) that could offer a way forward in terms how the DoD measures quality for these services.

Research Objective III

The foundational knowledge and research collected through this project allowed for a procedural framework to be built that can improve DoD source selection procedures. This framework offers a path of empirical reasoning, as opposed to theoretical deduction when determining evaluation factors. Figure 9 represents the CBC framework as it is incorporated into current source selection procedures.

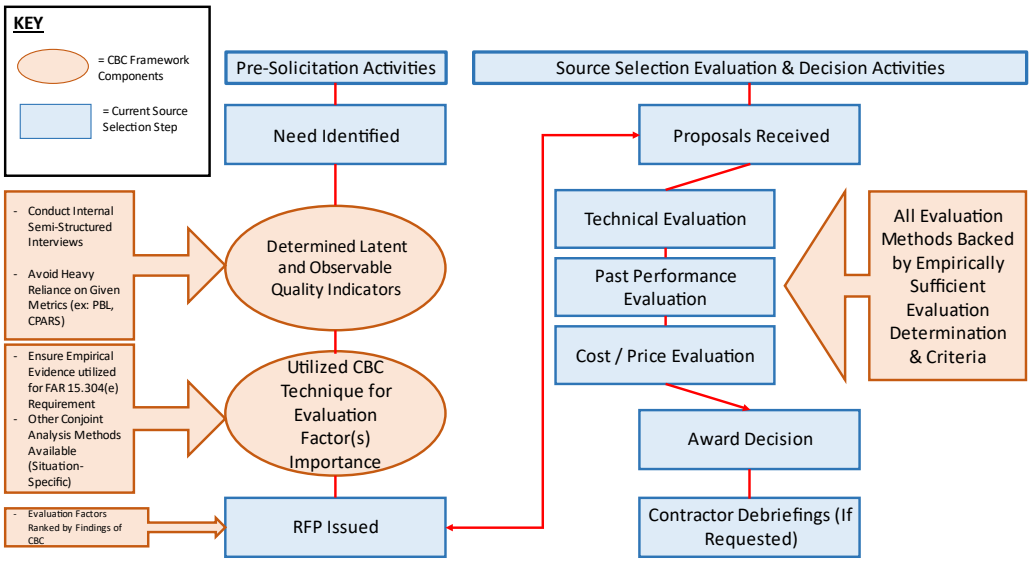

Figure 9. Source Selection Process with CBC Framework Incorporated. (Nicholas, n.d.).

With the CBC framework incorporated into source selection procedures, Source Selection Teams (SSTs) can develop latent quality indicators through the very methodology this research utilized (semi-structured interviews), transition these indicators and perhaps some objective indicators to evaluation factors, and finally rank these evaluation factors utilizing a CBC or other conjoint analysis technique. In utilizing this framework, SSTs avoid ranking evaluation factors on theoretical deduction, ensure they are examining grouped evaluation factors (as opposed to strictly list form), and later portions of the source selection are no longer compromised as early use of CBC ensures empirically sufficient evaluation determination and criteria.

Conclusion

As the DoD continues to operate with limited resources, witnesses rising tensions with geopolitical powers, and contends with an extremely accelerated technological shift, it is important it finds ways in which to effectively function and rapidly adjust to the changes these three factors present. The research presented in this paper provides opportunities to manage resources more effectively, avoid acquiring ill-suited acquisitions to meet the evolving

geopolitical threats, and bring a technological advantage to avoid the risky, ad hoc status quo in DoD source selections. In essence, applying the CBC framework to current DoD source selections offers a small, yet important, shift in how the DoD can deliver best value to rapidly protect and defend the United States of America (DoD).

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