FROM CATEGORICAL IMPERATIVE TO LEARNING BY CATEGORIES: COST ACCOUNTING AND NEW CATEGORICAL PRACTICES IN AMERICAN MANUFACTURING, 1900–1930

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ABSTRACT

Organizational scholars increasingly appreciate the role of categories as bases of order or "cognitive infrastructures" in markets. Yet they construe categories as disciplinary devices. They understand category formation, implementation, and revision as the purview of professionals. And they tie those processes to notions of institutional development that sharply distinguish settled from unsettled or disordered eras. We challenge these conceptions through a historical study of how manufacturers, associations, and cost accountants broke from the disciplinary functions of accounting categories underlying mass production to create new categorical schemes devoted to learning, innovation, and improvement. Reformers reconfigured the uses *of categories in markets, mobilizing classifications to spark reflection, experimentation, and*

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improvement among firms by perturbing taken-for-granted assumptions. They also redesigned the practices of producing, implementing, and revising *categories. Manufacturers themselves produced and routinely revised classifications through collective deliberation, while accountants served as their consultants, rather than autonomous authorities who monopolized category formation and implementation. In so doing, reformers forged foundations for upgrading markets and fostering competition based on innovation and improvement in a variety of industries. Based on these findings, we extend existing research beyond categorical imperatives to highlight how categories also serve as cognitive infrastructures for learning, discovery, and innovation in markets.*

Categories and classification schemes are ubiquitous in markets, varying considerably in form, formalization, and the processes they induce. They range from common-sense schemes for demarking industries, types of firms, product lines, or costs to codified directories published by trade magazines, associations, and the business media. They appear in the ranking systems used in "mediated markets" by film and food critics, stock analysts, and certification, watchdog, and credit rating agencies. They also include accounting systems promulgated by states, regulators, and the professions to track, evaluate, and control costs, people, organizations, and financial flows.

But as organizational scholars find, even the least formalized classifications do substantial work in ordering and stabilizing markets and fields. Common-sense product categories provide market participants with "cognitive interfaces" for simplifying complex realities, focusing attention, grouping and comparing products and producers, locating themselves in the world, and orienting themselves toward rivals and trading partners (DiMaggio, 1987; Porac, Thomas, Wilson, Paton, & Kanfer, 1995; Lounsbury & Rao, 2004; Kennedy, 2005). Even simple schemes for classifying firms and products are media through which organizations craft and project identities to potential audiences for recognition and evaluation (Porac, Wade, & Pollock, 1999; Rao, Monin, & Durand, 2003; Hsu, 2006a; Hannan, Pólos, & Carroll, 2007; Ruef & Patterson, 2009). By their mere existence, too, categories help answer the question, "who are my peers?," creating bases and pathways for emulation, coordinated activity, and mutual regard (Strang & Meyer, 1994; Lant & Baum, 1995; Soule & Zylan, 1997). And even without enforcement, classifications can unleash potent

pressures for conformity and homogeneity, as with business and law schools, where simply publishing rankings prompted the reorganization of once diverse fields around single sets of organizational criteria (Hedmo, Sahlin-Andersson, & Wedlin, 2006; Wedlin, 2006; Espeland & Sauder, 2007). Indeed, the cultural turn in organizations research has yielded new insights into categories as sensemaking and order-creating devices, highlighting their role as "cognitive infrastructures" that stabilize and make possible markets, valuation, and exchange.

Less apparent in these accounts, and obscured from view, are the destabilizing functions of categories and classification, and their roles as cognitive infrastructures for learning and innovation in markets. Creative destruction, innovation, and improvement have long been understood as key features of capitalism. In fact, competition and governance geared toward discovery, experimentation, and revision are hallmarks of the best potentials of a capitalist economy, "new" and old. Yet organizational research is largely silent on how categories can perturb taken-for-granted understandings about products, consumers, costs, and processes, enabling firms to raise new questions, consider new possibilities, and compete with one another via improvement and innovation.

Part of the issue likely lies with the types or locations of category systems that preoccupy existing work. Scholars focus heavily on the consumer–producer interface and classification systems used by consumers and critics to categorize, evaluate, and authoritatively rank firms or products, ranging from French cuisine and films to law and business schools, mutual funds, and securities offerings. These, by design, are devices for holding producers to established standards, rather than fostering experimentation in products or production process.

But part of this one-sidedness is theoretical. Organizational research closely ties the sensemaking and ordering functions of categories with their disciplinary uses and with projects of making persons "auditable" and "governable." It also links its analyses of categories with particular conceptions of institutions. Typically, arguments about how categories shape markets draw on imageries of institutions as settled orders, institutionalization as consolidation and convergence, and development as punctuated equilibrium – theoretical tendencies revealed by the common trope of "once in place." Once in place, categories tend to become simplified and compacted, and induce self-sustaining dynamics of commensurability and performativity, fostering reduction, hierarchy, and homogeneity (Porac, Rosa, Sanjol, & Saxon, 2001; Espeland & Sauder, 2007). Once in place, categories become imperative, creating pressures for conformity

as conditions for recognition and legitimacy, and growing penalties for boundary crossing, type mixing or identity confusion (Porac et al., 1995; Zuckerman, 1999, 2004; Zuckerman, Kim, Ukanwa, & von Rittman, 2003; Hsu, 2006b; Hannan et al., 2007; Ruef & Patterson, 2009). Once in place, categories become bases for professional critics to consolidate privileged positions as gatekeepers of recognition and endorsement (Hsu, 2006a; Rao et al., 2003). They become bases as well for managers to shield themselves against negative evaluations (Porac et al., 1999), or for dominant firms to protect their market positions and lobby media to preserve existing categories in the face of ambiguity (Lounsbury & Rao, 2004). And once categories are in place, all the politics, debates, struggles to come to terms with novelty, all the work of category revision, experimentation, and redefinition cease, recede from view, becoming buried in the archives, day to day practices, or architectures of markets (Lounsbury & Rao, 2004, p. 974).

Organizational scholars acknowledge the inherent incompleteness of categories. They likewise confront how ambiguity, poor performance, and novelty can undermine the taken-for-granted character and ordering functions of categories, prompting politics, struggles over definitions and revision, including category expansion, contraction, or even new categories. But in linking categories to disciplinary processes and conceptions of order that sharply divide settled and stable from unsettled and disordered, scholars relegate novelty, ambiguity, contestation, revision, and reflectivity to unsettled times, walling them off conceptually from what categories normally do, as something apart from classifications and their core ordering and sensemaking functions. They are cast, in effect, as disturbances or disruptions to the cognitive infrastructures of markets, with experimentation, revision, and redefinition appearing as exceptional, as entrepreneurial activity or hybridization by marginalized outsiders or only the most status privileged, or as defections from existing classification orders (Porac et al., 1995; Zuckerman & Philips, 2001; Zuckerman et al., 2003; Rao, Monin, & Durand, 2005). Such formulations, we argue, are too narrow a container for understanding how categories serve as cognitive infrastructures for learning, innovation, and diversity in markets, processes in which producers mobilize, perturb, and revise taken-for-granted notions about products and production – and even categories themselves – on a regular, rather than exceptional basis.

In this chapter, we reconsider the role of categories as cognitive infrastructures for learning and innovation through a study of accounting and the development of new classifications and categorical practices in American manufacturing in the early 20th century. Like commonly studied

schemes for classifying and rating producers or products, accounting systems help make up the *cognitive infrastructures* of markets – the cultural elements, narratives, theories, classification schemes, and discourses by which firms and others make sense of, locate themselves and others within, and give shape and order to markets (Carruthers & Espeland, 1991). They are grounded in *classification schemes*, that is, in the taxonomies or typologies market participants use to make commensurable, group, compare, and distinguish organizations, activities, and phenomena. In studying accounting, we look beyond the typologies of *industries*, *producers*, and *products* that preoccupy organizational research to consider taxonomies of *costs*, *production processes*, *customers*, and *jobs*. And as is true with classification schemes for film, knitwear, and security issues, accounting systems are ultimately grounded in *categories*, or the basic elements or types in classification schemes, whether they be types of products (legal books, textbooks, custom printing), production process (composition, binding, printing), or costs (indirect, direct, overhead). Indeed, accounting systems entail shared, industry-wide classification schemes and categories, promulgated via professional and industry associations, through which firms cognize, recognize, and place themselves and others in the market. They serve, in effect and by design, as cognitive interfaces by which firms orient their activities toward competitors and trading partners, their own production processes, and even, as we shall see, their past and future selves.

Moreover, at first blush, accounting systems in American manufacturing also fit comfortably with the existing literature's more specific conceptions of the use and production of categories in markets. Mass producers and distributors relied heavily on accounting systems as disciplinary devices. They used classification schemes for processes, costs, and financial flows, and categories like stock turn, return on assets, or revenue per-ton-mile to represent themselves to investors and orient themselves in competition, while eliminating variability, minimizing discretion and waste, and otherwise ensuring high-volume throughput of goods and services. In addition, by 1920, financial accountants had largely monopolized the tasks of producing, implementing, and revising these classifications, defining these activities as a specialized field of technical expertise over which they had jurisdiction.

Yet, as we document in detail, there was a broad countermovement within American manufacturing and the accounting profession against mass production, its category using and making practices, and the kinds of competitive dynamics it involved. Rejecting the "volume bug" for its illusions about costs, associationalists and cost accountants in a wide

range of sectors crafted new institutions to support learning, diversity, and competition based on innovation and improvement in products and processes. Moreover, advocates turned to accounting classifications and categories as the cognitive foundations for this program, in much the same way financial accountants helped consolidate mass production. But, in this case, manufacturers and cost accountants explicitly eschewed the disciplinary functions of the accounting schemes associated with mass production in favor of new classification systems and categorical practices that were experimentalist in a double sense. First, the classification systems were designed to help manufacturers pose new questions and pursue new possibilities regarding costs, products, and production processes, fostering discovery, deliberation, and experimentation in markets on an ongoing basis. Second, the categories themselves were built "from the bottom up" and designed to be modified, experimented with, and revised routinely by manufacturers in light of new discoveries or questions. In effect, this program not only redesigned the cognitive interfaces by which producers oriented themselves to others and themselves in markets, but also created new category making and using practices. In so doing, it reconfigured the relationships between professionals, the practitioners who used categories, and the objects to which they applied.

The following sections present a case study of how categories and classification schemes were used in American manufacturing as cognitive infrastructures for learning, innovation, and new forms of competition. This is a "deviant" case of categories in markets, one that confounds existing organizational imageries of their functions and production. Manufacturers, accountants, and others in our case pursued a deliberative and experimentalist, rather than a disciplinary, approach to categories. Professionals eschewed gate keeping, top-down mediation, or monopoly over categories in favor of consultation and facilitation to support that project.

Part I describes how cost accounting pursued an experimentalist use of categories in the early 20th century US economy. We show how a group of manufacturers, accountants, and state officials became disillusioned with efforts to discipline volume production through accounting and scientific management. They discovered instead how new accounting systems could provide cognitive foundations and market interfaces for shifting firms from rivalry based on volume to competition based on constant improvements in products and production processes. Producers, associations, and cost accountants retheorized costs and the accounting systems commonly used to track them. They criticized standing accounting practices and categories for holding unreflectively to faulty assumptions about fixed costs and volume,

and showed their colleagues how those assumptions led firms to interface with competitors, suppliers, and their own operations in strikingly counterproductive ways. They set out then to reconstruct classification schemes and accounting practices to support an empirical and experimentalist approach to competition, costs, and production. This project entailed not just the creation of new, more refined classification schemes (or changes in the *content* of such schemes), but also the creation of new categorical *practices* (or changes in how participants used and made categories). For reformers, firms would no longer use cost categories as disciplinary "ideals" or targets to ensure reliability and control in production, but rather as "yardsticks" for comparison, by which firms could perturb assumptions, raise questions, and sustain experimentation and discovery about costs, products, and production. Furthermore, to realize this project, reformers eschewed a "top-down" strategy of category production in favor of bottom-up deliberative practices, in which firms themselves routinely modified and revised categories as new questions or possibilities arose regarding costs, production, or competitive strategy.

Part II describes in detail the character of these new categories and categorical practices in American manufacturing, tracing what producers did as they incorporated new classification systems into their routines, and how these practices fostered new relations between categories, activities, and markets. Here, we document how producers in a variety of industries used new categories and practices – collective deliberation, uniform cost schemes, benchmarking, and more – to shake preconceived notions about costs, formulate new questions about products and processes, and experiment systematically with plant layouts, product mix, and new technologies. We document how producers used new categories as cognitive interfaces to reorient themselves to the market, their competitors, suppliers, and vendors, and to their past and future selves, substantially altering competitive dynamics in their industries. And we document how manufacturers produced, modified, and revised category schemes on an ongoing basis as an integral part of this experimentalist program. In a variety of sectors, new categories and practices served as cognitive infrastructures for alternatives to mass production, fueling shifts in competitive strategy from volume to innovation by focusing management's attention on learning, discovery, and the exploration of new avenues – and categories – for improving products and processes.

We conclude by developing the implications of our findings in two directions. We aim, on the one hand, to bring the organizational literature's insights about the cognitive infrastructures of markets to bear on learning,

innovation, the new economy, and alternatives to mass production, issues of central importance to institutional and constructivist scholarship on economic development (Herrigel, 2007; Powell, Koput, & Smith-Doerr, 1996; Sabel & Zeitlin, 2004; Whitford, 2005; Scranton, 2000). We aim, on the other hand, to contribute to the organizational literature on categories in markets through a case study that highlights both novel uses of categories and practices of ongoing elaboration and revision. Our observations confound the organizational literature's core imageries of category use and production. And in shifting the focus from categorical imperatives to learning by categories, they suggest possibilities for expanding existing formulations about market interfaces and cognitive infrastructures.

PART I – MASS PRODUCTION AND AN EXPERIMENTALIST TURN TOWARD COMPETITION, CATEGORIES, AND CATEGORICAL PRACTICES

The apparent triumph of mass production during the merger wave of 1898–1904 involved what looked like inescapable demands for reliability and control, prompting the use of classifications and accounting categories in three intertwined disciplinary projects. For producers, categories and accounting were means to minimize variability, eliminate discretion, and ensure high-volume throughput. As such, they served as the cognitive interfaces by which managers oriented themselves toward markets and their own operations. For trade associations and the state, product and cost categories were mechanisms to control markets and prices, serving as interfaces for competitors to coordinate their strategies. For accountants, categories and cost accounting were vehicles of scientific management, ensuring proper asset valuations for financial markets, and securing their role as expert authorities, serving as interfaces between firms and investors.

While many producers, associations, state officials, and accountants advanced accounting for discipline, others became disillusioned and discovered that classification schemes and accounting practices could be used for experimentalist aims instead. Working on their own, and then together during the 1910s and 1920s, discontents in each camp rethought the uses of modern technology, the nature of prevailing competitive strategies, and the role that categories and accounting played in supporting those strategies. Each discovered how little firms actually knew about their costs,

and came to link faulty accounting systems and untested theories about costs to the dead ends of overcapacity, the collapse of cartels, and the failures of scientific management. Each discovered in these connections new prospects for competition based on innovation and continual improvement, theorizing new systems of cost accounting as the cognitive infrastructures for a revitalized capitalism. And as they worked together to build those infrastructures, discontents proposed classification schemes that were experimentalist in the use and production of categories. Reformers eschewed strictly disciplinary uses of accounting in favor of treating classifications and categories as bases for learning, discovery, and improvement in products and production. They also turned to deliberation and experimentation as bases for producing categories, treating classification schemes as provisional frameworks to be routinely revised as new discoveries or questions arose.

Manufacturers and the Volume Bug

For mass producers, volume was the solution to the problem of modern technology and the high fixed costs of debt. The more they produced, they reasoned, the lower were their costs, the more competitive they would be, and the more likely they could cover fixed costs. Such a strategy placed extraordinary premiums on detecting and eliminating variability, discretion, or bottlenecks that impede high-volume throughput, prompting the development of accounting systems and categories designed to monitor and discipline volume and flow. Railroads invented "cost-per-ton-mile"; mass distributors learned to measure "stock turn;" manufacturers developed factory accounting categories like "unabsorbed burden" (a measure of capacity utilization) to track the costs of running below a standard volume; and DuPont invented rate of return categories that multiplied earnings on sales by "turnover" in order to tie returns to the speed and volume of material flows through plants (Chandler, 1977, pp. 117–20; 223–5; 278–9; 445–7). These categories were cognitive infrastructures for mass production.

But mass production also regularly generated crises of competition. While many manufacturers continued to scramble to control competition through cartels or vertical integration, others questioned the taken-for-granted obsession with volume. They identified it as the problem rather than the solution, and in doing so, they began to hypothesize that collective assumptions about cost categories and the schemes by which manufacturers classified products and processes, rather than the demands of modern technology, drove them to over-value volume and cut-throat competition.

Manufacturers began to understand how their own categories generated self-defeating behavior in markets. They began to recognize how little they had probed their costs, and conjectured that new methods of classifying costs, products, and production could open other avenues for competition and profits. They began, too, to see that revising industry classification schemes and how firms used those schemes could shift competition from volume to learning, innovation, and improvement.

Commercial printers were among the first to undertake this project. In 1909, they assembled in New York to discuss the demoralized state of their industry. The International Typographers Union had won the 8-hour day, and the Panic of 1907 had fueled fierce competition. Inevitably the conversation turned to price fixing. But cartels had failed so dismally that printers began to question the logic of volume production, launching a project to reform rather than control markets. The industry, some suggested, was demoralized not because of the high fixed cost of technology, greedy workers, or the inability to enforce cartels. Instead, they hypothesized that ignorance of costs and faulty methods of classifying products and production processes led printers to the illusion that success was best measured by volume, or as one printer put it, output measured by "the number of printed sheets" (Berk, 2009, pp. 185–215). The problem, wrote the editors of *The Typothetae Bulletin* (the printers' leading trade publication), was "not to attain maximum production through additions of labor and equipment, but to arrive at the extreme efficiency of the plant as it already is, so that maximum profits may be derived, and nonprofitable processes [will be] eliminated." And if a printer adopts cost categories for classifying products, production processes, and the way costs are incurred more carefully, he will "be in a position to ascertain just what type of business is making him money, and what type of equipment is the most productive" instead of taking on new equipment and more debt in the endless chase for volume ("Production," 1925, p. 54). New – and healthier – ways to compete will result.

New York printer, W.R. Ashe, expressed this skepticism with mass production well, calling for the "intelligent guidance" of new classification schemes to make sense of the relationship between technology, production, cost, price, and success.

> Nearly all printers have put the cart before the horse by trying to adjust volume to equipment … The average printer is prone to hang a millstone around his neck. He puts in every machine his competitor happens to have, before sufficient profitable volume has been acquired for running machinery the necessary productive hours at which its maintenance cost is absorbed… . There appears but one alternative, and the result is an

> *affliction of the volume bug*, and bang goes the price in an effort to get business … The printer has an … occupied plant but at a sales price that is in unbalanced relation to plant cost. In final analysis, he overcomes a financial loss faced in unoccupied equipment to confront an equal of greater selling loss and no progress is made. His position is the same as a dog chasing its tail – the tail is always ahead of the dog, because lower than cost rates are used in attracting sales, with no attempt to conform actual costs to these rates. This conformation obviously cannot be made without the intelligent guidance of a cost system by which adjustments are effected of equipment to production, and correlation made between production and cost and sales. (Ashe, 1930, p. 233)

East Coast printer, Henry Porter, likewise retheorized the causes of cut-throat competition from fixed costs to volume-based categories and accounting measures. Success, Porter wrote, should be measured in profit not volume. The "chief output which printers desire from the pressroom" should not be "printed sheets …, but an output of real money which shall find its repository in a bank where no holder of printer's notes, or press leases, can ever claim it as his." Volume is "essential." But "mere volume is not profit." Printers are all too familiar with the shop where success is measured as "a large yearly press output," but the consequences are "nothing more … than so much worn out machinery and a ledger with red figures" (Porter, 1910, pp. 98–101).

There was an alternative to the volume bug, Ashe and others insisted: using new cost accounting methods to support an empirical, experimental, and discovery-based approach to product mixes, job selection, and equipment investment. With such systems in hand, printers can ask questions about and investigate which jobs and products add profits, rather than simply assume that chasing jobs and fillers will be profitable. With more refined classifications, Ashe argued, printers can disaggregate costs, hold technology accountable for its precise additions to productivity, and discover which products actually made money, enabling them to "successfully combat competition with highest quality work and service at minimized cost."

> The profitable program stands four square against indiscriminate meeting of competitive prices. It does not depend on higher than average volume as a means of price reduction. It adheres firmly to a more intelligent and wiser policy of properly relating capital and revenue expenditures to an economic amount of profitably acquired sales with watchful control of all operations, so that capital investments are justified and properly conserved. (Ashe, 1930, p. 231)

Early experiments with cost accounting showed that printers overestimated the volume needed to profit. "Under minimized expense … volume does not have to exceed 50 per cent of plant capacity to break even" (Ashe, 1930, p. 233).

Cost Commissioner Frank Ellick likewise emphasized how cost systems can lead to new discoveries about scale and product mixes. A new system, he explained, "will put you beyond the profitless job … [It] will … remove the haze caused by filling your plant with work at a loss and place within reach the very thing we are all striving for, a reasonable profit" (Ellick, 1912, p. 68). And it will reduce the widespread practice of taking on "fillers" – work whose only purpose was to keep the plant running during slack times. "Printers have never really known what they cost. At best they've been subtracted from total profits at the end of the year." In short, classifying products by profitability will likely "cause a loss of business" but raise profits because printers will "throw out a lot of unprofitable work, or advance … prices" (Foote, 1910, pp. 114–18).

Beyond realigning competitive relations, printers saw in new categories a method to treat technology as an experiment, rather than a constraint, realigning relations between printers and machine vendors. "The tendency in the printing business is almost invariably to over-equip and under-organize," charged A.M. Glossbrenner. If "master printers" tracked production costs carefully, they would be "very slow to increase the size of their plants until they had become thoroughly convinced of maximum efficiency. They would not simply buy machines at the solicitation of supply men and because they were led to believe competitors were investing in like manner, for the conditions between plants may be radically different." Only "painstaking investigation" revealed such differences (Glossbrenner, 1910, pp. 47–51).

Printers' efforts to address the causes of destructive rivalry by remaking accounting into infrastructures for learning and intelligent competition spread to cognate industries: graphic arts, paper and paper products, cardboard, envelopes, and boxes. Manufacturers of corrugated and fiber shipping containers also retheorized poor performance as an artifact of mass production's cost conventions. Container makers, complained accountant Charles Stevenson, are habitually "VOLUME MINDED" in how they conceptualize costs. They focus unreflectively on "overhead" costs, "figuring that if they could only increase their volume they could reduce their overhead per unit." But the results were perverse, as producers "undersell the market" in anticipation of lower cost, fueling a "vicious struggle for the division of available volume" in which profits collapse, capital is impaired, and wages are debased (Stevenson, Jordan, & Harrison, nd).

Somehow added Grafton Whiting (1926, p. 12), "profit and volume" have become "inseparable in the minds" of container makers and they lose sight

of a basic lesson: "a little business at a profit [is better] than a large amount at cost or at a loss." But firms classified costs in ways that made investigation into this principle unthinkable.

> The astonishing thing to one who has spent nearly twenty-five years in [this] field, is the extent to which whims, pet theories, notions, prejudices, … treasured theories, … and the blind acceptance of the past play a part in … our cost accounting practice. (Knoeppel, 1927, p. 14)

A particularly destructive habit, Whiting complained, was aggregating diverse products into a single category and tracking their average unit costs. Ignoring the "relative costs" of different product categories, manufacturers sought the big job with many products and bid on the basis of average costs, assuming they decline with volume. But consumers often "split" the order, buying each product from the cheapest vendor. The result is "a loss to each manufacturer because his ignorance of relative costs has led him to rely on average and the buyer has given him the part of the order which is on the wrong side of his average figure" (Whiting, 1924, p. 12). Only by categorizing each product separately and estimating its "relative cost" will firms learn a healthier way to compete.

Market Reform, Cost Classifications, and the State

State officials also reflected on the effects of cost categories, which over valued volume and led to cartelization and anti-trust. They, too, turned to new accounting systems as a basis for reforming competition in markets. In 1916, Federal Trade Commission chair, Edward Hurley initiated a program to upgrade competition by reconfiguring the way that producers classified products, production, and costs. Hurley had been a successful tool-manufacturer who, as president of the Illinois Manufacturers Association, observed how faulty cost conventions demoralized competition and truncated experimentation, learning, and improvement (Berk, 2009, pp. 122–129).

Like the printers, Hurley asked manufacturers to test, rather than assume, the idea that big orders of diverse products reduced average unit costs. For example, he asked them to experiment with methods of classifying and tracking costs by individual product line. Hurley complained that fruit juice manufacturers kept no independent record of the costs and revenues of jams

and jellies; iron and steel manufacturers failed to segregate the costs of coke and pig iron; and many firms evaluated salesmen by the volume, not the profitability, of their sales. This limited efficiency and caused cut-throat price competition, as manufacturers slashed prices in pursuit of volume and market share.

> Every article produced should bear its equitable share of all expenses, including overhead and selling expenses. There are manufacturers whose line consists of, say, six articles; on three they are making a profit and on three they are losing money, but claim that these three articles help to take care of the overhead expense. This method of doing business is most detrimental to healthy business conditions. Frequently one of these articles may be the sole product of an individual who is striving and struggling to exist against a firm which is placing the same article on the market as a means to help take care of its overhead expense. Surely this is not wholesome competition. An adequate cost system reveals this unhealthy condition and makes a remedy possible. (Hurley, 1917, p. 7)

Develop more nuanced and differentiated costs categories, Hurley said, and managers will redirect competitive strategy from volume to product quality and diversity. With "this information" managers "can concentrate on the manufacture and sale of the product on which the profits are satisfactory." "Q*uality and service* will become increasingly important." Consumers will adjust and "long after … price … is forgotten … *quality* [will be] *remembered*." In short, new methods of classifying products and measuring costs will teach manufacturers to specialize on strong lines and competition will turn on quality, diversity, and nonvolume improvements in productivity (Hurley, 1916a, p. 3, 1916b, pp. 23–24, 1917, pp. 18–19, 180–181).

Nor was this to be a one-time transition. "To be progressive," Hurley added, manufacturers must abandon control for experimentation on an ongoing basis. "We must be improving our methods of production, changing our designs to meet new conditions …, and always endeavoring to adopt some new method that will reduce the cost of operation in every part of the business … Intelligent cost accounting lies at the basis of [progressive] management." Like "a compass on a ship," it is the means to constant invention in products and production processes (Hurley, 1917, pp. 3–4, 36).

Associations and Accountants Rethink Cartels and Scientific Management

Associations and accountants, too, became disillusioned with mass production's disciplinary projects. They also turned to new classifications as cognitive infrastructures for competition based on learning, innovation,

and improvement rather than volume. Moreover, in rethinking the content and use of cost classifications, they also rethought the practices through which those classifications were produced and revised.

For associations, product and cost categories were vehicles for coordinating pricing in cartels. But repeated failures led associationalists to experiment with "open pricing," where they invented new classification practices – cost experiments, deliberation, and costs committees – to reform market competition (Berk & Schneiberg, 2005; Berk, 2009, pp. 150–184).

The attorney Arthur Jerome Eddy initiated associations' shift from discipline to learning when he convened the New York Bridge Builders' Society in 1911. He asked members to submit bids for a job to the association and discuss the outcome afterwards. Eddy hoped firms would learn to moderate cut-throat pricing by pooling data in an "open price association," but the conversation became heated. Did winning contractors have genuinely lower costs and better products? Or had they bid below cost, sweated their workers, or used inferior materials? No one knew the answers without agreeing first over what constituted a cost. Members shared a "natural curiosity" for comparison, but realized they spoke different languages. The conversation over how to measure costs was no less controversial: "*no two agreed upon all the items that should be charged against a given piece of work* … Differences of opinion and practices … were so surprising that a competent committee was appointed to work out a cost system" (emphasis original) and make comparison possible. Thus, a top-down disciplinary effort became a bottom-up project to revise classifications for measuring and comparing costs (Eddy, 1912, p. 148).

Other associations followed Eddy. Having repeatedly failed to fix prices, associationalists in printing, tanning, paint and varnish, drugs, silk, castings, biscuits, stoves and furnaces, plywood, and millwork also turned to new classification schemes and practices to compare costs. Like Commissioner Hurley, they realized that faulty cost accounting categories resulted in cut-throat competition. Like Eddy, they discovered that experiments in comparison could spark interest in cost accounting. Associations asked manufacturers to estimate the cost of a standard product, such as business cards, soda crackers, a "16-inch taffeta," or a simple steel casting. The variations were dramatic, ranging from 15% in steam-fitting products, to 60% in metal casting, 125% in silk, 139% in printing, and 250% in drugs. It took little reflection to realize the differences flowed from differences in cost accounting methods, not productivity. There was "great consternation" among drug manufacturers; metal casters concluded "that actual differences in production costs account[ed] for a small part of the range

in estimates.'' Surprise prompted ongoing efforts to reclassify and compare products, processes, and costs, convincing metal casters, cracker and biscuit makers, and plywood manufacturers of the need for ''uniform cost accounting,'' a ''common language and calling the same things by the same names'' (US Chamber of Commerce, 1923, pp. 14–17, 1924a, p. 81; National Association of Cost Accountants, 1921, pp. 163–164).

Here, too, efforts to coordinate pricing in cartels turned into deliberation and the use of accounting to prompt reflection about categories and costs among firms. Associations redirected their goals from suppressing competition to upgrading it through more refined and uniform cost categories. This approach, associations learned, could foster improvement by communication and comparison, raising novel questions about performance, and sparking regular efforts to revise categories.

For accountants, the journey from control to learning flowed from disillusionment with two disciplinary uses of accounting – to ensure proper asset valuation for financial markets and to promote scientific management. This process led discontents to redefine themselves as consulting engineers, who worked with clients (manufacturers and associations) to design their own cost systems from the bottom up and use those systems as yardsticks for comparison, discussion, and improvement (Berk, 2009, pp. 153–170).

In 1913, American accountants squared off over a seemingly obscure issue about how to classify costs: whether to include interest on debt as a cost. This fight was so divisive it resulted in divorce. In 1918 cost accountants bolted the American Institute of Accountants to form their own association, the National Association of Cost Accountants (NACA), where they would reconsider their professional role in setting and revising accounting categories (Johnson & Kaplan, 1991, pp. 130–141).

For financial accountants, including interest as a cost in balance sheets and income statements was a fundamental mistake of classification. Interest, they argued, was an ''anticipated profit.'' To include it as a cost on a financial statement would be to inflate assets or profits and misrepresent corporate accounts to interested clients. Having spent the previous decade valuing assets for corporate mergers, financial accountants aspired to professional autonomy in a world of self-interested clients. From this perspective, including interest as a cost undermined the probity of accounts and the fragile legitimacy of this immature profession.

Cost accountants, by contrast, classified interest as a cost, because it provided critical information for management. How could manufacturers decide whether to make or buy a component or calculate a profitable mix of

products without including the cost of capital? Cost accounting's purpose was to enable comparisons. But no significant comparisons between "different establishments, different periods within the same establishment, or between different methods" were possible if the cost of capital investment was neglected, complained William Cole (1913). Trained primarily in the factory, cost accountants saw themselves more as "management engineers" than simply accountants, and eventually invented the profession of business consulting in the United States. From their point of view, how firms classified costs revealed indispensable stories about how to improve products and production.

The failures of scientific management also led cost accountants to reconsider their role in the formation and use of accounting classifications. Followers of Frederick Taylor, many cost accountants initially saw their trade as a vital means to realizing optimal efficiency through discipline and control. But experience taught them that early efforts to implement scientific cost systems failed. As NACA President, J.P. Jordan, recounted, "along came a beautiful breed of efficiency engineers, of which I happened to be one myself." We designed theoretically elegant methods and attempted to "ramrod" them down our clients' "throats." The results were disastrous. The "best" cost systems languished on shelves – too complex, impractical, and costly to put into practice (US Chamber of Commerce, 1924a, pp. 51–57).

Cost accountants drew a central lesson from these failures about the use and making of cost categories, namely, that categories were no more than conventions, which were best formed through a bottom-up process of collective deliberation with practitioners. As the NACA's second vice president, Eric Camman (1932), put it, the category of "standard costs" had two meanings in accounting: "ideals" and "yardsticks." The former were "objects of attainment," set centrally by autonomous accountants working for management or associations. As such, they were used as targets against which to monitor and discipline performance. Ideals necessitated confidence in the objectivity of measurement, the authority of measurers, and the probity of accounts. Otherwise, the exercise of authority would appear capricious.

In the second meaning – yardsticks – "standard costs" were conventions, whose effectiveness depended upon agreement among practitioners. Uniformity of classification provided practitioners with a common language to make comparisons of their own performance over time or to compare performance across diverse circumstances. A yardstick, Camman (1932, pp. 34–35) wrote, was simply "a unit of measurement, … a common denominator, … a basis for analysis." It serves as a "point of departure, a place to start from." "It does not make so much difference at what level you

establish [yardsticks] because you are only using them as a base'' from which to ''compare successive changes'' within the firm or how well firms are doing relative to others. Yardsticks, he added, should be revised by deliberative forums when producers no longer thought they were effective means of comparison. It was necessary to repeatedly ''bring together'' practitioners to ''talk with one another'' (US Chamber of Commerce, 1924a, pp. 56–57).

Thus, for cost accountants, creating cognitive infrastructures for a reformed competitive capitalism meant crafting not only new classification schemes or ways of using them. It also meant revising the practices by which categories were produced and revised. We turn now to the ways in which manufacturers and associations embraced and elaborated these new classification schemes and practices.

PART II – "A COMPASS ON A SHIP" FOR UPGRADING COMPETITION: NEW CATEGORIES AND CATEGORICAL PRACTICES IN US MANUFACTURING

In the early 20th century, discontents joined forces to institutionalize a program for using cost accounting to channel competition from volume and cut-throat pricing into innovation and continual improvement. This movement reached its first milestone in 1909, when printers, their association, and accountants organized the American Printers' Cost Commission. It gathered steam in the 1910s when industry associations and the National Association of Cost Accountants (NACA) promoted cost systems; when printers and allied trades like ink, printing machinery, photoengraving, paper, envelopes, boxes, and lithography engaged in a large-scale organizing drive; and when the box, label, corrugated and fiber shipping container industries formed a joint cost committee. In 1916, the movement gained a new ally: the FTC launched a cost accounting department, which worked with practitioners to publish and review cost systems, and began discussions with NACA and the US Chamber of Commerce on how to improve cost accounting. And it reached a zenith in a series of national meetings of associations, cost accountants, and manufacturers, sponsored by the Chamber between 1920 and 1924.

By 1925, 246 associations in 95 industries, or roughly 30% of US manufacturing industries expressed interest in these cost systems, at least participating in discussions and monitoring developments in the new

categorical schemes (Berk & Schneiberg, 2005). Seventy-four associations in 46 industries (over 13% of manufacturing industries) institutionalized cost systems in some form; 34 associations in 21 industries (or over 6% of industries) implemented fully developed systems that included all key elements.

The cost system, which grew out of this movement, rejected the strictly disciplinary *uses* of categories for an experimentalist approach, which fostered perturbation, discovery, innovation, and improvement in products and processes. It also rejected professionally monopolized, top-down strategies of *making, implementing*, *and revising* categories in favor of practices that confounded sharp distinctions between open and settled classifications. Categories within classification schemes were designed to be flexible, so that practitioners could customize, elaborate, and modify them for use in diverse circumstances and in response to constantly changing problems. And the process of defining and revising classifications was designed to be deliberative, provisional, and ongoing, making it possible to constantly incorporate new learning. Four features defined this experimental program, which comprised a cognitive infrastructure for competition based on learning, innovation, and improvement: deliberation and a common cost lexicon, provisional and flexible cost and product categorization, benchmarking, and revision.

Deliberation, Common Language, and the Cost Committee

The first feature of the system involved exercises designed to induce surprise, reflection, and discussion among firms regarding their ignorance or confusion about costs. Associations invented experiments to mobilize firms by perturbing taken-for-granted assumptions. They exploited surprise to engage participants in deliberation over a common cost lexicon. And they institutionalized those discussions in deliberative cost committees to elaborate new categories. At each step, associations built on their members' "natural curiosity" for comparison, self-reflection, and learning, turning away from their earlier efforts to discipline collective action, or to simply create a new system and leave it at that.

Association executives used several strategies to prod manufacturers to reflect on categories by which they measured costs. Many devised cost experiments, in which they asked manufacturers to estimate the cost of a standard commodity. Drug manufacturer J.H. Joy explained how the huge

variation on some products (as much as 250%) ''created great consternation'' among manufacturers. ''They could not believe it.''

> In that way we stimulated interest to the point where a committee was appointed to look into this thing and to study why it was so, and why the industry was so far behind the other industr[ies] that had adopted … standard cost accounting system[s]. The result of the interest that was awakened at that time was the appointment of a Cost Accounting Committee. (US Chamber of Commerce, 1924a, pp. 84–87)

In malleable castings, where a cost experiment revealed a 57% difference in per pound costs on a standard commodity, ''everyone knew that actual differences in production could account for only a small part of the range in estimates.'' It revealed not only diversity in method, but also that many casters were simply ''guessing at their costs.'' Widespread surprise convinced many ''manufacturers who were skeptical of the need of and benefits from uniform cost accounting methods'' and mobilized many to join the association's cost committee (US Chamber of Commerce, 1923, pp. 4–5).

Surprise over the vast differences in cost estimates sparked inquiry and debate over *real* cost differences between firms. The more stove manufacturers learned about accounting differences, noted S.V. Dunkel of the industry association, the more they asked ''well, am I [truly] high or low in my manufacturing cost, or in my commercial expenses?'' And these questions were merely the ''forerunner[s]'' of more detailed inquiries into comparative ''direct labor'' costs, ''manufacturing burden,'' and ''major divisions of commercial expenses'' (US Chamber of Commerce, 1923, p. 16).

Other industries utilized cost questionnaires to disconcert manufacturers and spark interest in a common language. The International Association of Milk Dealers administered a questionnaire asking members to define common terms in the industry. To members' surprise, they found they ''were not speaking in a uniform tongue'' and realized quickly the need for a common lexicon. R.E. Little reported that this ''helped … greatly to create'' interest in cost accounting and ''enthusiasm'' for a committee to create a ''uniform cost system'' (Little, 1923, pp. 3–4).

Still others drew upon a core of interested members to form a temporary cost committee and craft a preliminary cost system, which was distributed to the broader membership for discussion. The American Foundrymen's Association formed a Committee to deliberate over cost categories. Given the diversity of individual experiences, the committee opted for a ''simple system,'' which could be ''adapted to the particular needs of its members,'' put it into practice, and then improve it with experience (US Chamber of Commerce, 1923, p. 6). The Knitted Outerwear Manufacturer's Association developed a federation of local cost councils – a ''Cost Soviet'' – which drew

upon the "accountants and bookkeepers" and "executives" of member firms. Local councils mobilized members, schooled them in deliberation, formed preliminary cost schemes, and served as "advisers" to a national cost committee. "We want [our members] excited," reported W. Lutz, the chairman of the Cost Accounting Committee. "We want them to talk and come forward and tell us what they want." "By getting the whole crew together," members "feel that they are helping a good thing along, … taking part in" the development of "new accounting methods," and a broader deliberative effort to "unify cost accounting systems" (US Chamber of Commerce, 1923, pp. 11–13). The National Tent and Awning Association likewise formed a preliminary committee, which aroused great interest with its rudimentary system. "Over 200 signed up in the first year. [Everyone] want[ed] to know more." On the basis of the curiosity aroused, the association assembled interested firms "to talk" and form a broader cost committee (US Chamber of Commerce, 1924b, pp. 29–34).

Thus, unlike the making of disciplinary classification schemes, which were devised by autonomous professionals who applied general principles to diverse circumstances, associations and accountants in this new system utilized experimentation, surprise, and reflection to mobilize manufacturers into a deliberative process of category making. They built new classifications from the bottom up, launching a program in which firms became active participants in both customizing categories for individual purposes and collectively revising classification schemes on an ongoing basis. Through this process, associations and their members began to redesign cognitive infrastructures in a broad swath of markets.

Flexible and Provisional Categories

Deliberation and cost committees produced new classifications for manufacturers to categorize, reflect upon, and then rethink their costs, product lines, and production processes. These systems were designed to support three categorical practices within firms: departmentalization, overhead distribution, and product costing.

Departmentalization involved creating classification schemes that divided production into "cost centers" or "departments" where costs were incurred. The construction of department categories was meant to be flexible, depending upon what a manufacturer wanted to learn, rather than an objective classification of production. At the heart of the printer's system, for example, was a monthly worksheet called "Form 9-H" (see Fig. 1). Like a spreadsheet, the columns on Form 9-H broke the production process

Standard Cost Finding System Form 9 H-S

NAME OF FIRM _____ **SUMMARY OF DEPARTM**

LINE NO.	Totals	ITEMS	1 General Administrative	2 Selling	3 General Factory	4 Stock Storage & Handling	5 Packing, Shipping & Delivery	6 General Commercial
1	2622500	INVESTED CAPITAL	Fx. 1,500.00	200.00		FF. 300.00	Fx. 150.00	
2	3407500	Assets	5,350.00			H. 2,500.00	Tank 850.00	
3		POWER BASIS						
4		FIXED EXPENSES:						
5	240000	Rent and Heat	2462	615		4923	923	
6	28000	Insurance	146	19		273	98	
7	4000	Taxes	209	28		390	134	
8	27417	Depreciation	1250	167		250	1896	
9	169724	Interest on Invested Capital	3311	100		1400	500	
10		CURRENT EXPENSES:						
11	1707125	Wages			8450	2975	1500	
12	8172	Light	66	26		66	26	
13	32480	Power						
14	8950	Spoilage (Reserve) and Allowances			8950			
15	156446	Dept. Direct Supplies and Expense				450	1400	
16		Stock Storage and Handling						
17	36880	Packing, Shipping and Delivery					3680	
18		Machine Metal Waste						
19								
20								
21		GENERAL ADMINISTRATIVE EXPENSES:						
22	485500	Salaries	485500					
23	24000	General Expense	24000					
24	116990	Office Expense	116990					
25	52260	Bad Debts (Reserve)	52260					
26								
27		SELLING EXPENSES:						
28	347550	Salaries and Commissions		347550				
29	78550	General and Traveling		78550				
30	115000	Advertising		115000				
31								
32	4001144	TOTAL DEPT. DIRECT EXPENSES	752894	550055	174400	10727	10162	
33		DIVISION OF GENERAL ADMINISTRATIVE (To Cols. 2-3 & 6) 30 - 10 - 60 %		225588	75529			45177
34		DISTRIBUTION OF GENERAL FACTORY (To Cols. 4-5 & Factory Depts.)			249429	1059	1004	
35	2543772	FACTORY COSTS OF DEPTS.			(9.8749 %)			
36	45177	DISTRIBUTION GENERAL COMMERCIAL TO FACTORY DEPTS.						45177
37	2995549	TOTAL DEPT. COSTS						(17.76006%)
38		TYPEMAKING; ADD TO HAND COMP. DEDUCT FROM MACH. CASTING DEPTS.		A		B	C	
39	1005595	DIST. SELLING; STK-STRG., HDLG., PCK., SHIP. & DEL. (Tot. Cols. 2, 4, 5.)		776143		11786	11166	1005.95
40	4001144	TOTAL ALL INCLUSIVE COST						(33.58127%)
41		CHARGEABLE HOURS EACH DEPARTMENT						
42		WAGE COST PER CHARGEABLE HOUR						
43		FACTORY COST PER CHARGEABLE HOUR						
44		GENERAL COMMERCIAL COST PER CHARGEABLE HOUR						
45		COST PER CHARGEABLE HOUR (Exclusive Selling—Stock Storage and Handling—Packing, Shipping and Delivery)						
46		**ALL INCLUSIVE COST PER CHARGEABLE HOUR**						
47		12 MONTHS AVERAGE HOUR COST (Basis for Costing Rate)						
48		TOTAL POSSIBLE PRODUCTIVE HOURS BY DEPTS.						
49		PERCENTAGE PRODUCTIVE TIME BY DEPTS.						
50								
51		PRODUCTION:						
52		Total Ems, Sheets or Impressions for Month						
53		Running Hours						
54		Average Ems, Sheets or Impressions per Running Hour						
55		COST RECONCILIATION AND GROSS PROFIT (or Loss) FOR MONTH						
56	4001144	Total Cost of all Depts.						
57	56450	Add: Inventory Work in Process, First of this Month (Hours at Set-up Rate)						
58	4056594	Total						
59	47830	Less: Inventory Work in Process, Last of this Month (Hours at Set-up Rate)						
60	4009064	Total Mfg. Cost ALL Depts.						
61	2015000	Total Materials USED on Orders Completed During Month						
62	6105064	Total Cost of Goods Manfd. & Sold						
63	7693350	Total Sales (Net)						
64	1587786	GROSS PROFIT (OR LOSS) FOR MONTH						
65								
66								

Total used Cost of Individual Jobs summarized for month
Difference (Used and Actual Costs)
Total Net Difference (Used Costs more than actual costs Current Twelve Months)
Total Net Difference (Used Costs less than actual costs Current Twelve Months)

FOR PLANTS USING INTERLOCK ACCOUNTING SYSTEM.
A. SELLING——% OF TOTAL COST EXCLUSIVE OF MATERIAL USED, STOCK STORAGE AND HANDLING, AND PACKING, SHIPPING AND DELIVERY.
B. STOCK STORAGE AND HANDLING—CHARGE COST PER POUND MATERIALS USED OR % OF COST OF MATERIALS USED.
C. PACKING, SHIPPING AND DELIVERY—CHARGE AS COST PER POUND OF GOODS SHIPPED, PLUS FIXED CHARGE PER SHIPMENT.
NOTE: COL. 4 STOCK STORAGE AND HANDLING TO BE OMITTED BY TRADE COMPOSITION PLANTS.

Fig. 1. United Typothetae of America Form 9-H. *Source:* (Koch, 1928)

5,000—7-28-28—Printed in U. S. A.

ENT COSTS FOR MONTH ______ 19___

Hand Comp.	Platen Press Small H.F. #1-2	Platen Press Large H.F. #3	Platen Press Large M.F. #4	Cyl. Press Small H.F. #5	Cyl. Press Large M.F. #6	Cutter (Power)	Folder M.F. #7	Bindery "C" (3)	Bindery "D"		LINE NO.
Fx. 5400.00	900.00	825.00	1,600.00	2,800.00	3,200.00	2,100.00	1,500.00	1,100.00	200.00		1
Ty. 3,600.00											2
											3
											4
6154	554	246	1231	1538	2154	677	431	554	1538		5
877	88	80	156	273	312	205	146	107	20		6
1253	125	115	223	390	446	292	209	153	28		7
12000	750	687	1333	2333	2667	1750	1250	917	167		8
4500	450	413	800	1400	1600	1050	750	550	100		9
											10
75000	19500	3750	5600	11500	7400	3750	7350	11500	12450		11
276	52	26	26	39	39	26	39	39	66		12
	248	191	337	816	690	633	260	65			13
											14
3592	350	1680	3290	1781	1175	250	1375	150	153		15
											16
											17
											18
											19
											20
											21
											22
											23
											24
											25
											26
											27
											28
											29
											30
											31
103652	22117	7188	12996	20070	16483	8633	11810	14035	14522		32
											33
10238	2184	710	1284	1982	1628	853	1167	1386	1434		34
113890	24301	7898	14280	22052	18111	9486	12977	15421	15956		35
20227	4316	1403	2536	3917	3216	1685	2305	2739	2833		36
134117	28617	9301	16816	25969	21327	11171	15282	18160	18789		37
											38
45039	9610	3124	5647	8722	7162	3751	5132	6098	6310		39
179156	38227	12425	22463	34691	28489	14922	20414	24258	25099		40
467	187	62	118	84	46	52	78	127	228		41
1.61	1.04	.60	.47	1.37	1.61	.72	.94	.91	.55		42
2.44	1.30	1.27	1.21	2.62	3.94	1.82	1.66	1.21	.70		43
.43	.23	.23	.21	.47	.70	.32	.30	.22	.12		44
2.87	1.53	1.50	1.42	3.09	4.64	2.14	1.96	1.43	.82		45
3.84	2.04	2.00	1.90	4.13	6.19	2.87	2.62	1.91	1.10		46
											47
679	400	200	200	200	200	200	200	600	232		48
69%	47%	31%	59%	42%	23%	26%	39%	21%	98%		49
											50
											51
	135,908	35,579	77,439	76,849	39,270						52
	122.	47.	83.	67.	34.						53
	1,114	757	933	1,147	1,155						54
											55
179156	38227	12425	22463	34691	28489	14922	20414	24258	25099		56
35000	1050	150	5200	- - - -	11500	1250	- - - -	450	1850		57
214156	39277	12575	27663	34691	39989	16172	20414	24708	26949		58
17500	4250	1600	- - - -	11500	6200	800	400	- - - -	5280		59
196656	35027	10975	27663	23191	33789	15372	20014	24708	21669		60
											61
											62
157500	37500	13000	27500	17500	40680	15900	21800	10980	26000		63
(39156)	2473	2025	(163)	(5691)	6891	528	1786	(13728)	4331		64
											65
											66

into departments, such as composition, typesetting, and presswork. Rows classified costs incurred in each department, from rent and wages to overhead and administrative costs (Koch, 1928, pp. 31–33; United Typothetae Standard Cost Finding System, 1927, pp. 6–19, 24–25).

Form 9-H and departmentalization redesigned the cognitive interfaces through which firms oriented themselves toward their competitors, their own operations, and their past and future selves. They had two broad goals. The first was to ensure that manufacturers no longer simply assumed that volume reduced average costs by having manufacturers systematically record all their expenses. For the first time, firms would have tools to carefully track costs to their sources, where they might locate costly bottlenecks, inappropriate materials, unproductive machinery, or misplaced labor skills. With this information, manufacturers could discover new cost relations.

The second was to provide manufacturers with the flexibility to generate novel hypotheses, invent experiments, and track results by creating new production, product, and cost categories. Although Form 9-H included set categories for departments, these were not predetermined by the physical constraints of plant layout or machinery. It was flexible by design, empowering manufacturers to make and revise new categories at will. Indeed, much of Form 9-H left row and column titles blank, so that printers could devise or modify categories to their own ends. Notice how handwritten column titles "departmentalize" single machines ("platen press small" or "cylinder press large"), a group of machines ("bindery 'c'" or "bindery 'd'"), or a labor category ("hand composition"). Printers created new categories because they had unanswered questions, and they formed those questions because Form 9-H provided them with a classification scheme which made posing them possible. Questions might pertain to products, such as, what is the pressroom cost of two different classes of printing (law books and business cards)? They might pertain to a machine category, such as, is it cheaper to use a large or small platen press for certain sorts of jobs? Or they might refer to labor, such as, is it cheaper to pay an in-house compositor or subcontract to a specialist? Moreover, Form 9-H was a monthly worksheet, so printers could utilize custom production categories to track their performance over time in specific areas, such as, the cost of spoilage in small platen presses, or the cost of power used in electric folding machines.

As printer Henry Acton testified, departmentalization taught him to pay attention to details in production he had never thought to regard. He had long believed it was cheaper to deliver forms to the pressroom as needed.

But many came to press with mistakes and the cost of "waiting time" incurred for corrections turned out to be dearer than "having enough material to work with" on hand. In another example, he discovered a "loss of over $300 in one year on ink alone," by departmentalizing the cost of individual presses. Even small adjustments, he concluded, added up to the difference between profitable and unprofitable work (Acton, 1914, pp. 90–92).

"There is no guesswork," added a Tennessee printer. Departmentalization has "shown us the inefficiency of our plant, … the time lost on account of having to use some makeshift, [and] … if we are lacking equipment in any department." "We have been able to stop leaks by adding a little type, leads, rules, etc." Departmentalizing individual machines "has also shown us what equipment we do not need" (Ellick, 1912).

Departmentalization also let manufacturers learn how to distribute overhead costs to individual cost centers, rather than averaging them across the production process (and assuming they will decline with increased volume). As Grafton Whiting of the National Container Association explained, manufacturers overestimated fixed costs because they assumed that it was impossible to distribute overhead expenses to the departments in which they were incurred. Rent, heat, insurance, taxes, depreciation, and clerical and management salaries, they figured, were the same, regardless of what or how much was produced. But once manufacturers broke production down into departments, they could turn this assumption into a hypothesis. Printers learned to distribute overhead on Form 9-H by allocating the total costs in rows to the departments where they were incurred. Costs of "Rent and Heating," "Depreciation," and "Taxes" could be distributed to the "Hand Composition," "Platen Press Small," or "Bindery C" departments.

Departmentalization even let manufacturers distribute overhead costs when it was not obvious in precisely which department they were incurred. Manufacturers could calculate the percentage of total annual costs incurred by each department and then allocate untraceable overhead costs according to the department's share in total costs. Either way – by tracking actual costs or through estimation – departmentalization made it possible to track overhead costs, compare them across departments, and compare a firm's performance in minimizing overhead costs over time. With that information, it was possible to turn fixed into variable costs and subject taken-for-granted assumptions to evaluation and experimentation (Whiting, 1924, pp. 10–12).

For example, container firms who distributed overhead costs carefully were able to alter their product and job mixes, allowing their "competitors to take … undesirable orders and suffer losses while they choose the profitable [jobs] for themselves" (Whiting, 1924, p. 12). Similarly, printers who paid attention to distributing overhead costs learned to pose novel questions about production. As one printer put it, when he learned that a large department in his plant was "not capable of bearing its just share of overhead burden distributed on the basis of departmental cost," he searched for the reasons. "The fault," he hypothesized, "may be in the department, poor management, too much nonproductive time, or … with the proprietor and his selling force; the product of the department may be sold for too little money." None of these conjectures were possible without the capacity to distribute overhead costs to departments, which rested on classifications like Form 9-H (Meyer, 1910, pp. 133–37).

"Product costing" was another categorical practice intended to shift management from volume to ongoing reflection, experimentation, and learning. Here, firms traced costs for each individual job or product back to the departments within which they were incurred. As Part I demonstrated, many manufacturers realized that they chased volume because they simply assumed it was cost effective to cross-subsidize jobs, or take work at or below cost during the slow season ("fillers") in order to amortize debt and keep workers busy. By contrast, new classification schemes tutored manufacturers to track the costs of every order back to the departments where they were incurred. For example, the United Typothetae of America's (UTA) "Individual Order Summary" showed printers how to track for each order or job the hourly and total costs of labor and machines, broken down by the categories in Form 9-H, as well as the cost of materials, handling, and packing and shipping (Koch, 1928, pp. 84–89). Such schemes let firms distinguish profitable from unprofitable work, and make more informed decisions about where they had market advantages, or whether volume was profitable.

Like departmentalization, product costing was flexible. Firms could classify and reclassify products, and develop new categories, as they introduced new products or devised novel questions. As one printer put it, this allowed him for the first time to "find out which branch of our business paid us the most money. With that end in view … , we … analyzed our sales and costs; that is, we … divided into eight different divisions our total sales": law books, express printing, job printing, and so on. "At the end of each month our financial statement shows us the total sales of each division, together with the total cost thereof. Each class of printing,

therefore, stands for itself and it can be easily determined which is the most advantageous to the company's interests'' (''A Few Things the Cost System Has Done for the JB Lyon Co,'' 1910).

Benchmarking

Benchmarking was the third key feature of the system. Once associations established uniform cost categories, they asked individual members to submit their classified cost data to a central organization, which calculated detailed averages, and distribute them back to the manufacturers. These benchmarks were composed of classification schemes, like the printers' Form 9-H. But instead of individual cost data, the cells included industry averages, providing firms with a basis for comparing their operations with those of other firms. Benchmarking, in effect, provided firms with cognitive interfaces for orienting themselves in wholly new ways not just to their past and future performance, but also to their competitors and the industry more generally. And, like departmentalization, benchmarking was designed to perturb individual habits and spark reflection, experimentation, and learning; it was not to discipline a firm's behavior through mimesis of industry best practices.

Benchmarking emerged from association efforts to mobilize members' ''natural curiosity'' for comparison. As we saw in Part I, once manufacturers were assembled in a deliberative forum, they inevitably asked ''how do I compare? Are my costs higher or lower than my competitors?'' And once those questions were broached, everyone agreed that it was necessary to speak a ''common language.'' Manufacturers learned it was impossible to broach discussion over competitive practices, or compare production costs, without ''a uniform tongue'' (US Chamber of Commerce, 1923, p. 4). Building upon member desires for useful comparisons, a wide range of associations launched benchmarking schemes (Berk & Schneiberg, 2005).

Many associations benchmarked modestly and early. The photoengravers began with a ''batting average,'' which ranked concerns ''in order of [operating] efficiency'' (US Chamber of Commerce, 1924a, p. 24). Other associations compared aggregate manufacturing and commercial expenses. Once started, benchmarking became more frequent and complex. Here, too, the printers were pioneers (Berk, 2009, pp. 197–199). In 1915, the UTA published its first *Composite Statement*, a compilation of industry cost averages broken down by department, based on data in Form 9-H.

By consulting the *Statement* and comparing it to monthly entries in their own completed Form 9-H, printers could learn how they compared on wages in machine composition, on rental costs in the bindery, or a host of other categories. The *Statement* also provided average costs for various standard products, so that individual printers could compare their job or product costs to industry standards and assess their comparative market advantages. In this way, benchmarks altered the competitive relations between firms.

Other industries followed. Photoengravers published monthly reports, showing "average cost per hour in different departments, average costs of the different kinds of products, and average costs of different kinds of operations" (US Chamber of Commerce, 1924a, p. 24). The Newsprint Service Bureau began benchmarking in 1920. By 1927, 34 associations in 21 industries were collecting cost data from members and publishing regular reports of industry averages (Berk & Schneiberg, 2005, p. 68).

Benchmarking data was used to disconcert. By fostering perturbation through comparison, benchmarks served as interfaces between firms, their competitors, and their past and future selves, making experimentation, innovation, and evaluation possible. Benchmarking, noted G.A. Ware of the Newsprint Service Bureau, "stirs up inquiry, … stirs up curiosity" (US Chamber of Commerce, 1924a, pp. 166–72). And when "you work against figures and facts that other people have developed, finding out what the best performance in the industry is and use that as your standard to compete against, it gives you something to shoot at and is bound to have a tremendous effect on your own operations," added cost accountant and National Envelope Association secretary, Charles Stevenson (1923). Or, as a prominent Detroit printer put it,

> You may have the finest set of … production records in existence. You may be maintaining, day in and day out, the average of your plant, but are you sure that the average of your plant is equal to the average of your city or the average of the country as a whole? There is only one way for you to determine this, and that is by comparison of your averages with averages obtained from other sources. … By compiling average records you have the means by which the efficiency of your plant may be brought before your eyes. (Chantrey, 1926, p. 115)

Mabel Dwyer, the secretary of the Typothetae Cost Accountants Association, added "knowing … if your statement is below average this knowledge acts as an incentive for you to try to improve it" (Dwyer, 1930, p. 100).

J. Lee Nicholson, the first president of the National Association of Cost Accountants, joined the chorus in support of trade association benchmarking:

> If a manufacturer cannot make money in competition with other concerns when using the same methods of figuring costs, he can only conclude that his goods or his marketing, or both of them, are costing him too much. His next step, naturally, is to analyze closely the methods and conditions under which he is manufacturing and marketing his product, until he finds and corrects the inefficiencies which are handicapping him so seriously. (US Federal Trade Commission, 1929, p. 12)

In fact, benchmarking often revealed counterintuitive findings. As printer George Voorhees (1925) testified, benchmarking revealed "ways of increasing production" by "seemingly illogical means." Consulting the UTA's *Standard Guide*, he learned that "greater production on [some] hand-operated machines can be obtained by running the machines slower. It would be hard to believe this as a fact," he concluded, "without the use of average production records." Others testified likewise to useful findings. Some learned that their firms were comparatively top-heavy with costly administrators: comparison allowed one Detroit printer to ask whether he had "too many executives for the volume of business he [was] doing, [and what] part of the salary they [were] drawing [was] really profit?" (Dwyer, 1930, pp. 100–3). Manufacturers learned that machinery layout in their plant resulted in above average heating and lighting costs; that ill-considered mixes of production materials or skilled and unskilled labor left them below industry benchmarks; and that claims by machine vendors to cost reduction were often vastly inflated. In short, benchmarking refocused management from their earlier efforts to maximize volume to incremental improvements in productivity, products, marketing, and administration. And it did so by perturbing habits born of looking only inward to processes within the firm.

Revision and the Loose-Leaf Binder

Producing and modifying classification schemes and categories did not end with the formation of standard cost systems. Although associations settled on classification schemes for departments, product costs, and the like, they were not rigidly codified in a rulebook, to be implemented by specialists trained in those principles. Collective deliberation, experimentation, and revision of accounting schemes were not transitional practices. They became routine. Adjustment, trial and error, and the elaboration and modification of categories went beyond individual adaptation of forms to include collective

processes of revising classification on an ongoing basis. In fact, many associations made their cost committees permanent and hired staff accountants to work with member firms and communicate their experiences to those committees. The committees, in turn, compiled and evaluated those experiences and revised cost systems with new learning. In official recognition of this learning process, a number of associations published their cost systems in a loose-leaf binder, where they could be easily revised, instead of in a hardbound rulebook.

Communication between individual member plants and trade association cost committees was critical to the process of reflection, discussion, and revision. Some cost committees sent consulting accountants into plants to observe existing cost systems during the design process. Staff accountants for the Rubber Association of America "walked into plants, view[ed] their systems, and carr[ied] away whatever we could" in the way of transferable principles, cost categories, and experiences. For other associations, installation provided opportunities for revision. The Newsprint Service Bureau hired a professional accountant not only to help individual manufacturers install its standard cost system, but to visit plants regularly and report his findings back to the association's cost council (US Chamber of Commerce, 1924a, pp. 16–18, 129–30).

The Printers' Ink Cost Bureau went even further. Instead of waiting until it completed its cost manual, the Bureau published a tentative system and encouraged its members to experiment. Vice president George J. Warmbold reported that "during installation many important points have come to light [that] make further revision necessary." But rather than concluding that it was only a matter of time before installation and use became routine, Warmbold learned that an effective system must be "elastic so as to provide for continual revision." Ink manufacturers

> decided the manual should be a loose leaf device because we realized that the manual will never be complete, nor the last word in methods. That this is so has been brought home to us for after having submitted this tentative manual to the members of our Bureau and soliciting their criticism and suggestions we received such a volume of criticism and suggestions that we have found it necessary to make many changes and we are now in the process of revamping this tentative manual. If it was not for the fact that we originally made it a loose-leaf device we would have been in trouble. (US Chamber of Commerce, 1924b, pp. 5–11)

The loose-leaf binder contrasts sharply with the more common professional accounting documents of the era, which were devised for discipline and control – the textbook and the professional association rule manual. While the

latter were routinely revised, they were done so through a far more cumbersome process of professional peer review and associational rulemaking (Miller & O'Leary, 1987). In contrast, the loose-leaf binder reflects a provisional, deliberative, and experimental approach to categories. The Tanner's Council produced a cost manual "made in loose-leaf form with brass staples, with the idea that in the future … when a change is made to have merely a leaf or two leaves reprinted, sent out and inserted in place of the old ones" (US Chamber of Commerce, 1924a, pp. 113–14). Container makers also placed their cost system in a loose-leaf binder (Hankins & Whiting, 1925). Our "manual is constantly growing," noted T.J. Bolitho of the International Milk Dealers' Association. Because "it is [so] tentative" we publish it in a loose-leaf binder, and "necessarily at the end of a few years, we may not recognize this old manual" at all (US Chamber of Commerce, 1924a, p. 20).

As G.A. Ware of the Newsprint Service Bureau told his colleagues in the ATAE, "no individual concern has a monopoly … of the best procedure to follow." The "best ideas" are worked out when members "pool their experience" and there is no "limit" set on "progress in improved accounting." On the "contrary," the existing system "sets a standard which provides an incentive toward which all mills can work." And as they discover new methods, they contribute to improvement in the industry system (US Chamber of Commerce, 1924b, 166–172). Indeed, the Manufacturing Division of the US Chamber of Commerce acknowledged the provisional nature of association classifications and the importance of learning in and across industries when it agreed to serve as a "clearing house for the best ideas in uniform cost accounting" (US Chamber of Commerce, 1923, p. 27).

Thus, practices of *using* cost systems for experimentation, innovation, and learning, instead of discipline, were closely linked with practices of *making and revising* classification and categories that broke down the sharp distinctions between emerging and established systems. Associations put cost systems into practice early in order to adjust their design to new learning. They engaged constant communication between accountants and practitioners about what worked. And they placed their cost systems in loose-leaf binders instead of textbooks, so lessons learned from practice could be readily incorporated into new categories and classifications.

Taken together, the four elements of experimentalist cost accounting radically reconfigured the interfaces through which firms cognized and related to their competitors, their vendors, and customers, and their past, present, and futures selves. They served, in effect, as a cognitive infrastructure for escaping the volume illusion and fostering new forms of competition based on innovation and improvement. As FTC Chairman Hurley and others put it,

new methods of classifying production, products, and costs would reform competition: firms who knew their product costs were unlikely to set prices below them and if everyone tracked overhead, product, and department costs carefully, scrambling for volume, accepting vendors' claims, and cut-throat pricing should disappear. In fact, cost accounting taught these manufacturers that over-valuing volume led only to poaching one another's business, and that tracking product costs, diversifying and innovating went a long way toward resolving cut-throat pricing.

But others in this movement to revise categorical practices in the service of upgrading competition went even further to couple benchmarking, product costs, and revision with the practice of pricing off of running averages, or "normal costs." For Charles Stevenson, such practices might raise prices in the short run. Yet they will subsequently reduce prices as firms used new classification schemes for improvement and cost reduction, subjecting themselves and peers to new forms of competition.

> [I]f an average industry price were established, certain companies would make more than normal profit and certain companies would make less… . In a desire to make more than normal profit, constant efforts to increase the efficiency of the industry would be made. Individual initiative would be preserved, and fair industry price would be gradually reduced so that the public would be able to buy more of the products or secure them at a lower price… Inefficient companies would be gradually forced out of business or compelled to modernize and improve their own efficiency, which, in turn would further reduce the industry price level. (NACA Yearbook, 1934, pp. 63–64)

Here, too, new categorical practices like product costing, benchmarking, and revision would be a cognitive infrastructure or "compass on a ship" for navigating – and promoting – a new competition.

CONCLUSION: BEYOND CATEGORICAL IMPERATIVES

Organizational scholars and institutionalists have made impressive strides in understanding how categories and classification schemes do substantial work in ordering and stabilizing markets. As sensemaking and orienting devices, categories represent "cognitive infrastructures" or "interfaces" between producers, consumers, critics, firms, and audiences that stabilize and even make possible markets, valuation, and exchange. Yet in tying the sensemaking and orienting functions of categories so closely to their disciplinary functions, and with "two stage" or punctuated equilibrium models of institutional development, existing work narrowly conceptualizes

the role of categories and classification and professional mediators in markets and fields. ''Once in place,'' categories and classification schemes serve as foundations for limiting attention; for conformity, simplification, reduction, and uniformity in markets; for producing and maintaining status hierarchies; and for critics, raters, and professional specialists to establish privileged and autonomous roles as gatekeepers of recognition, endorsement, and style. And ''once categories are in place,'' debates, deliberation, and struggles with novelty – all the work of category revision, experimentation, and redefinition – more or less cease, receding into the background as the exception rather than the rule.

This chapter aims to perturb and expand existing conceptions of categories as cognitive infrastructures for markets via a case study of a movement to reform market competition through new cost accounting systems in American manufacturing. We showed how disillusionment with mass production and its disciplinary use of categories prompted broad and successful efforts by manufacturers, associations, and cost accountants to reconstruct cost accounting categories, mobilizing them instead as cognitive infrastructures for learning, diversity, and innovation in markets.

Our analysis of these classification schemes and practices contributes to the existing organizational and institutional literature on categories in three related ways. First, in studying accounting, we move beyond the consumer–critic–producer interface and classification schemes for firms and products to consider other, equally important, kinds of classifications, thickening existing imageries of the market's cognitive infrastructures and identifying new interfaces for classification. As with more commonly studied schemes, the accounting classifications and categories examined here served as interfaces by which producers understood, located themselves within, and oriented themselves toward their competitors, trading partners, and the market more generally. But they were also interfaces by which firms and managers came to understand and orient themselves to their own employees and operations, their product mixes and performance profiles, and their past and future selves. They were cognitive interfaces for reflexivity, whose analysis suggests possibilities for understanding categories and their uses that emerge less clearly from previous analyses of classification at the consumer–critic–consumer interface.

Second, our analysis identifies qualitatively new functions of categories in markets. As they harnessed cost accounting for innovation and improvement, manufacturers and their associations shifted the emphasis in category using and making from discipline to learning, generating both new and more refined classification schemes and new methods for using and making

categories. Categories in this program were not imperative, taken-for-granted mechanisms for limiting attention and achieving conformity, uniformity, and control. Rather, they were designed and used to perturb taken-for-granted relations, help producers pose new questions about products and production, and foster experimentation, discovery, and diversity in the service of continual improvement in products and processes. Equally important, categories and classification schemes were provisional conventions. They were produced through association and reflective deliberation, and revised on a routine, rather than exceptional, basis as conditions changed, new discoveries and questions emerged, and new competitive strategies altered productivity, cost, and technology within industries. Few, if any, of these relations and practices figure centrally in categorization and classification in the existing literature. Few fit easily with analytical perspectives that sharply divide settled systems and the normal operation of classification from processes of revaluation, modification, and revision.

Third, our analysis identifies new roles for professional specialists in market mediation. As new forms of cost accounting shifted the emphasis in categories from discipline to learning, they reconfigured the relations between professionals and clients. Cost accountants in this world were no longer category gatekeepers or autonomous professionals in the usual sense. In fact, rather than seeking to monopolize classification as a basis for a privileged position in markets, cost accountants embedded themselves within firms and associations, collaborating with producers as consultants and association secretaries to institutionalize ongoing, bottom-up processes of deliberation, category production, and revision. In these roles, cost accountants worked more as category midwives than gatekeepers. Furthermore, while fully documenting this role awaits future research, cost accountants supported these strategies organizationally by decentralizing and opening up their own professional associations to clients, using them as clearinghouses for lateral communication and collaborative problem solving across firms and industries. Here, too, our work expands existing organizational conceptions of categories and classification practices in markets, shedding some new light on the possible roles of critics or professions as category mediators. Here, too, we provide observations for beginning to decouple the organizational literature's insights about categories and cognitive infrastructures from conceptions of institutions and institutionalization as settled orders, convergence, and punctuated equilibria.

At the same time, our findings bring the organizational literature's considerable insights about the cognitive infrastructures to bear on the centrality of innovation, learning, and improvement in capitalist economies.

There is a rich and growing literature on alternatives to mass production, ranging from the work on industrial districts and flexible specialization to research on networks, new economy sectors, and the role of experimentation and learning in capitalism more generally (Herrigel, 2007; Powell et al., 1996; Sabel & Zeitlin, 2004; Whitford, 2005; Scranton, 2000). While that literature attends carefully to the institutional conditions for alternatives and questions of institutional design, it has left the cognitive side relatively unexplored. In contrast, organizational research on categories has pursued the cognitive or cultural turn in remarkably fruitful ways. And in extending that to an analysis of learning by categories, we identify some important cognitive foundations not just for new economy sectors and alternatives to mass production, but also, we suspect, for creative destruction, innovation, and improvement more broadly.

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