UNITED STATES DEPARTMENT OF COMMERCE

E-Stats

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Manufacturing 1999 and mid-2000

This *E-Stats* Analytic Report highlights a comparison of 1999 online purchases and e-commerce shipments at manufacturing plants in the U.S. and presents the first available data on the mid-2000 use of e-business processes in those plants. This report expands the e-commerce information the U.S. Census Bureau released on March 7, 2001.

Note to reader

In June 2000, the Manufacturing and Construction Division of the U.S. Census Bureau mailed a Computer Network Use Supplement (CNUS) to all plants in the 1999 Annual Survey of Manufactures (ASM) sample. Responses were received throughout the remainder of the year and the final response rate was approximately 82 percent. The results presented here are based on data provided from the more than 38,000 manufacturing plants that responded by mail, via the Internet, or from telephone follow-up.

Estimates representing the entire manufacturing population for the e-shipments and e-purchases variables were derived using established statistical methods. These data are included in Tables 1A and 2A. However, reliable population estimates for the remaining variables in the survey could not be produced with the information available. Therefore, all tabulations and discussion of the e-business processes in this study are solely based on the observed data from respondents. No adjustment has been made for non-respondents to the CNUS. All tables numbered 3 and higher contain data only for the survey respondents.

The ASM uses a probability-proportionate-to-size sample design which results in a sample primarily comprised of larger manufacturing plants. While a number of small plants are included in the ASM, the number is disproportionately small in comparison to the entire manufacturing population. Consequently, statements about "all responding manufacturing plants" are likely to be more representative of the larger plants in manufacturing than of the entire manufacturing population. A comparison of estimates for the manufacturing population and the corresponding tabulated respondent data is shown in the appendix.

U.S. Census Bureau data show that online purchases accounted for 11 percent ($231 billion) of all cost of materials at manufacturing plants in 1999. The March release showed that 12 percent of all manufacturing shipments ($485 billion) were accounted for by orders accepted online. Online purchases (e-purchases) like e-commerce shipments (e-shipments) were present in all manufacturing subsectors (Tables 1A and 2A).

In the March report, Census noted that 1999 e-shipments were concentrated in five of the 21 manufacturing subsectors. E-purchases were even more concentrated. Two subsectors accounted for more than half of all e-purchases in manufacturing in 1999. Transportation Equipment was the largest, accounting for almost half of total manufacturing e-purchases ($112 billion) in 1999. Computer and Electronic Products accounted for another 10 percent ($23 billion).

E-purchases occurred in every manufacturing subsector although e-purchases accounted for more than 10 percent of total cost of materials in only four subsectors. Transportation Equipment was again the largest with e-purchases accounting for over one-fourth of all cost of materials. E-purchases were also substantial in the Machinery (12 percent), Computer and Electronic Products (12 percent), and Electrical Equipment (10 percent) subsectors.

Manufacturing plants that responded to the Census' supplemental survey were highly "wired" in mid-2000. Almost 90 percent of the responding plants reported a computer network in place (Table 3B). While over 80 percent of responding plants had Internet access at the plant (Table 6B), there were opportunities for further integration of e-business processes. Almost half of the plants that accepted orders online did not

place orders online. The next section discusses the presence of computer networks at the plants followed by discussion of the e-business processes enabled by those networks. It will be clear that studies focusing exclusively on e-shipments and e-purchases exclude a large part of manufacturing plants' use of e-business processes.

Use of Computer Networks by Survey Respondents

Eighty-seven percent of reporting manufacturing plants had a computer network in place in mid-2000 (Table 3B). "Computer network" includes both open networks such as the Internet, and proprietary networks running systems such as Electronic Data Interchange (EDI). Sixty-six percent of reporting plants had more than one network in use. Only 1 percent of plants reported no network in use - other respondents reported "don't know," skipped the item, or reported inconsistently. These responses are not "adjusted" to represent all manufacturing plants.

Network use was common in all subsectors. The highest percentage of manufacturing plants reporting network use was 96 percent in the Computer and Electronic Products subsector while the lowest was 74 percent in the Petroleum and Coal Products subsector. In seven of the remaining 19 subsectors, over 90 percent of plants reported networks in use.

Responding manufacturing plants that reported e-shipments or e-purchases were asked what was their primary network for making each type of transaction. Plants using the Internet as their primary network for accepting online orders accounted for only 5 percent of e-shipments at responding plants, while the plants primarily using EDI networks accounted for two-thirds of e-shipments (Table 4B). Plants using the Internet as their primary network for making online purchases accounted for 14 percent of e-purchases at responding plants, while plants primarily using EDI networks accounted for 65 percent (Table 5B).

While EDI networks continued to dominate e-shipments and e-purchases transactions at responding manufacturing plants, there is great interest in the uses of the Internet. The next section focuses on Internet usage.

Internet usage -

Eighty-four percent of responding manufacturing plants had Internet access available at the plant (Table 6B). Plants of multi-plant companies were more likely to report Internet access (88 percent of plants of multi-plant companies versus 76 percent of single-plant companies), and the percentage of plants reporting Internet access was generally higher among plants with more employees (Table 7B).

Internet access was most common among survey respondents in the Computer and Electronic Products (95 percent), and Electrical Equipment, Appliances and Components (93 percent) subsectors. More than 80 percent of manufacturing plants reported Internet access available in 15 of the 21 manufacturing subsectors (Table 6B).

By location, the percentage of plants reporting Internet access at the plant ranged from a high of 90 percent in Minnesota to a low of 60 percent in Delaware (Table 8). The percentage of plants reporting access available was over 80 percent in all but 11 states. However it is very important, especially at the state level, to understand that these data are not adjusted for nonresponse to this survey. Hence, some states figures include only a few respondents (e.g. 10 plants responded in Delaware).

Networks and Jobs -

Another perspective on computer network use is the number of jobs affected by such

networks. Manufacturing plants that reported a computer network (open or proprietary) in place accounted for 96 percent of the employment of reporting plants. Plants that reported more than one network in use accounted for 85 percent of employment. Plants that specifically reported no network in use accounted for less than 1 percent of employment at reporting plants. Plants reporting network use accounted for more than 90 percent of employment at reporting plants in all but one subsector - in Wood Products where 88 percent of employment was accounted for (Table 3B).

Focusing again on Internet use - Internet access was not usually available to all employees at a plant. Of plants reporting that Internet access was available, 69 percent indicated that 1-25 percent of their employees had Internet access (Table 6C). Another 16 percent of plants with Internet access said that 26-50 percent of their employees had access, 4 percent reported that 51-75 percent had access, and 11 percent reported that most employees at the plant (over 75 percent) had access to the Internet. In the Computer and Electronic Products subsector, over one-third of plants with Internet access said that most employees had Internet access.

Among manufacturing plants that reported Internet access, the extent of employee Internet access varied by plant size. The highest percentages of plants reporting that most employees (over 75 percent) had Internet access occurred in the two smallest and the two largest employment-size classes (Table 7C). Among the smallest plants, 36 percent of plants with 1 to 4 employees, and 23 percent of plants with 5 to 9 employees, reported that most employees had Internet access. The next most widely available access was among the largest plants, 17 percent of plants with 1,000 to 2,499 employees and 28 percent of plants with 2,500 employees or more reported Internet access available to most employees. Among plants in the other size classes, the percent of plants reporting that most employees had Internet access ranged from 8 to 13.

Use of Selected E-business Processes

In addition to information on the network (open or proprietary) used and Internet availability to employees, the survey collected information on the use of e-business processes. For this report, several processes that appear closely related to online commercial activity are highlighted. In the next section, e-shipments activity is compared to accepting online payments and providing online customer support. Then in the final section, online purchases are compared to online payments, and online bidding. In each case, there is substantial opportunity for increased integration of e-business processes in the responding plants.

The definitions of e-commerce and e-business processes used here are those put forth in earlier Census Bureau reports. E-commerce is the value of goods and services sold over computer-mediated networks (open or proprietary). Online purchases are the cost of materials purchased over computer-mediated networks. E-business processes include any process that a business organization conducts over computer-mediated networks. Computer-mediated networks are electronically linked devices that communicate interactively over networks. More detailed discussions of these definitions and the Census Bureau's approach to measuring the electronic economy are available through *www.census.gov/estats.*

E-shipments -

Seventeen percent of the shipments of reporting plants were accounted for by e-shipments (Table 9). The percentage of shipments accounted for by e-shipments was generally higher among larger reporting plants. While e-shipments made up a larger share of shipments among larger reporting

plants, these shipments were present among plants in all size classes.

Thirty-one percent of reporting manufacturing plants accepted orders online but only 11 percent accepted online payments (Table 10B). In some cases, online orders could have been accepted with payments processed through a headquarters location. Still, 27 percent of plants that reported accepting online payments didn't accept online orders (Table 10D). Finally, while only 11 percent of plants reported accepting online payments in mid-2000, another 21 percent reported that they planned to accept such payments by December 2002. Even if these plans materialize, there is considerable opportunity for further integration of online order- and payment-acceptance.

Another area with potential for increased integration in respondents' e-business processes was the linking of online customer support and accepting orders online. Nineteen percent of reporting plants provided online customer support (Table 11B) and, as noted above, 31 percent of reporting plants accepted online orders. Plants may have accepted online orders but relied on a different location to provide customer support, however, more than 40 percent of plants reporting that they provided online customer support didn't accept online orders (Table 11D). While only 19 percent of reporting plants provided online customer support in mid-2000, another 28 percent planned to provide such support by December 2002 (Table 11C). Again, even if these plans materialize, there is opportunity for further integration of e-business processes.

E-purchases -

Sixteen percent of the cost of materials at responding plants was accounted for by e-purchases (Table 12). The percentage of cost of materials accounted for by e-purchases was higher among larger reporting plants. Among responding plants with 2,500 or more employees, e-purchases accounted for 33 percent of cost of materials.

As with shipments, there is opportunity for further integration of making online purchases (e-purchases) and making online payments. About 34 percent of reporting manufacturing plants purchased online in mid-2000 while only 9 percent reported that they made online payments (Table 13B). Another 19 percent planned to make online payments by December 2002. While security concerns might lead plants to purchase online but not make payments online, 29 percent of those who made online payments didn't purchase online (Table 13D).

While some may associate online purchasing with online bidding, our data indicate that these are quite different activities. Thirty-four percent of reporting manufacturing plants purchased online, but only 7 percent engaged in online bidding (Table 14B). Only 13 percent of those who made purchases online also engaged in online bidding (Table 14C).

Summing Up

It's clear that focusing exclusively on e-shipments or e-purchases excludes much of manufacturing plants' online activity. Among survey respondents, the use of computer networks and e-business processes are far more prevalent than either e-shipments or e-purchases. The percentages of plants reporting various e-business processes are shown in Table A below.

Eighty-seven percent of manufacturing plants responding to the survey reported the presence of one or more computer networks at the plant; yet, only 31 percent of these plants reported that they accepted orders online and only 34 percent reported that they made online purchases. What did the remaining plants do with their networks?

Table A. Number and percent of plants

	Count plants reporting	Percent of all responding plants
Network at the plant	34,024	87.3
E-business processes:		
Shipments oriented processes		
Accept orders online	12,069	31.0
Receive online payments	4,307	11.1
Provide online support	7,474	19.2
Purchases oriented processes		
Place orders online	13,233	33.9
Make online payments	3,358	8.6
Engage in online bidding	2,756	7.1

We have seen some of the e-business processes that accounted for the presence of computer networks in manufacturing plants that didn't report e-shipments or e-purchases. Some plants that didn't accept online orders did accept online payments. Similarly, some plants that reported no online orders provided online customer support. And, there were plants that didn't make purchases online but did make online payments and/or did engage in online bidding.

There is considerable opportunity for further integration of e-business processes and for growth of e-shipments and e-purchases. Table B below shows the relationship between e-shipments and e-purchases at manufacturing plants reporting to the survey. Only 16 percent of reporting plants (6,063 plants) made both e-shipments and e-purchases, while 49 percent (19,203 plants) made neither.

Table B. Number of plants

	Status of e-shipments			
Status of e-purchases	All plants	Make e-shipments	Do not make e-shipments	Unknown
All plants	38,985	12,069	26,462	454
Make e-purchases	13,233	6,063	7,061	109
Do not make e-purchases	25,237	5,901	19,203	133
Unknown	515	105	198	212

Looking Forward -

Information on other e-business processes was collected on the survey. A quick review of the responses has revealed that the most often-reported e-business process was e-mail. Over three-fourths of reporting plants used e-mail to communicate with vendors and customers in mid-2000, while 70 percent used e-mail communication within the plant (Tables 15 and 16). Another 6 percent of plants reported they planned to use e-mail to communicate with vendors and/or customers by December 2002. Future reports will detail survey results for additional processes.

Explanatory Notes

The estimates in this release for e-commerce shipments and online purchases, and the tabulations of survey respondent e-business processes are based on data collected on the 1999 Annual Survey of Manufactures (ASM) Computer Network Use Supplement (CNUS). A copy of the survey form is attached. The estimates of e-commerce shipments and online purchases represent the values for all manufacturing plants in the U.S. in 1999. The statements about computer network use and e-business processes are as of mid-2000. The estimates of employment at responding plants were constructed from a combination of 1999 and mid-2000 information.

The ASM is designed to produce estimates for the manufacturing sector of the economy. The manufacturing universe is approximately 360,000 plants. Data are collected annually from a probability sample of approximately 50,000 of the 240,000 manufacturing plants with five or more employees. Data for the remaining 120,000 plants with fewer than five employees are imputed using information obtained from administrative sources.

The 1999 ASM CNUS was mailed in June 2000 to all plants in the 1999 ASM sample. This supplement collected information about manufacturers' e-commerce activities and use of e-business processes. The questionnaire

asked if the plant offered online ordering and the percentage of total shipments that were ordered online. Information on online purchases was also asked. In addition, information was collected about the plant's current and planned use of selected e-business processes and the extent to which the plant shared information online with vendors, customers, and other plants within the company.

Approximately 82 percent of the manufacturing plants responded to this supplement. A stratified random sample of approximately 150 nonrespondents was selected. These plants were contacted by telephone to determine if they accepted online orders and to obtain the percentage of total shipments ordered online. The amount of online purchases for these 150 plants were then estimated based on respondents with similar online shipments behavior. The information collected from this sample was weighted to represent the entire group of nonrespondents.

Estimates of e-commerce shipments and online purchases for North American Industry Classification System (NAICS) subsectors were calculated from the respondents to the supplement by summing their online data weighted by the inverse of the probability of the plant's inclusion in the ASM sample. Estimates from the supplement and the nonresponse sample were summed to represent the entire ASM sample. These estimates were then linked to the 1997 Economic Census results to reduce sampling and nonsampling error.

Reliability of Estimates -

The estimates of e-commerce shipments and online purchases at all manufacturing plants presented in this release are based on a sample survey and are subject to sampling and nonsampling errors. Sampling error occurs because only a subset of the entire population is measured. Nonsampling error encompasses all other factors that contribute to the total error of a sample survey estimate and may also occur in censuses. The tabulations of data from respondents presented in this release are also subject to nonsampling error.

Tables 1B and 2B show sampling errors for estimates of percentages and coefficients of variation for estimates of level. The standard error measures the extent to which estimates derived from all possible samples drawn using the same design differ from the average of these estimates. The coefficient of variation (expressed as a percentage) is the standard error of the estimate divided by the estimate. Note that sampling errors and coefficients of variation are estimates derived from the sample and are also subject to sampling error.

The coefficients of variation presented in the tables may be used to compute confidence intervals about the sample estimates. The particular sample used for each survey included in this report is one of a large number of samples of the same size that could have been selected using the same design. In about 9 out of 10 (90 percent) of these possible samples, the estimates would differ from the results of a complete enumeration by less than 1.645 times the percentage shown.

To compute a 90-percent confidence interval for an estimate of level, multiply the estimate by its coefficient of variation and then by 1.645. This amount is then added to and subtracted from the estimate to give the upper and lower bounds of the interval. As an example, the estimated total value of shipments from Textile Mills (Table 1A, NAICS code 313) is $54,854 million and the estimated coefficient of variation for this estimate is 1.2 percent (0.012). Multiplying $54,854 million by 0.012 and then by 1.645 gives $1,083 million. Subtracting $1,083 million from and adding $1,083 million to $54,854 million gives a 90-percent confidence interval of $53,771 million to $55,937 million. Confidence statements for estimated

percentages are computed in a similar manner.

One source of nonsampling error is the inability to obtain information about all cases in the sample. Eighty-two percent of potential respondents reported in the survey. The appendix table shows the share of the estimated population composed of these respondents. This is discussed below.

Other sources of nonsampling error include response errors, definition difficulties, differences in the interpretation of questions, mistakes in recording or coding the data obtained, and other errors of collection, response, coverage, and estimation of missing data. Although no direct measures of these sources of nonsampling error have been obtained, precautionary steps were taken in all phases of the collection, processing, and tabulation of the data in an effort to minimize their influence.

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