

Coherence and Oddities: A Retrospective of Cost Estimating Publications 1978-2016

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Abstract

Intellectual sedimentation can operate unobserved within professions. Assessing publication trends serves to make such conventional wisdom explicit. Our analysis of articles from the *Journal of Cost Analysis and Parametrics* (and its predecessors) provides insight regarding research coherence and oddities within the cost estimating community. This knowledge is essential for envisioning alternative futures and could be of benefit to those engaged in the praxis of cost estimating or its research.

Keywords

Cost Analysis, Estimating, Parametrics, Risk Analysis, Schedule Analysis, Department of Defense

All societies discourage and penalize ideas and writings that threaten the ruling status quo.
– Saul Alinsky

1. Introduction

Membership in a society entails some degree of conformity. Alinsky's insight [1] highlights the role of punishment as a means of dressage, as well as the privileged position of texts as a medium of social critique. This view can be amplified further by taking note as Foucault did, that "each society has its regime of truth, its 'general politics' of truth: that is, the types of discourses which it accepts and makes function as true" [2]. Views on the relative legitimacy, necessity, and function of these parameters are influenced by whether one is inside or outside the society of interest.

Within organizations and professions intellectual sedimentation can operate unobserved (or unacknowledged) by its members. Analyzing a society's archival publications holds potential to reveal the obfuscated *regime of truth* operating within an organization, and identify points of contestation. In short, assessing publication trends serves to make a society's conventional wisdom explicit. The knowledge gained through such an interrogation of published texts is essential for envisioning alternative futures. At the starkest extreme, one is able either to fully commit to the maintenance of the status quo, or to engage in its radical alteration. More modestly, incremental actions can be informed.

Our analysis of articles from the *Journal of Cost Analysis and Parametrics (JCAP)*, along with its predecessor publications, covering the years 1978 through 2016, provides some initial insight regarding research coherence and oddities within the cost estimating community. This could be of benefit to those engaged in the praxis of cost estimating or its research. While arguably unorthodox in theme and tone, this study is conventional in its construction. Background for this research is presented in section 2. Following that brief contextualization, the methodology is provided in section 3, with results presented in section 4. Some concluding remarks and plans for future research are included in section 5.

Jackson and Boehmke

2. Background

While claiming to be planning the future, organizations are engaged frequently in what Weick referred to as “retrospective sense-making” [3]. Making sense of the past can be an indispensable part of determining one’s future direction. As Webster and Watson noted, “a review of prior, relevant literature is an essential feature of any academic project,” and “an effective review creates a firm foundation for advancing knowledge” [4]. Several high-quality reviews have occurred within the cost community on specific areas of interest in estimating and analysis [5-8]. However, a holistic review of the cost estimating corpus is currently lacking. Filling this void holds implications for both content and direction. Linkages between these two elements of interest are alluded to in a few publications.

As early as 1989 the editors of the *Journal of Parametrics (JOP)* noted how the International Society of Parametric Analysts (ISPA) originated as a “users’ group,” and acknowledged that a question as to “what the *Journal* should be” existed between those advocating for a focus on theory and those advocating for a focus on application [9]. In that same year, it was also noted that an “allegation has been made that too many articles published, have been aerospace industry and Department of Defense oriented” [10]. Such critiques were not limited to journals and articles, but extended to the nature of the profession itself. In 1997 it was noted that, “the cost estimator must take the lead...in reinventing his/her own profession [11]. Individually and collectively this call summons us to understand where we have been and to determine where we are headed. This more existential concern will be expanded upon in the conclusion of this paper (section 5).

This study focuses on cost estimating as it has appeared in published articles from five professional journals. In addition to the articles from *JCAP* and *JOP*, articles from *The Journal of Cost Analysis & Management (JCAM)*, *The Journal of Cost Analysis (JCA)*, and *Journal of Cost Estimating (JCE)* comprise the corpus of this study. Figure 1 contains the publication timeline associated with each of the respective journals, along with contextual information related to the mission and focus of the respective organizations. Through the information contained in Figure 1, it is possible to see stability and adaptability in both the cost estimating societies and their respective journals.

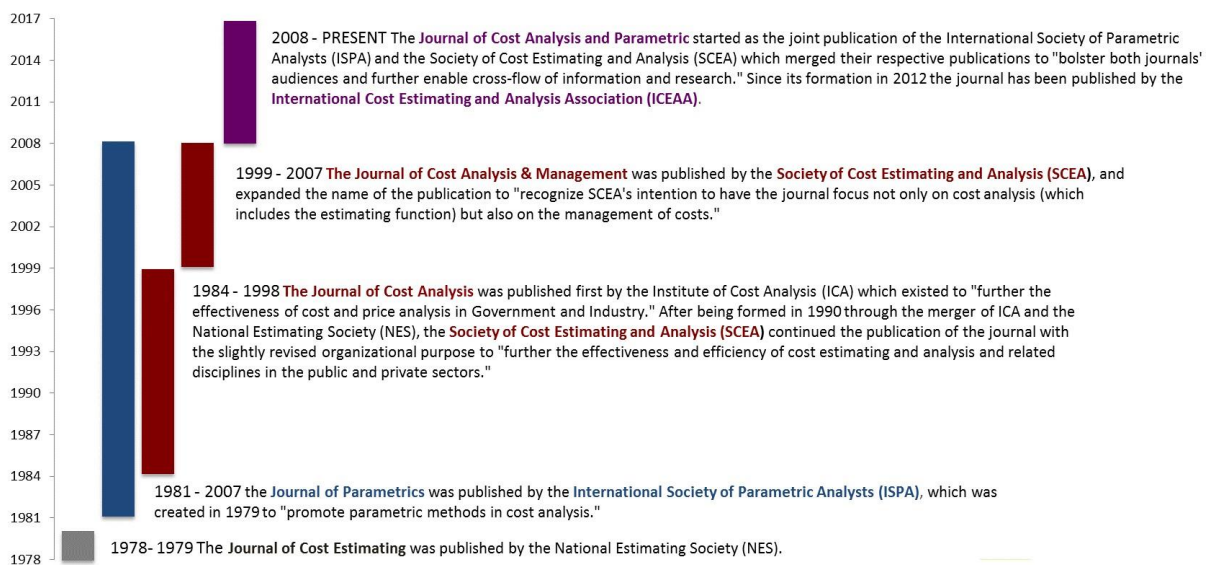


Figure 1: Publication Timeline and Context

As indicated in Figure 1, only two years of publications (1978 and 1979) from the *JCE* are included in this study. These publications are interesting as they mark an organization in transition. An extension of this study might focus on articles prior to 1978. There is also a subtle switch in phrasing between that used by the Institute of Cost Analysis and that used by the Society of Cost Estimating and Analysis (SCEA). The mission changed from “effective” to “effective and efficient” and “government and industry” became “public and private industry.” While only of incidental note here, this thread could be pursued further. With the publication corpus identified, we can now progress to the methodology used in this study.

Jackson and Boehmke

3. Methodology

The methodological approach used for this review was informed by approaches used in previous retrospective analyses of professional journals [12, 13]. The corpus for this study was identified and retrieved through the publisher's website [14]. Although the *JCE* dates to 1900, the publisher has only made articles available electronically back to 1978. Consequently, our corpus consists of 470 articles from 1978-2016. Next, a training set of 24 articles (~5% of the corpus) was abstracted. The training set afforded the opportunity to calibrate the assessment approach, along with an opportunity to refine the assessment matrix based on identified omissions, redundancies, and points of confusion within and between the categories of interest.

Ultimately, the assessment matrix used in this study was comprised of six major elements of interest: a) sector, b) primary subject, c) research type, d) research design, e) analytic methodology, and f) analytic technique. Detail associated with the assessment matrix is available in the appendix. While these elements are far from exhaustive, they nevertheless provide a sufficient foundation from which to identify trends and changes in publication content and approach. For the training set the authors independently reviewed all 24 articles and completed the assessment matrix. Only minor points of differentiation surfaced, these were addressed and the assessment matrix options were refined. Subsequently, the remaining articles were reviewed independently; however, both authors reviewed each other's assessment for validation and verification. With this brief development of methodology established, we can turn now to a presentation of the results of this study (Section 4).

4. Empirical Analysis Results

The empirical analysis section is comprised of three parts: a) publication volume (section 4.1), b) publication content and approach (section 4.2), and c) degree of collaboration (section 4.3).

4.1 Publication Volume

Prior to analyzing the content of articles, it is useful first to establish context as to where and when the articles were published. Such insights are essential for understanding if observed changes are the result of foundational shifts in focus, or are simply artifacts due to changes in the relative prominence of a given journal. Article counts were collected by journal for each year of publication from 1978 through 2016. A histogram is presented as Figure 2.

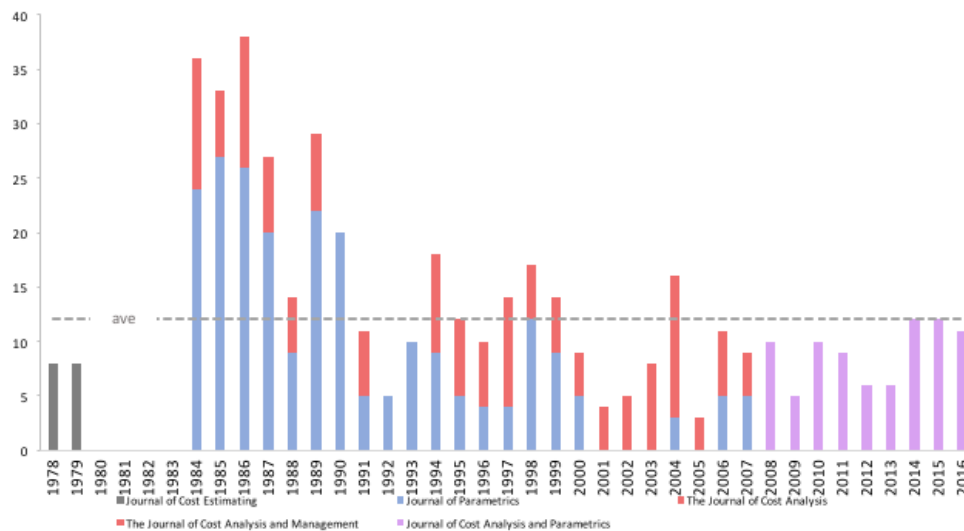


Figure 2: Aggregate Publications by Year (1978-2016)

Publications have been relatively consistent since 1991, with an observable dip in the early 2000's. A significantly greater publication volume occurred in the period between 1984 and 1990. Perhaps this was the "golden age" of cost estimating. A couple of points are worth mentioning. First, articles for *JOP* start in 1984 with volume 4. It is plausible, that volumes 1-3 (years 1981-1983) were published, but are unavailable from the publisher's archive. This could be a consequence that the first volumes contained articles that were neither copyrighted nor refereed [9]. An extension of this study might verify the existence of these early *JOP* publications, and capture/analyze them if available. With this context developed, it is possible to turn attention to the actual content of the articles. The analysis of the content and approaches used in the articles is presented in the following section.

Jackson and Boehmke

4.2 Publication Content and Approach

Data visualizations can be especially helpful in making sense of larger datasets [15]. As Tufte succinctly put it, “graphics reveal data” [16]. Determining which type of data visualization will be effective requires an awareness of context [17]. For the purpose here, a Sankey diagram (or Alluvial diagram) is useful for illustrating the proportional flow among specified elements of interest [18-19]. In this analysis five key aspects of the publications are presented. The respective journal, sector, area of primary focus, research design, and analytic methodology were mapped. Through the process one can visualize the interconnections that exist among the elements, and gain a sense as to what content operates at the center or periphery of the cost estimating society.

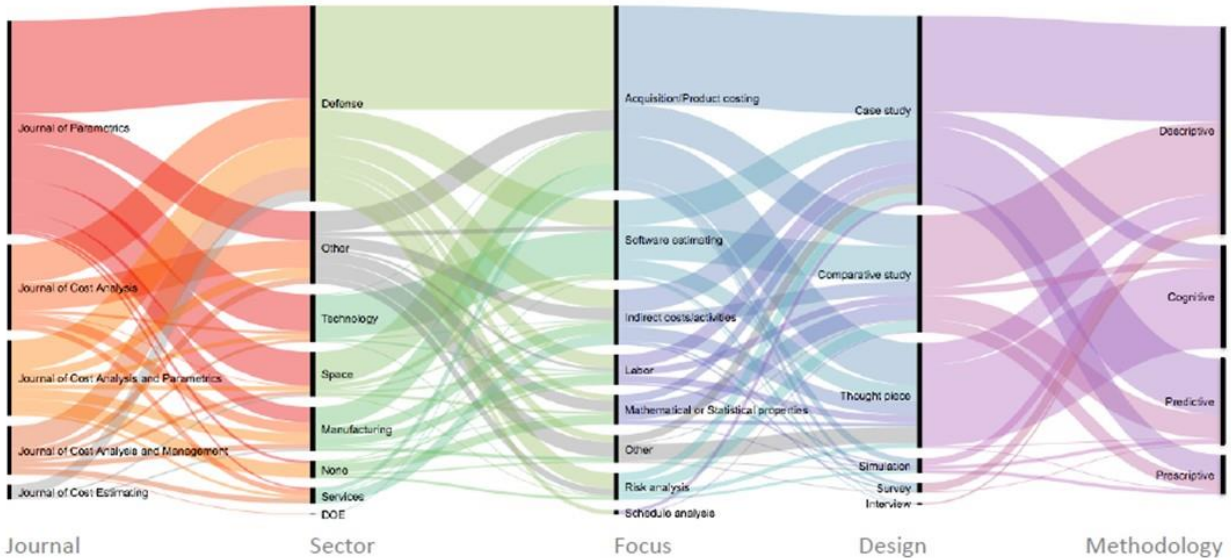


Figure 3: Dominance and Obscurity in Publication Content and Approach

Once one moves beyond the immediate, psychedelic charm of Figure 3, it is possible to appreciate the depth of information contained within this data visualization. For the purpose here, one can establish both elements of relative dominance and obscurity. Specifically, in the aggregate, a significant proportion of the cost-estimating publications from 1978 through 2016 have dealt with the defense sector. This is consistent with the critique referenced earlier [10]. Additionally, one is also able to observe that numerous articles had a focus on acquisition/product costing, used a case study design, and was descriptive (see appendix for definitions). While certainly informative, none of these findings are necessarily surprising.

What is perhaps less expected, and therefore more interesting, is the finding that a significant number of articles were thought-pieces and were largely cognitive in approach. This could reflect that the cost estimating community is, or at least has been, introspective about its role as a society and a profession. While beyond the scope of this study, increasing the granularity here and parsing enhanced distinctions among these articles could be useful. Additionally, a time series analysis to determine if the prevalence of these types of articles has changed is in order.

At the other end of the spectrum one can observe concepts and approaches, which operate in relative publication obscurity. These findings could be considered oddities. Relatively few publications in this corpus dealt with the service sector. Also, few articles focused exclusively on schedule analysis. To some degree schedule analysis might be understated here. Several articles had a focus on cost and schedule. Articles of this nature were cataloged here as having a primary focus on cost and a secondary focus on schedule. Survey and interview research designs, or articles which were prescriptive in nature, were also relatively rare. One is encouraged to spend some time tracing alternative publication threads in Figure 3, as one might discover insights of interest worthy of pursuit.

Those engaged in cost estimating, the management of its society, and the enacting of its publications might benefit from considering the implications associated with the proportion of publications, which are descriptive/cognitive as opposed to predictive/prescriptive. Such deliberations could benefit from considering the degree to which publishing is an individual or collaborative affair within the society. Results focused on collaboration are presented next.

Jackson and Boehmke

4.3 Degree of Collaboration

Societies are inherently social. This being said, activities within a society can range in execution from the individual to the collective. Understanding if its publications are enacted individually or collectively provides useful insight into the functioning of this society. Conducting such an analysis requires a coherent approach for determining the degree to which collaboration occurred.

There are several ways in which collaboration could be assessed. The assessment of collaboration presented here is probably one of its more basic constructions. The corpus was segmented first by journal and then by year. For each journal and each year, a collaboration-value was calculated as the result of the total number of authors contributing to the journal in a given year divided by the total number of articles published in that year. Boxplots were constructed for each journal. The results of this analysis are presented in Figure 4.

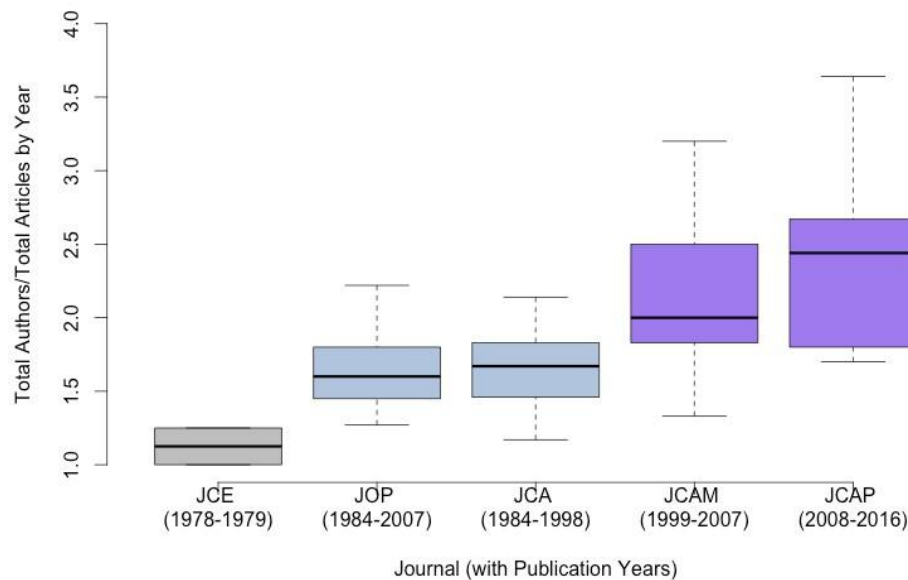


Figure 4: Increasingly Collaborative in the Pursuit of Publication

Publishing in the cost community appears to have transformed from a largely solitary affair in *JCE* to significantly more collaborative one in *JCAP*. It is uncertain if the observed change in Figure 4 is due primarily to the time of publication or to preferences of the journal. The skew of the distribution for *JCAP* is interesting to note as well. While significant overlap exists in the middle quartiles between *JCAM* and *JCAP*, *JCAP* has a more positive skew. Likewise, *JOP* and *JCA* are strikingly similar in terms of both median and distribution. Subsequent analysis will be conducted to determine if similar shifts in the degree of collaboration are observed when analyzed by publication year as opposed to by journal.

Future research should delve deeper into the articles and establish if the content is more rigorous in addition to being more collaborative. Initial review of the corpus certainly suggests this is a very real possibility. One aspect of this analysis will examine the number of references cited per article. While this alone doesn't mean an article is more or less rigorous, it might be suggestive of increased complexity. Another aspect might assess the level at which the articles are written (e.g., Flesch-Kincaid readability score, etc.). While this might be somewhat challenging given the number of articles in which equations are sequentially transformed, at a minimum this approach could be applied to the high volume of cognitive articles in the corpus.

Having briefly covered the publication volume (section 4.1), the content and approach (section 4.2), and the degree of collaboration (section 4.3), it is possible to now conclude this paper. Returning to the existential challenge for the cost estimating community alluded to in the background of this paper, the conclusion addresses areas of future research along with broader implications of engagement.

Jackson and Boehmke

5. Conclusion

Retrospectively, from 1978 through 2016, one can observe both coherence and oddities through the analysis of the cost estimating publication of *JCAP* (along with its predecessors). Building on this research, future studies might address the observed network of published authors within the cost estimating community, and the degree to which selected publications are frequently cited within the corpus. Both studies might prove useful in establishing what body of knowledge functions as Foucault's "regime of truth" within the cost estimating community.

Baez noted that, "as critics of society, researchers must also be critical of their role in society" [20]. As a profession, we might want to consider this. Are we to be the handmaidens of the elite, functioning similar to Chomsky's "new mandarins' whose claim to power is based on knowledge and technique" [21]? Or, should we use our unique position to speak truth to power? Being confronted by such a decision is rare. As Chomsky explained, "the opportunity to do the research that is required to separate fact from propaganda is limited to a privileged few [21]."

In joining a society one trades an element of autonomy for inclusion. As with anything, there are costs and benefits. Within societies battles rage (overtly or covertly) as to which thoughts, facts, and interpretations constitute orthodoxy, heterodoxy, and at the extreme, heresy. Acknowledged or not, as Stills explained, "there's battle lines being drawn." [22]. After 38 years and 470 articles it is clear those engaged in cost estimating are committed to improving its praxis. But, to what end? Perhaps it is time for our society to declare a side, to state in no uncertain terms the institutional role we envision for analysis and analysts. If not, we run the risk of intellectual sedimentation.

Disclaimer

The views expressed are those of the authors, and do not represent the official policy or position of the United States Air Force, Department of Defense, or the United States Government.

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Jackson and Boehmke

APPENDIX

Major Elements	Subcategories
Sector	Agriculture, Defense, Department of Energy, Healthcare, Manufacturing, Services, Space, Technology, Other, None ¹
Primary Subject	Acquisition/Product Costing, Indirect Activities & Cost, Labor, Life Cycle Cost Estimating, Risk analysis, Mathematical or Statistical Properties, Schedule Analysis, Software Estimating, Other
Research Type	Conceptual/Reconceptualization ² , Exploratory – Empirical Analysis, Hypothesis Testing, “How-to” ³ , Other
Research Design	Thought Piece, Case Study, Comparative Study, Survey, Simulation, Interview, Other
Analytic Methodology	Descriptive, Predictive, Prescriptive, Cognitive, Other ⁴
Analytic Technique	40 different analytic techniques (e.g. linear regression, data envelopment analysis, time series forecasting)

¹ None represents articles that were sector agnostic and were primarily thought pieces (e.g., Parametric Estimating: Its Present and Future (Otroso, 1984)) or purely mathematical articles (e.g., Generalized Degrees of Freedom (Hu, 2016)).

² Focuses on the concept or theory that explains or describes the phenomenon being studied. Typically, a theoretical or thought-piece format that qualitatively, not quantitatively, analyzes a topic.

³ These articles were either qualitative or quantitative but were written to describe a specific process (e.g., Parametric Cost Estimating: A Guide (Gasperow, Hackney, & Hudson, 1987)).

⁴ *Descriptive* analytics answers the question “What happened?”. Provides a representation of knowledge regarding a phenomenon without predicting a specific outcome. *Predictive* analytics answers the question “What could happen?”. Knowledge from historic data is extracted and used in such a form that one can apply the resulting model to new situations. The key factor is to predict future trends and possibilities. *Prescriptive* analytics answers the question “What is the best action or outcome?”. The key factor is to provide new ways to improve or maximize certain types of performance. Cognitive analytics are qualitative assessments of phenomena. This technique was generally used to categorize qualitative conceptual articles.