



COVID-19 BUSINESS IMPACT SURVEY WAVE 9

March 7, 2021

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EXECUTIVE SUMMARY

DEMOGRAPHICS

- The geographic location of respondents' organizations are statistically similar to all previous waves.
- During the last four waves of this survey, the percentage of firms with 25 or Fewer FTEs has steadily dropped from 50% in Wave 6 to 42% in Wave 9.
 - As a result, the median number of FTEs has steadily increased throughout this survey. In Wave 9 the median is 35 compared to 31 in Wave 8, 29 in Wave 7, 26 in Wave 6, 25 in Waves 5 and 4, 26.5 in Wave 3 and 23 in the first two waves.
 - The largest organization in Wave 9 has 9,000 FTEs. This figure has fluctuated between 11,000 and 7,500 throughout the series.

ECONOMIC SENTIMENT

- Although the majority of firms (67%) still feel the condition of the US Economy is worse compared to March 1, 2020, sentiment continues to improve. In addition, more firms continue to report their finances and cash flow are better than pre-Pandemic and better than in Wave 8 (September).
 - Firms with 25 or fewer FTEs are more likely than other firms to say their cash flow is worse today (39%) and this percentage has grown since the last survey (35%).
- One sign that the recovery is uneven among firms is that roughly 30% continue to say their firm's finances are "worse" than before the Pandemic.
- In a reversal from September 2020, optimism is beginning to grow that business will return to normal sooner rather than later.
 - More firms say business has already returned to normal (10%) than at any time in 2020. This is particularly true for firms with 25 FTEs or fewer (17%).
 - More firms expect business to return to normal within six months (31%) than at any time in 2020.
 - Another sign that the recovery is not hitting everyone evenly is that 40% of firms feel business will not return to normal for at least another year.

BUSINESS CONDITIONS

- More firms are reporting an increase in their backlog. Thirty-one percent of firms reported an increase in backlog in September 2020 (compared to six months prior). This figure has increased to 44% now. However, 30% of firms still say their backlog has decreased.
 - Firms with more than 500 FTE are more likely to say their backlog has *increased* (67%) compared to others.
- Since September 2020, the median backlog has increased from 6 months to 6.5 months. However, The backlog varies widely among firms. While 24% say they have less than 3 months of backlog, 50% have 7 months or more.
 - Backlogs have increased for some firm sizes, particularly those with 25 or fewer FTE and more than 500 FTE.
 - As in the previous survey, backlog increases as firm size increases.

BUSINESS CONDITIONS (CONT'D)

- Nearly half of firms have already implemented more stringent cyber security rules for off-site workers and another 20% plan to so do. Nearly two-thirds of firms have found/plan to find new ways of interacting remotely due to “Zoom Fatigue.” More than half of firms have/plan to diversify into new sectors.
 - The larger a firm is, the more likely it is to have implemented/plan to implement more stringent cyber security measures.
- Reflecting the uncertainty in the economy, between one-fifth and one-half of firms are “not sure” what will happen in each market over the next 12 months. Among those who could answer the questions, more firms plan to increase their market position in roads and bridges, energy and utilities, and water/wastewater compared to other areas.
 - In general, firms with more than 200 FTE are more likely to seek to increase their market position in any given market.
 - Substantial declines are expected in convention centers/sports facilities/cultural facilities, commercial real estate, airports and education.

PPP LOANS

- Nearly nine out of ten eligible firms (89%) applied and received approval for a First Round PPP Loan. This figure matches the results from Wave 7 (Late May 2020).
 - Firms with 25 or fewer FTEs are less likely than other firms to have received a PPP loan.
- A majority of firms have already applied for PPP loan forgiveness and most of the rest plan to.
 - Firms with 50 or fewer FTEs are more likely than other firms to have already applied for PPP Loan forgiveness. However, most firms of all sizes plan to apply if they haven't already.
- More than half of firms receiving a PPP Loan say the FAR Credits Clause will impact their overhead rate. A large 18% are not sure.
 - The FAR Credits Clause is much more likely to impact firms with more than 50 FTEs than smaller firms.
- Nearly all firms that plan to apply (27%) for a Second Draw PPP Loan have already done so (25%).
 - Firms with 25 or fewer FTEs are much more likely to apply for a Second Draw PPP Loan than larger firms.

OFFICE BUILDINGS AND REMOTE WORKING

- The median number of office building locations for a firm is two and is unchanged from September 2020. However, the average has increased due to fewer small firms responding in Wave 9.
 - Median number of office building locations by firm size:
 - 0 to 25 FTE – 1
 - 26 to 50 FTE – 2
 - 51 to 200 FTE – 4
 - 201 to 500 FTE – 12
 - 501+ FTE – 34
- Overall, more firms plan to decrease the amount of office space they utilize than increase it. This is much more pronounced among larger firms.
 - Firms with more than 50 FTEs are much more likely than smaller firms to decrease their office space.
- A plurality of firms plan to curtail their remote work policies so that workers are in the office more often once social distancing restrictions are lifted.
 - As firm size increases, so too does the likelihood firms will expand remote work policies. For example, while 13% of firms with 25 FTEs or fewer plan to expand remote working policies, the figure rises to 65% for firms with more than 500 FTEs.

VACCINES

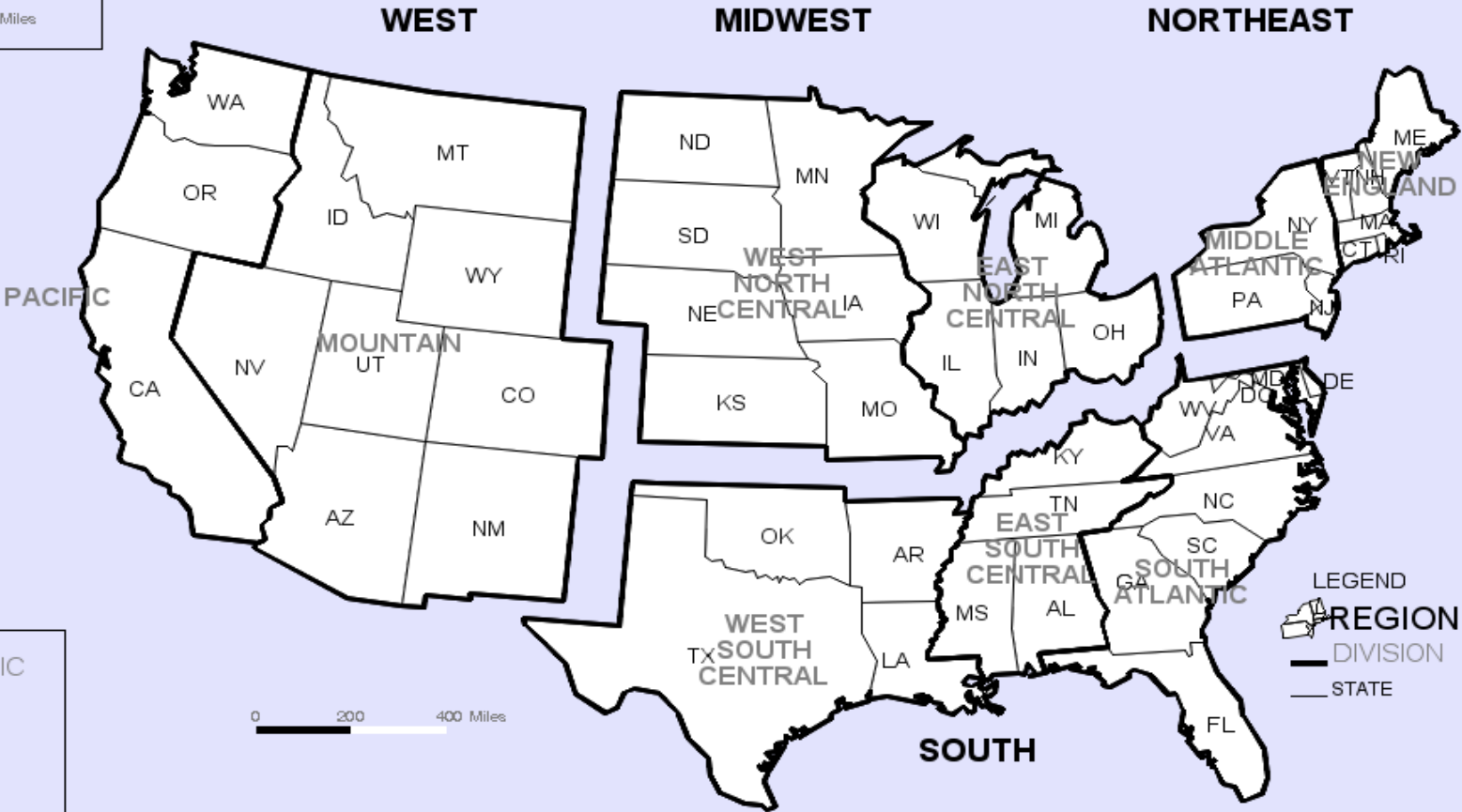
- A majority of firms will follow guidelines provided by the CDC and/or state/local authorities when it comes to vaccinations. About one-fourth will not require vaccinations.
- Although a majority of firms (58%) are at least somewhat concerned about being held liable for office workers getting sick, a large percentage (42%) are not.
 - As firm size increases, so too does the level of concern about being held liable for workers getting sick in the office. For example, while 54% of firms with 25 FTEs or fewer are concerned, the figure rises to 68% for firms with more than 200 FTEs.

LIKELIHOOD OF TRAVELING

- More than half of firms are likely to allow travel to events with 20 or fewer attendees within the next six months. This is a large improvement compared to a similar question asked in 2020.
 - Nearly half of firms are not likely to allow workers to attend large events with more than 100 attendees during the next six months, indicating that a return to normal may not occur until 2022.
 - Firms with more than 500 FTE are much less likely than other firms to allow travel to any size event in the next six months.
- Firms are much more likely to permit travel for client meetings compared to travel for events. Roughly nine out of ten firms plan to allow travel to client meetings in the next six months.
- Although a large percentage of firms feel it is important for event organizers to implement all safety measures tested, the most important are regular daily cleanings (90%), use of air filtration/purification systems (77%) and daily temperature checks (64%).

DEMOGRAPHICS

Census Regions and Divisions of the United States

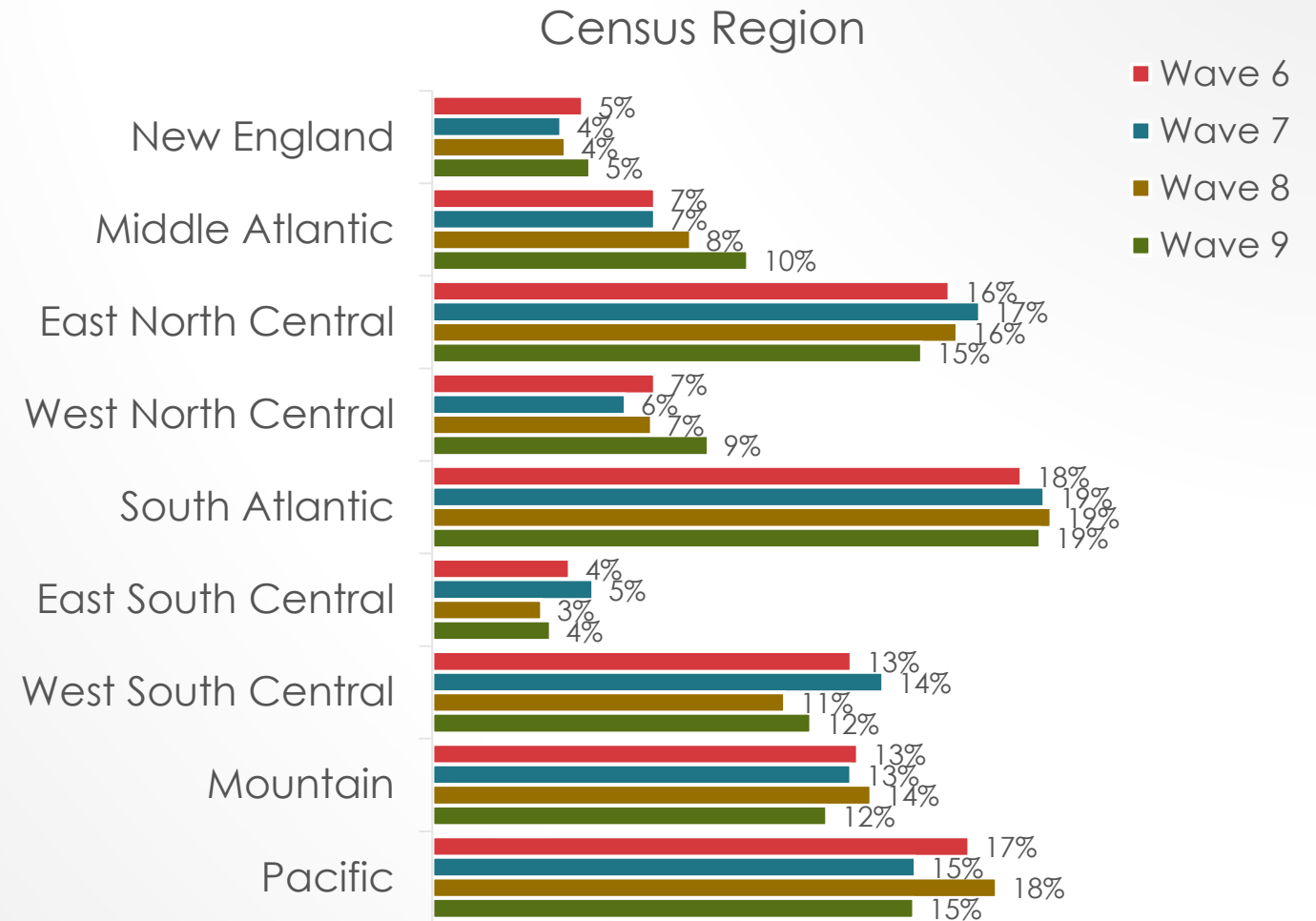


U.S. Department of Commerce Economics and Statistics Administration U.S. Census Bureau (Not) Prepared by the Geography Division

Imitation of http://www.census.gov/geo/www/us_regdiv.pdf

THE GEOGRAPHIC LOCATION OF RESPONDENTS' ORGANIZATIONS ARE STATISTICALLY SIMILAR IN ALL WAVES.

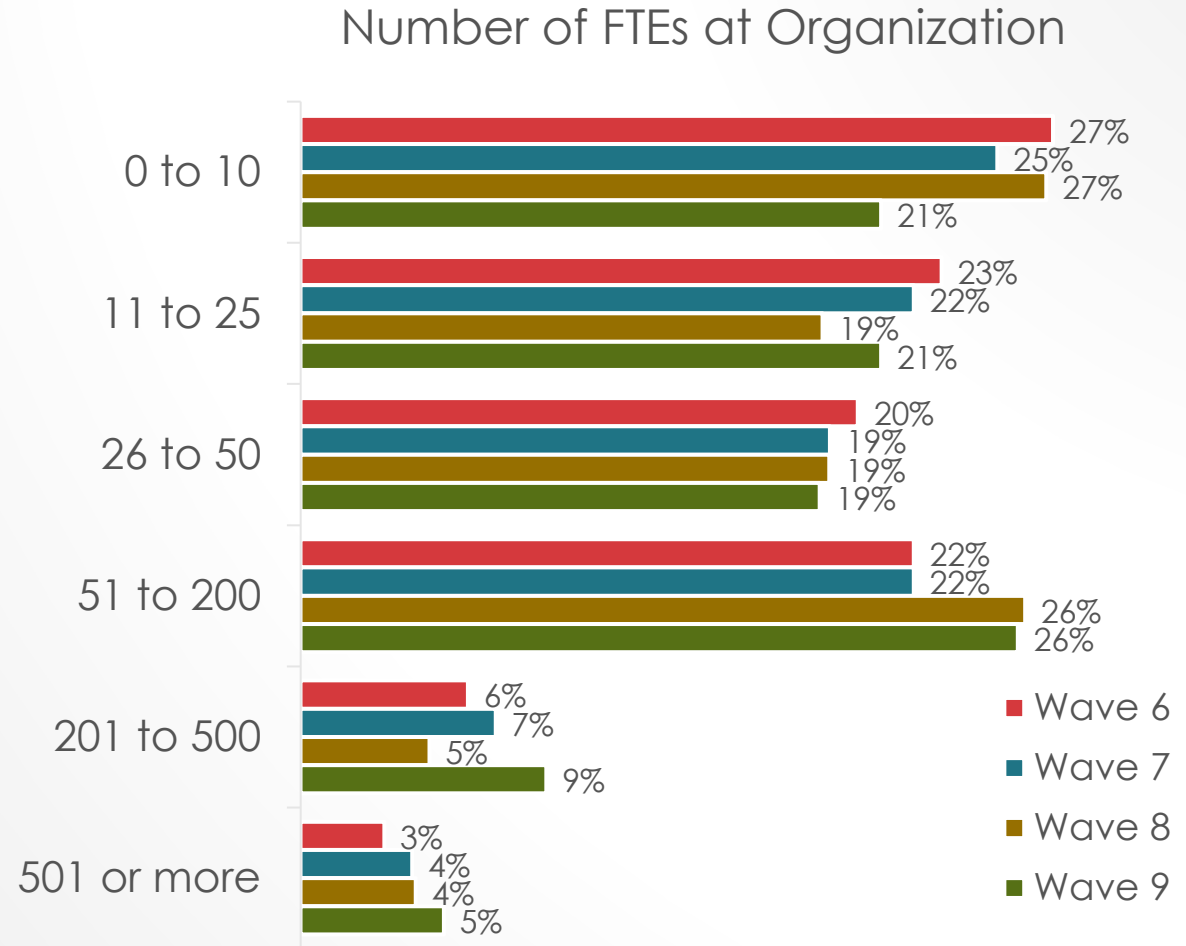
- Only the most recent four waves are shown in the graph.



Q2. In which state is your organization headquartered?
 Wave 6 n = 492, Wave 7 n = 538, Wave 8 n = 411, Wave 9 n = 408

DURING THE LAST FOUR WAVES OF THIS SURVEY, THE PERCENTAGE OF FIRMS WITH 25 OR FEWER FTES HAS STEADILY DROPPED FROM 50% IN WAVE 6 TO 42% IN WAVE 9.

- Only the most recent four waves are shown in the graph.
- The median number of FTEs has steadily increased throughout this survey. In Wave 9 the median is 35 compared to 31 in Wave 8, 29 in Wave 7, 26 in Wave 6, 25 in Waves 5 and 4, 26.5 in Wave 3 and 23 in the first two waves.
- The largest organization in Wave 9 has 9,000 FTEs. This figure has fluctuated between 11,000 and 7,500 throughout the series.
- Throughout this report all questions are reported by firm size and statistically significant differences are noted.

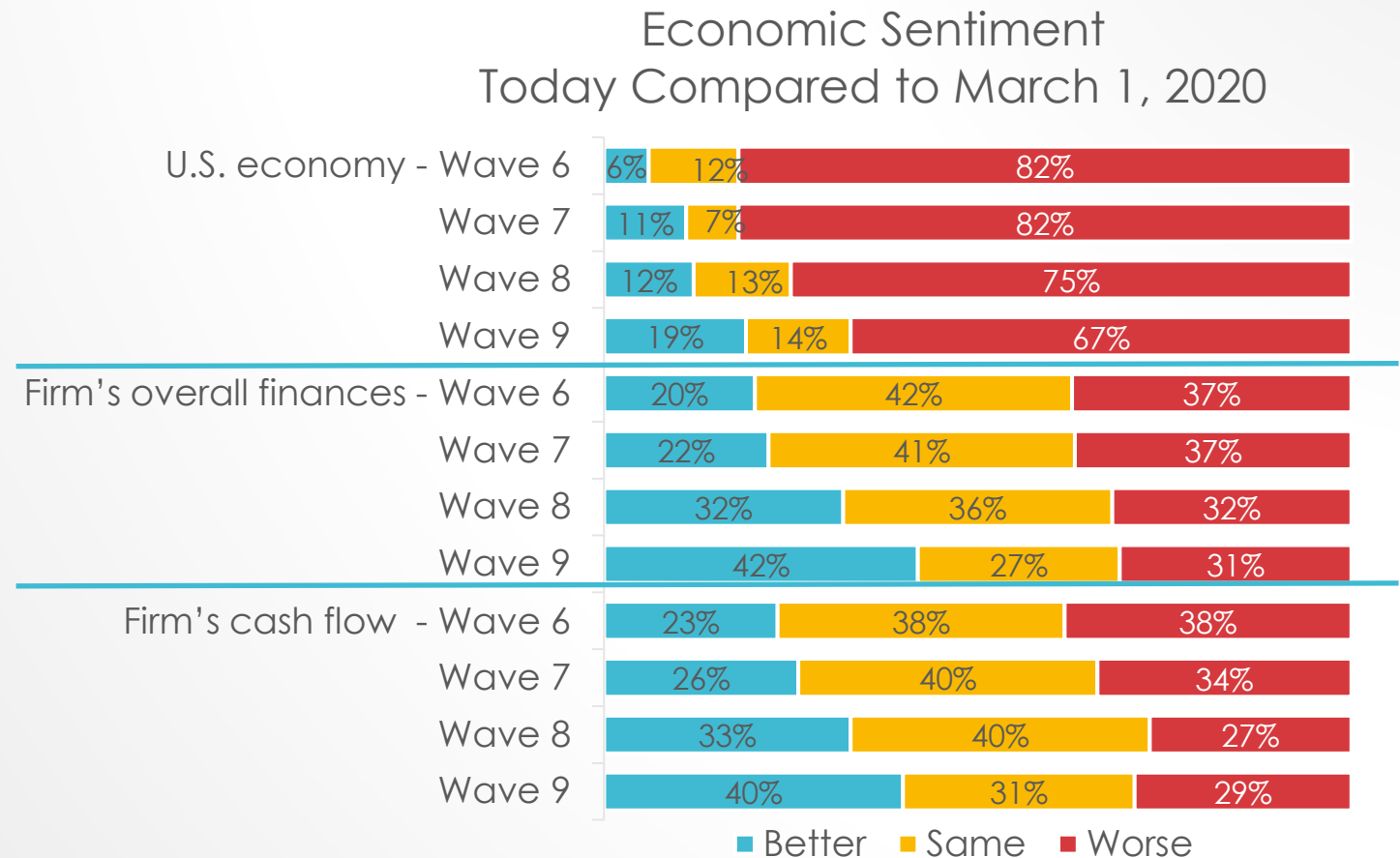


Q3. Including yourself, how many full-time equivalent employees (FTEs) do you have? If you are not sure, please provide your best estimate.
 Wave 6 n = 492, Wave 7 n = 538, Wave 8 n = 411, Wave 9 - n = 408

ECONOMIC SENTIMENT

ALTHOUGH THE MAJORITY OF FIRMS (67%) STILL FEEL THE CONDITION OF THE US ECONOMY IS WORSE COMPARED TO MARCH 1, 2020, SENTIMENT CONTINUES TO IMPROVE. IN ADDITION, MORE FIRMS CONTINUE TO REPORT THEIR FINANCES AND CASH FLOW ARE BETTER THAN PRE-PANDEMIC AND BETTER THAN IN WAVE 8 (SEPTEMBER).

- Only the most recent four waves are shown in the graph.
- One sign that the recovery is uneven among firms is that roughly 30% continue to say their firm's finances are "worse" than before the Pandemic.
- As has been the case in previous waves, there is one statistically significant difference by firm size:
 - Firms with 25 or fewer FTEs are more likely than other firms to say their cash flow is worse today (39%) and this percentage has grown since the last survey (35%).



Q4. Compared to March 1, how do you feel about each of the following today?

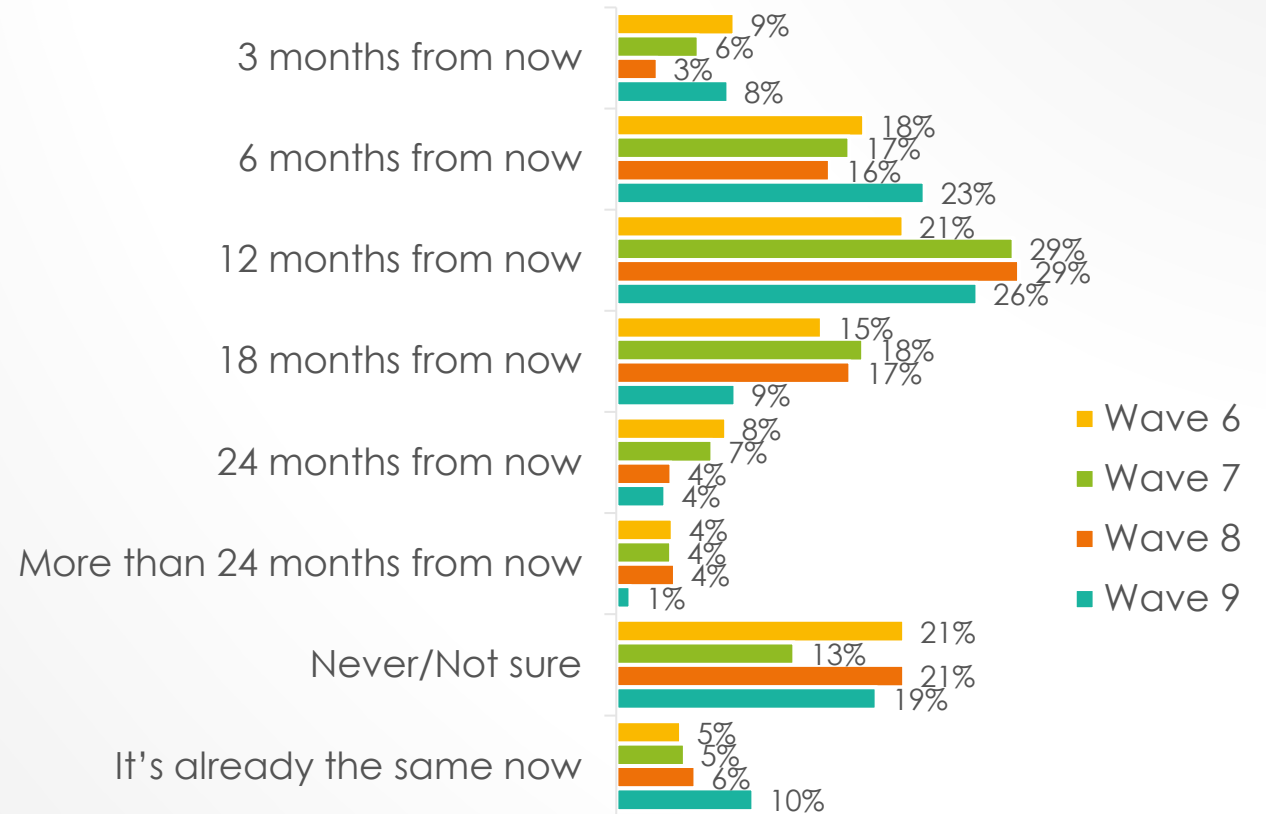
"Not sure" responses omitted from calculations

Wave 6 - n = 492 - 491, Wave 7 - n = 536 - 535, Wave 8 - n = 411 - 409, Wave 9 - n = 407 - 405

IN A REVERSAL FROM SEPTEMBER 2020, OPTIMISM IS BEGINNING TO GROW THAT BUSINESS WILL RETURN TO NORMAL SOONER RATHER THAN LATER.

- More firms say business has already returned to normal (10%) than at any time in 2020. This is particularly true for firms with 25 FTEs or fewer (17%).
- More firms expect business to return to normal within six months (31%) than at any time in 2020.
- Another sign that the recovery is not hitting everyone evenly is that 40% of firms feel business will not return to normal for at least another year.

Anticipation of Business Returning to Normal*



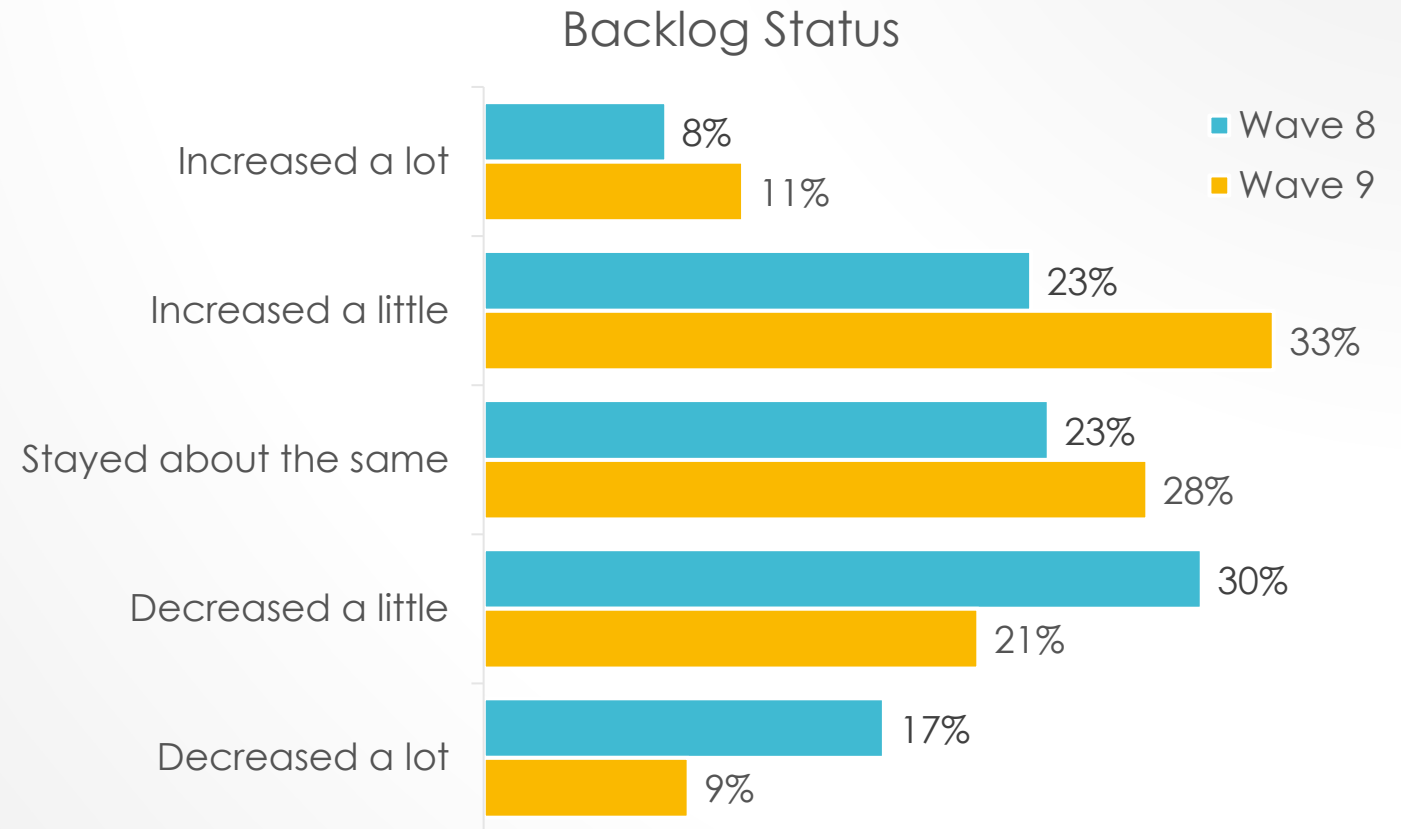
* Not asked prior to Wave 5

Q21. When do you anticipate your business will return to normal, meaning the way it was before the current pandemic?
Wave 6 - n = 485, Wave 7 - n = 530, Wave 8 - n = 398, Wave 9 - n = 391

BUSINESS CONDITIONS

MORE FIRMS ARE REPORTING AN INCREASE IN THEIR BACKLOG. THIRTY-ONE PERCENT OF FIRMS REPORTED AN INCREASE IN BACKLOG IN SEPTEMBER 2020 (COMPARED TO SIX MONTHS PRIOR). THIS FIGURE HAS INCREASED TO 44% NOW. HOWEVER, 30% OF FIRMS STILL SAY THEIR BACKLOG HAS DECREASED.

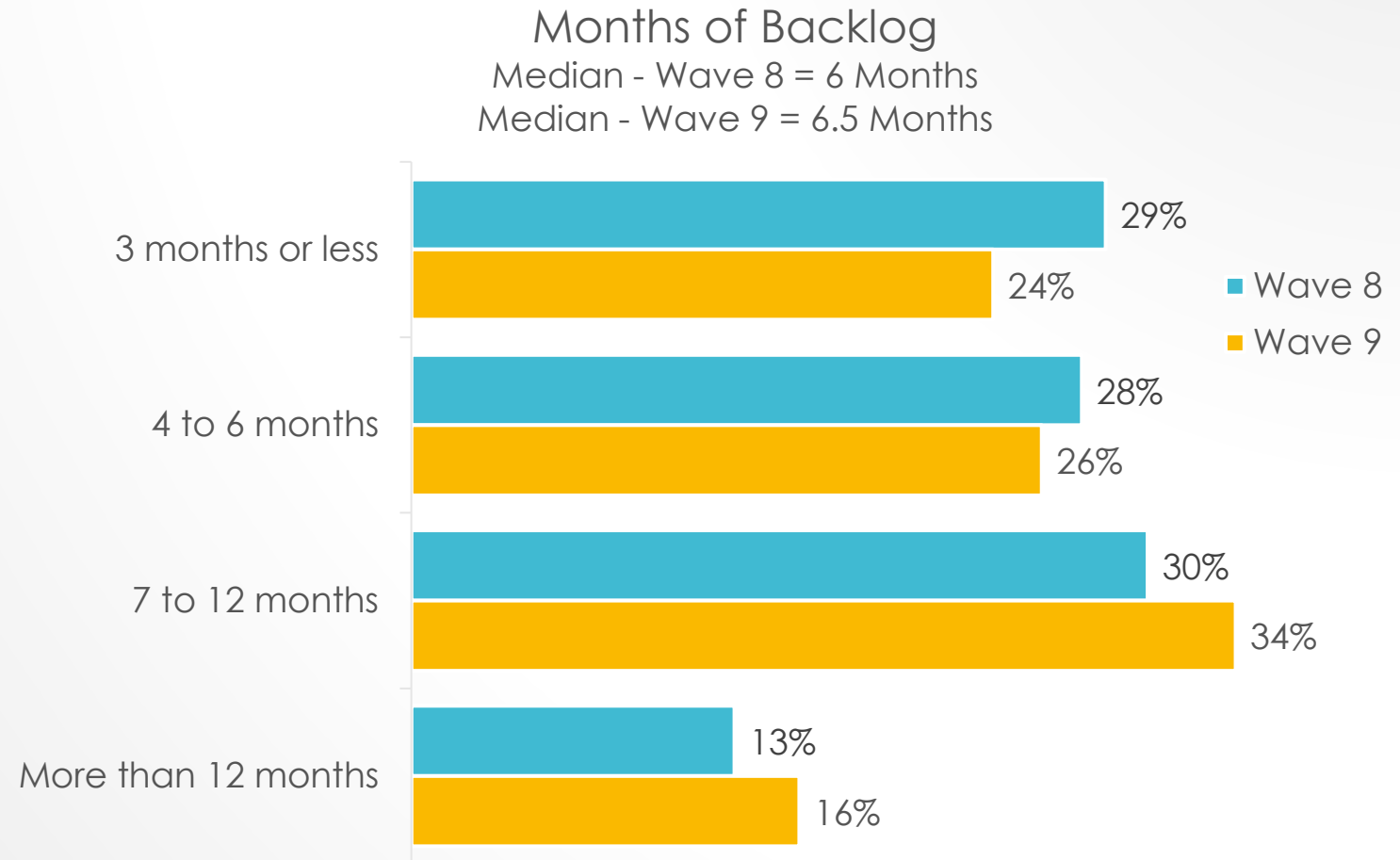
- Firms with more than 500 FTE are more likely to say their backlog has *increased* (67%) compared to others.



Q6. Compared to six months ago, has your backlog increased, decreased or stayed about the same?
Wave 8 - n = 410, Wave 9 - n = 400

SINCE SEPTEMBER 2020, THE MEDIAN BACKLOG HAS INCREASED FROM 6 MONTHS TO 6.5 MONTHS. HOWEVER, THE BACKLOG VARIES WIDELY AMONG FIRMS. WHILE 24% SAY THEY HAVE LESS THAN 3 MONTHS OF BACKLOG, 50% HAVE 7 MONTHS OR MORE.

- Backlogs have increased for some firm sizes, particularly those with 25 or fewer FTE and more than 500 FTE.
- As in the previous survey, backlog increases as firm size increases.
- The median backlog (in months) in Wave 8 vs. Wave 9 by firm size is:
 - 0 to 25 FTE – 3.5 vs. 5
 - 26 to 50 FTE – 8 vs 8
 - 51 to 200 FTE – 8 vs. 8.5
 - 201 to 500 FTE – 11 vs. 11
 - 501+ FTE – 10 vs. 11.5

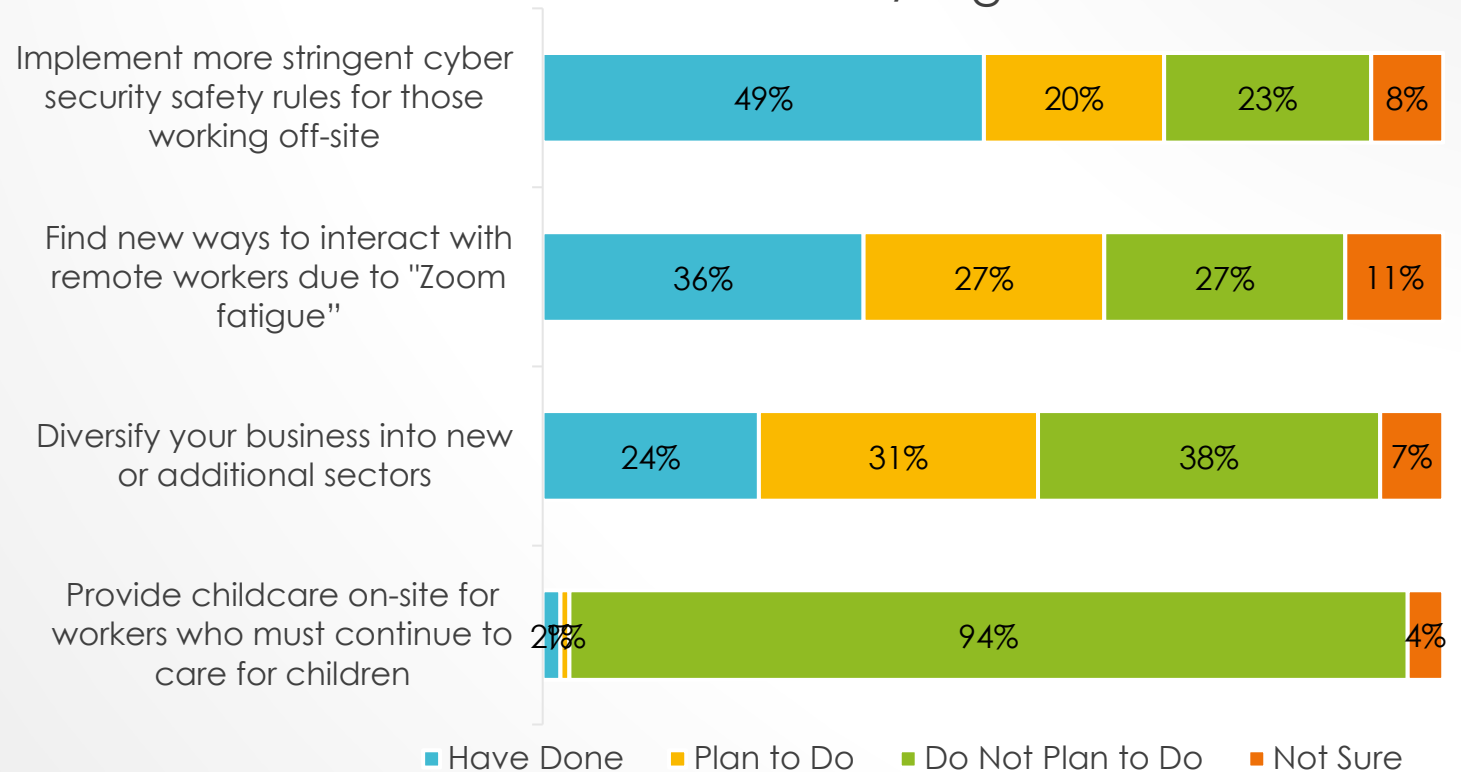


Q7. Assuming your firm wins no new projects, how many months of backlog does your firm have?
 Wave 8 - n = 405, Wave 9 - n = 399

NEARLY HALF OF FIRMS HAVE ALREADY IMPLEMENTED MORE STRINGENT CYBER SECURITY RULES FOR OFF-SITE WORKERS AND ANOTHER 20% PLAN TO SO DO. NEARLY TWO-THIRDS OF FIRMS HAVE FOUND/PLAN TO FIND NEW WAYS OF INTERACTING REMOTELY DUE TO “ZOOM FATIGUE.” MORE THAN HALF OF FIRMS HAVE/PLAN TO DIVERSIFY INTO NEW SECTORS.

- The larger a firm is, the more likely it is to have implemented/plan to implement more stringent cyber security measures.
- The same is true for finding new ways to interact with remote workers.

Incidence of Actions Firms Have Taken/Might Take

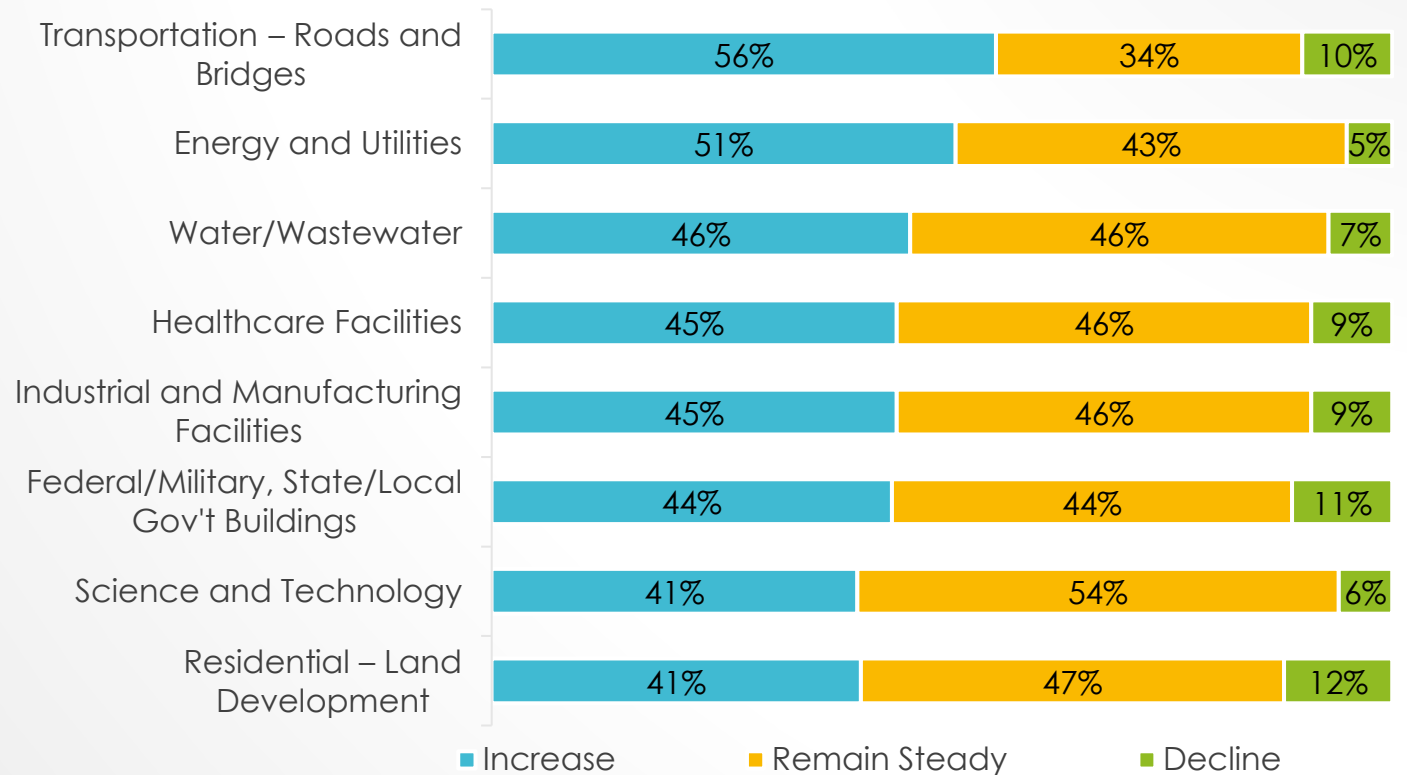


Q14. Which of the following, if any, has your firm done since the start of the Pandemic or does your firm plan to do in 2021?
Wave 9 - n = 394

REFLECTING THE UNCERTAINTY IN THE ECONOMY, BETWEEN ONE-FIFTH AND ONE-HALF OF FIRMS ARE “NOT SURE” WHAT WILL HAPPEN IN EACH MARKET OVER THE NEXT 12 MONTHS (NOT SHOWN IN GRAPH). AMONG THOSE WHO COULD ANSWER THE QUESTIONS, MORE FIRMS PLAN TO INCREASE THEIR MARKET POSITION IN ROADS AND BRIDGES, ENERGY AND UTILITIES, AND WATER/WASTEWATER COMPARED TO OTHER AREAS.

- In general, firms with more than 200 FTE are more likely to seek to increase their market position in any given market.

Future Expectations of Firms' Market Positions

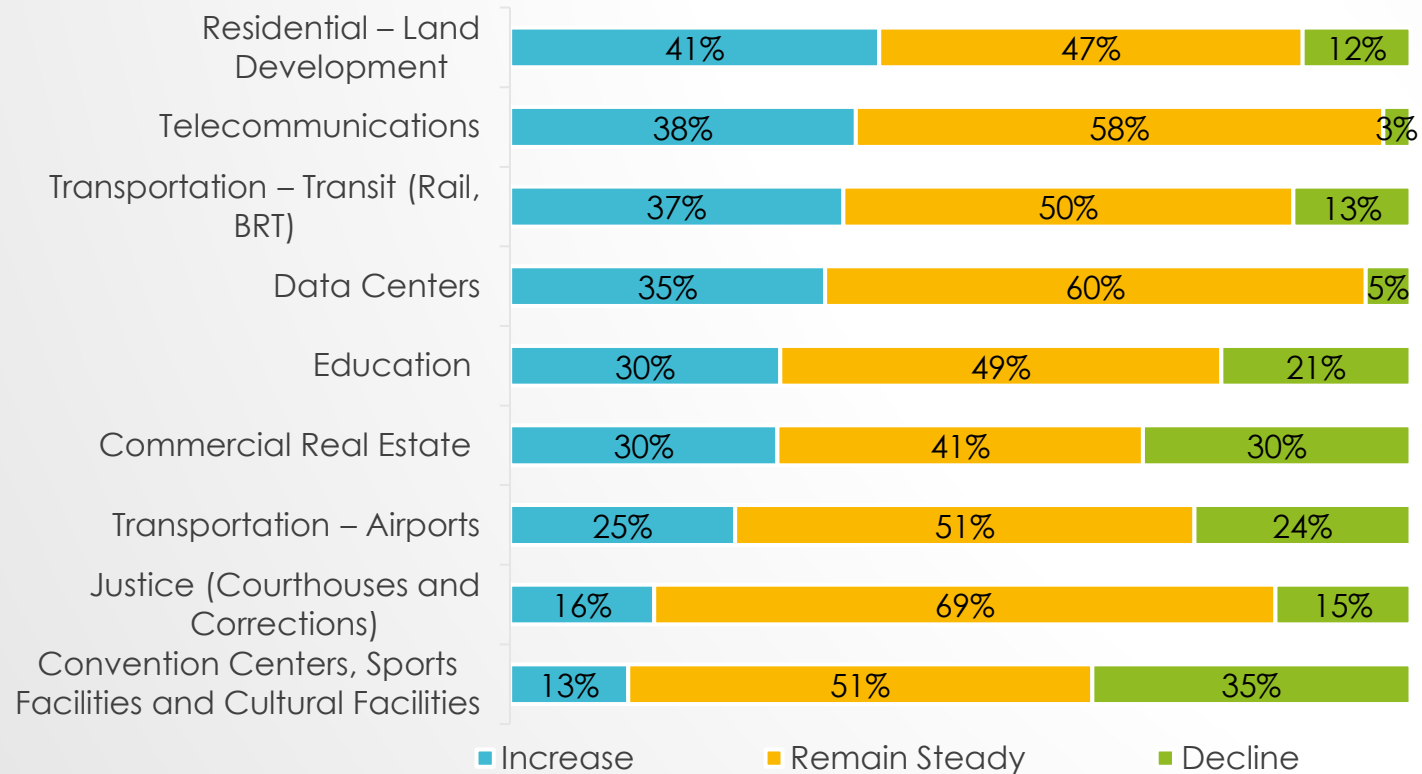


Q18. For each market listed, please indicate if you expect your firm's position in the market to grow, decline, or remain steady over the next 12 months. “Not Sure” responses omitted from calculations.

Wave 9 - n = 291 - 156

FIRMS ARE LESS LIKELY TO EXPECT TO INCREASE THEIR MARKET POSITION IN THE MARKETS SHOWN ON THIS SLIDE. SUBSTANTIAL DECLINES ARE EXPECTED IN CONVENTION CENTERS/SPORTS FACILITIES/CULTURAL FACILITIES, COMMERCIAL REAL ESTATE, AIRPORTS AND EDUCATION.

Future Expectations of Firms' Market Positions (cont'd)

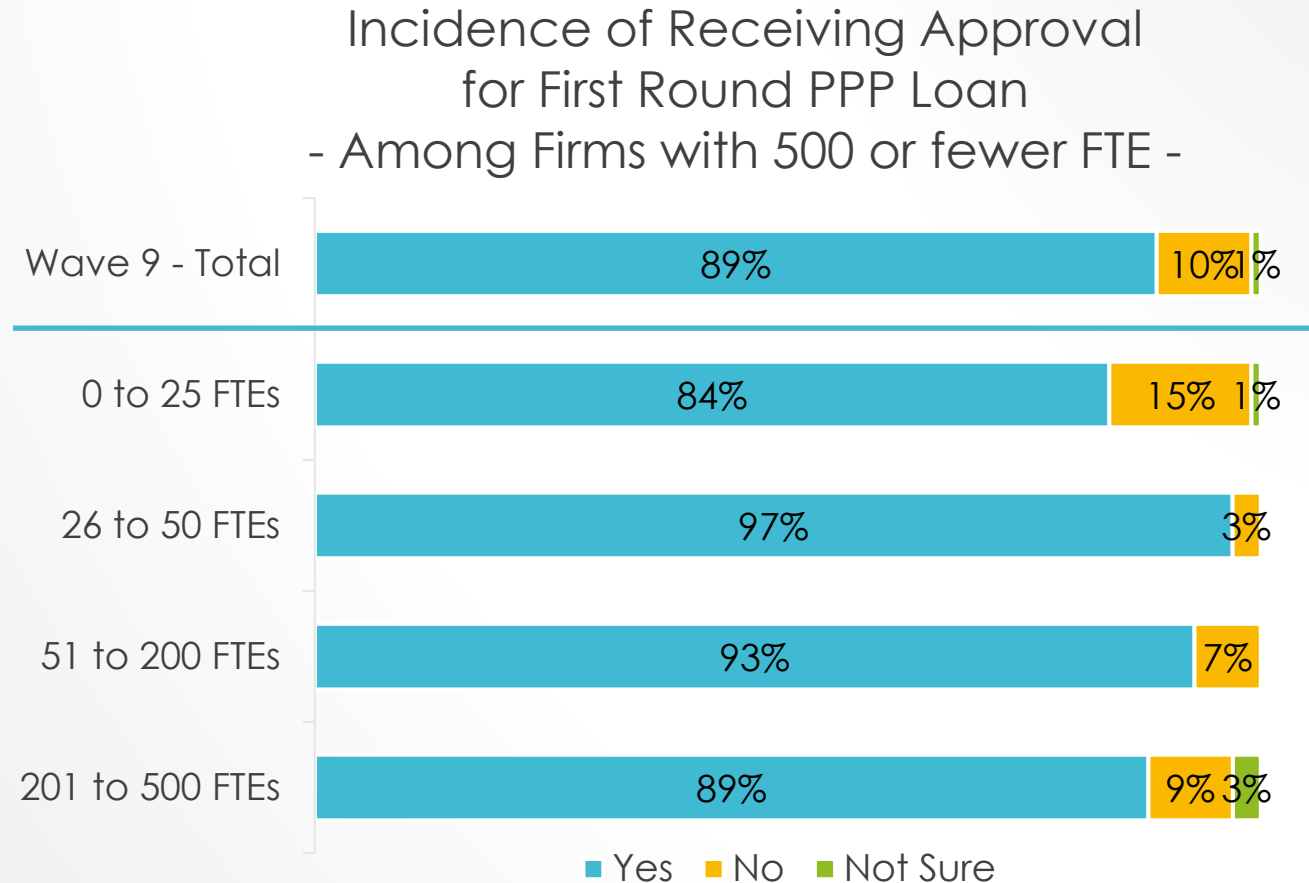


Q18. For each market listed, please indicate if you expect your firm's position in the market to grow, decline, or remain steady over the next 12 months. "Not Sure" responses omitted from calculations.
Wave 9 - n = 291 - 156

PPP LOANS

NEARLY NINE OUT OF TEN ELIGIBLE FIRMS (89%) APPLIED AND RECEIVED APPROVAL FOR A FIRST ROUND PPP LOAN. THIS FIGURE MATCHES THE RESULTS FROM WAVE 7 (LATE MAY 2020).

- Firms with 25 or fewer FTEs are less likely than other firms to have received a PPP loan.

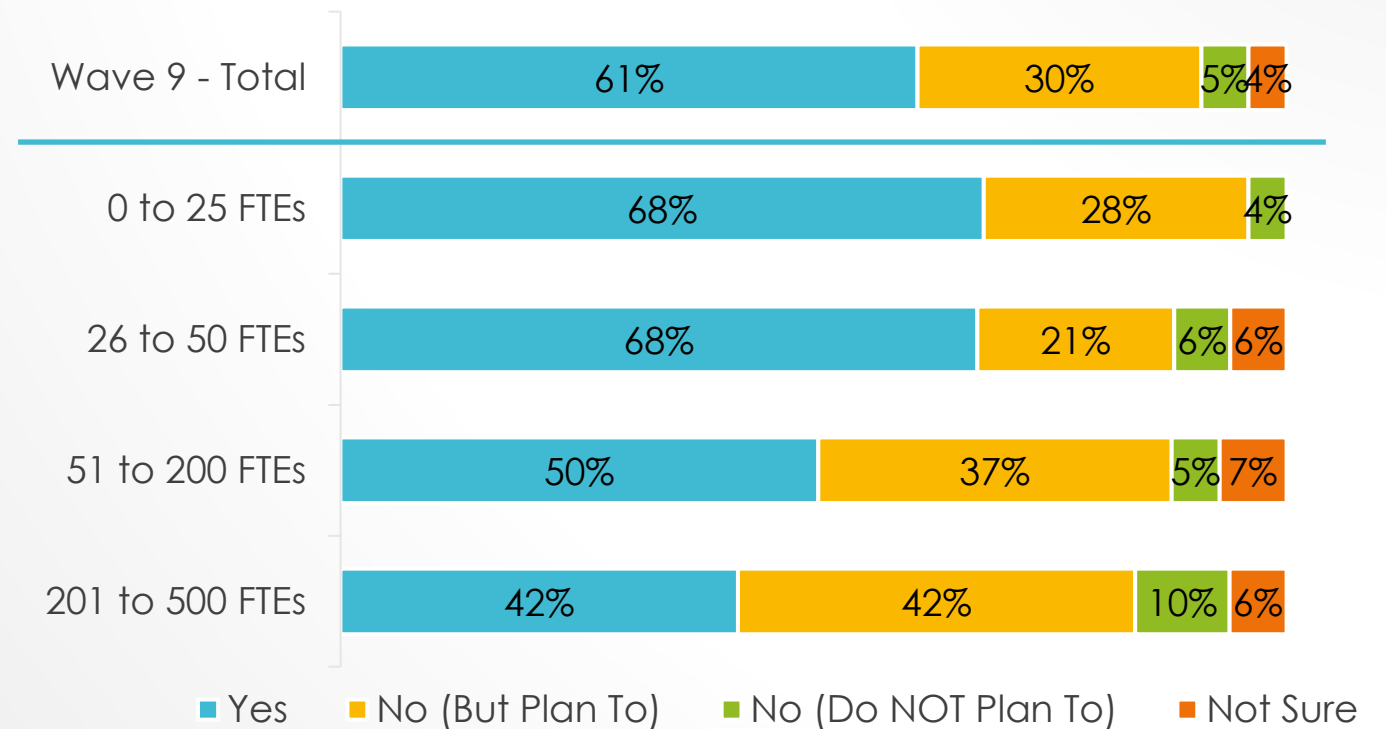


Q8. Did your firm apply and receive approval for a loan through the Paycheck Protection Program (PPP) between March and August of 2020 as part of the CARES Act?
Wave 9 - n = 379

A MAJORITY OF FIRMS HAVE ALREADY APPLIED FOR PPP LOAN FORGIVENESS AND MOST OF THE REST PLAN TO.

- Firms with 50 or fewer FTEs are more likely than other firms to have already applied for PPP Loan forgiveness. However, most firms of all sizes plan to apply if they haven't already.

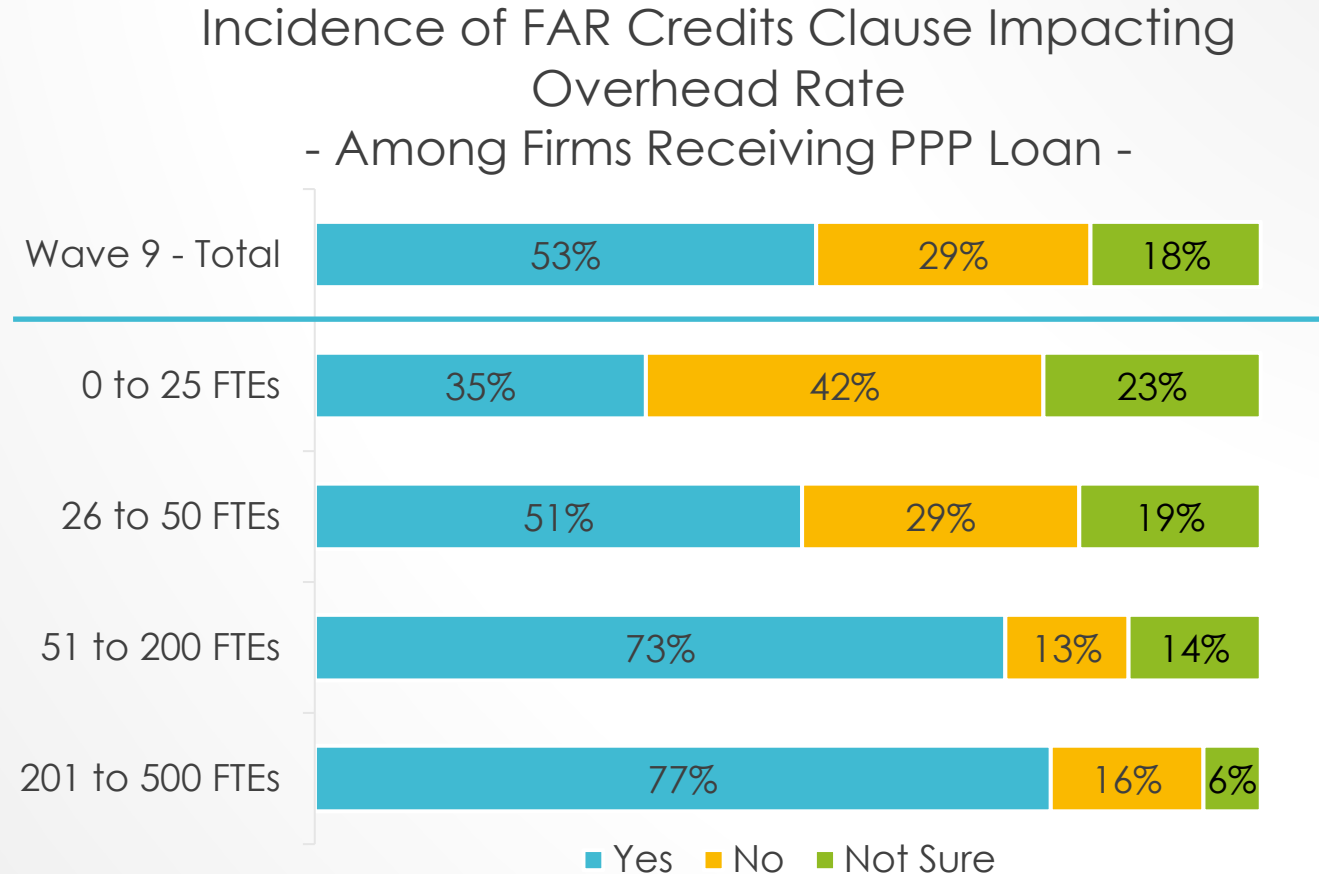
Incidence of Applying for Loan Forgiveness
- Among Firms Receiving PPP Loan -



Q9. Have you applied for PPP loan forgiveness?
Wave 9 - n = 338

MORE THAN HALF OF FIRMS RECEIVING A PPP LOAN SAY THE FAR CREDITS CLAUSE WILL IMPACT THEIR OVERHEAD RATE. A LARGE 18% ARE NOT SURE.

- The FAR Credits Clause is much more likely to impact firms with more than 50 FTEs than smaller firms.

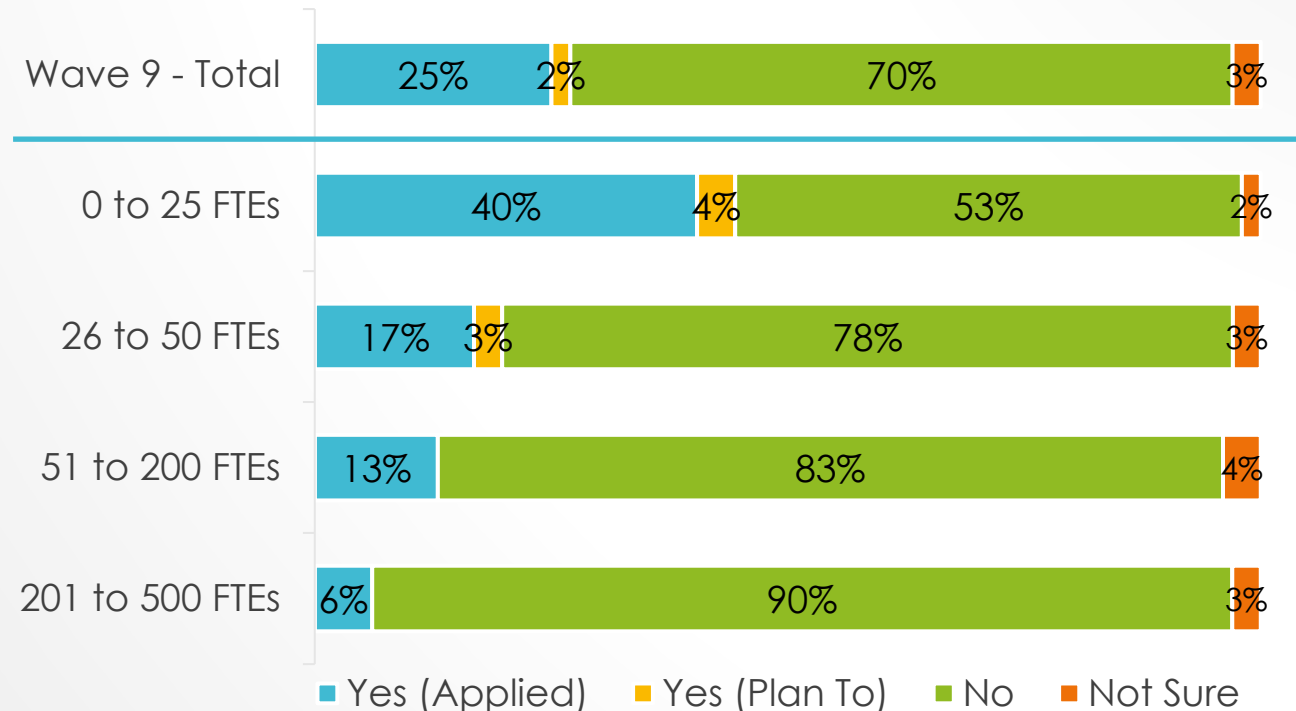


Q10. Will the application of the FAR credits clause impact your firm's overhead rate?
Wave 9 - n = 338

NEARLY ALL FIRMS THAT PLAN TO APPLY (27%) FOR A SECOND DRAW PPP LOAN HAVE ALREADY DONE SO (25%).

- Firms with 25 or fewer FTEs are much more likely to apply for a Second Draw PPP Loan than larger firms.

Plans to Apply for a Second Draw PPP Loan - Among Firms Receiving PPP Loan -



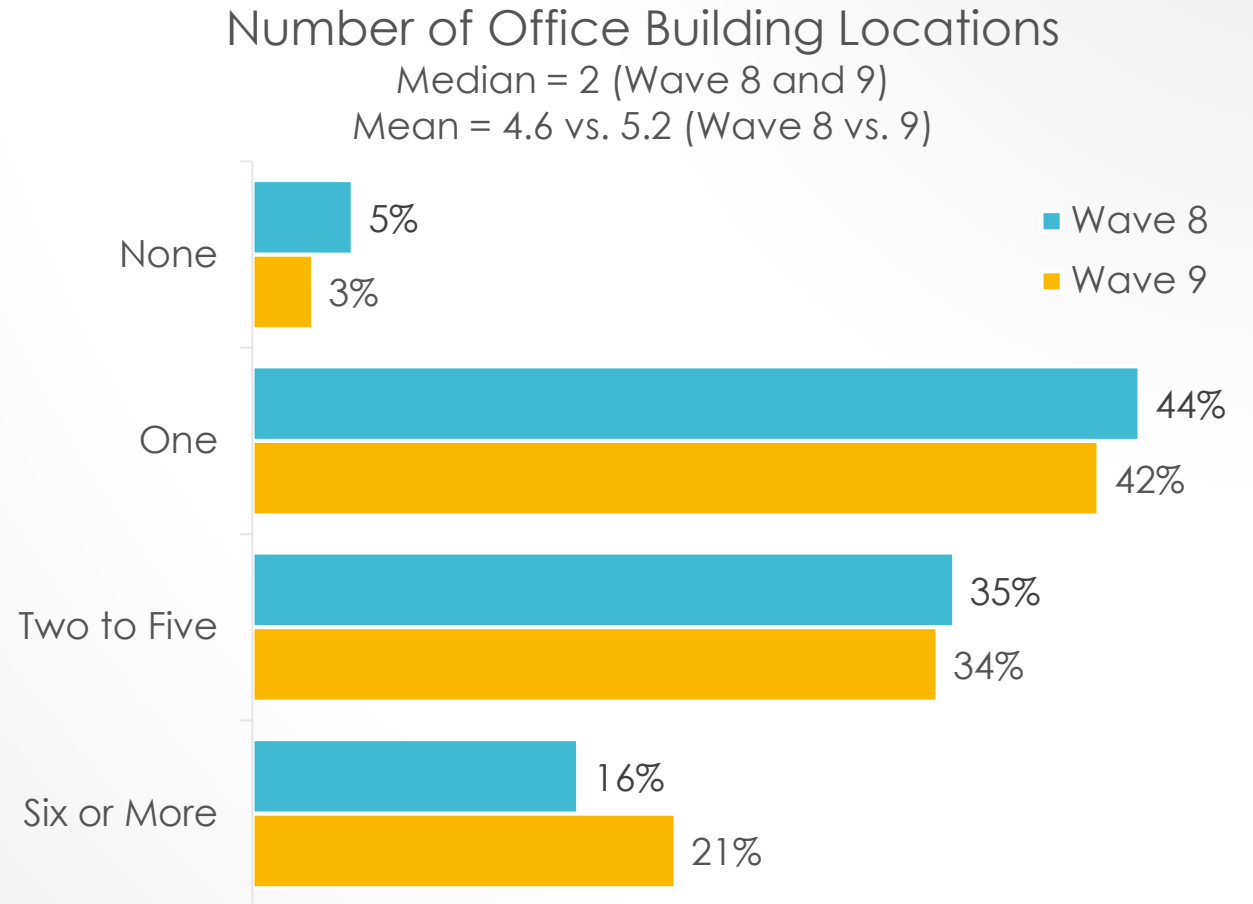
Q11. The year-end 2020 omnibus spending bill and economic relief plan authorized a second round of Paycheck Protection Program (PPP) loans. Have you/do you plan to apply for a Second Draw PPP loan?

Wave 9 - n = 337

OFFICE BUILDINGS AND REMOTE WORKING

THE MEDIAN NUMBER OF OFFICE BUILDING LOCATIONS FOR A FIRM IS TWO AND IS UNCHANGED FROM SEPTEMBER 2020. HOWEVER, THE AVERAGE HAS INCREASED DUE TO FEWER SMALL FIRMS RESPONDING IN WAVE 9.

- Median number of office building locations by firm size:
 - 0 to 25 FTE – 1
 - 26 to 50 FTE – 2
 - 51 to 200 FTE – 4
 - 201 to 500 FTE – 12
 - 501+ FTE – 34

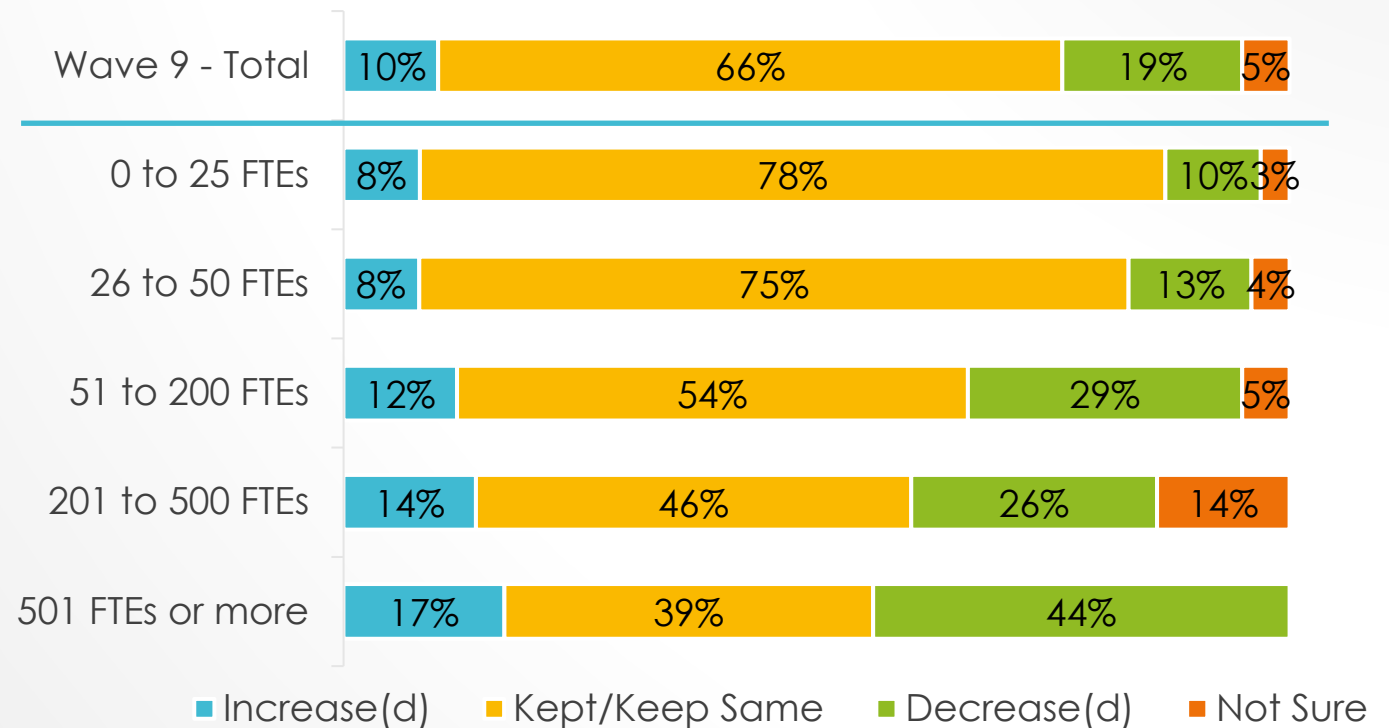


Q12. How many office building locations does your firm currently have in the US? If your firm only operates from residential locations, please enter "0".
Wave 8 - n = 402, Wave 9 - n = 398

OVERALL, MORE FIRMS PLAN TO DECREASE THE AMOUNT OF OFFICE SPACE THEY UTILIZE THAN INCREASE IT. THIS IS MUCH MORE PRONOUNCED AMONG LARGER FIRMS.

- Firms with more than 50 FTEs are much more likely than smaller firms to decrease their office space.

Plans for Office Space
- Among Firms With Office Space -

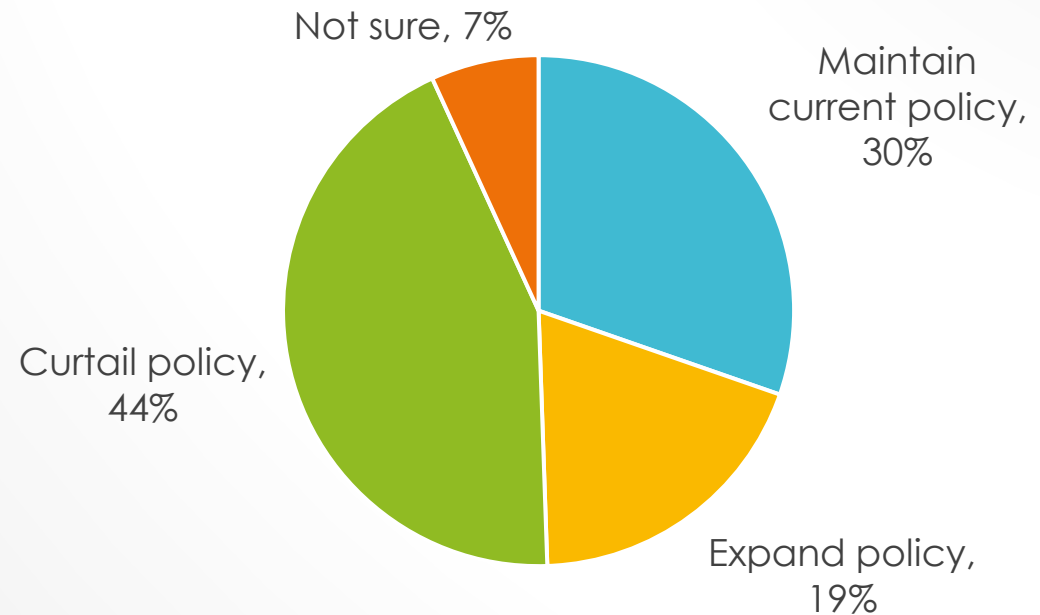


Q13. Since March 2020, what has your firm done or is your firm planning to do with its office building space?
Wave 9 - n = 383

A PLURALITY OF FIRMS PLAN TO CURTAIL THEIR REMOTE WORK POLICIES SO THAT WORKERS ARE IN THE OFFICE MORE OFTEN ONCE SOCIAL DISTANCING RESTRICTIONS ARE LIFTED.

- As firm size increases, so too does the likelihood firms will expand remote work policies. For example, while 13% of firms with 25 FTEs or fewer plan to expand remote working policies, the figure rises to 65% for firms with more than 500 FTEs.

Plans Regarding Remote Work Policy After Pandemic



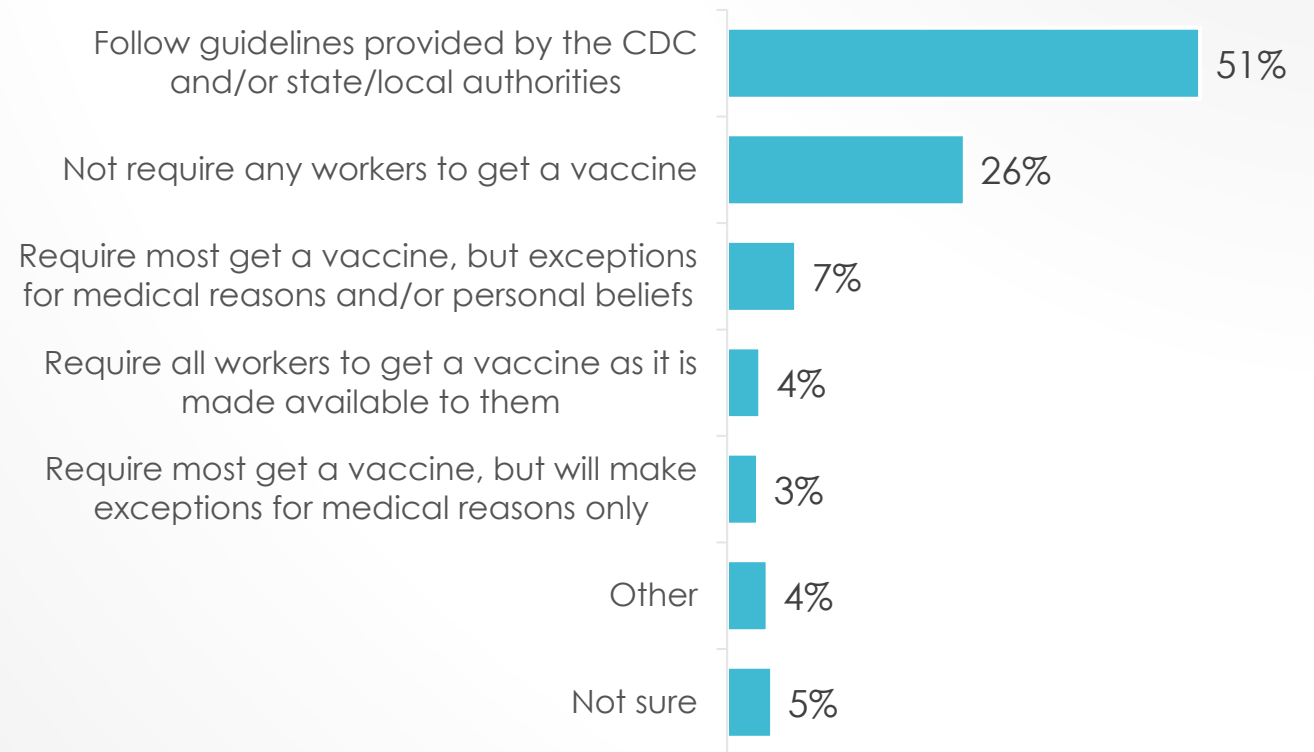
Q17. After restrictions regarding social distancing are lifted, which of the following best describes your firm's plans regarding allowing staff to work remotely?
Wave 9 - n = 366

VACCINES

A MAJORITY OF FIRMS WILL FOLLOW GUIDELINES PROVIDED BY THE CDC AND/OR STATE/LOCAL AUTHORITIES WHEN IT COMES TO VACCINATIONS. ABOUT ONE-FOURTH WILL NOT REQUIRE VACCINATIONS.

- Most firms that provided an “other” response indicated they are not requiring vaccinations but “strongly encouraging” them.
- There are no meaningful, statistically significant differences by firm size.

Firm Policies Regarding Covid-19 Vaccinations



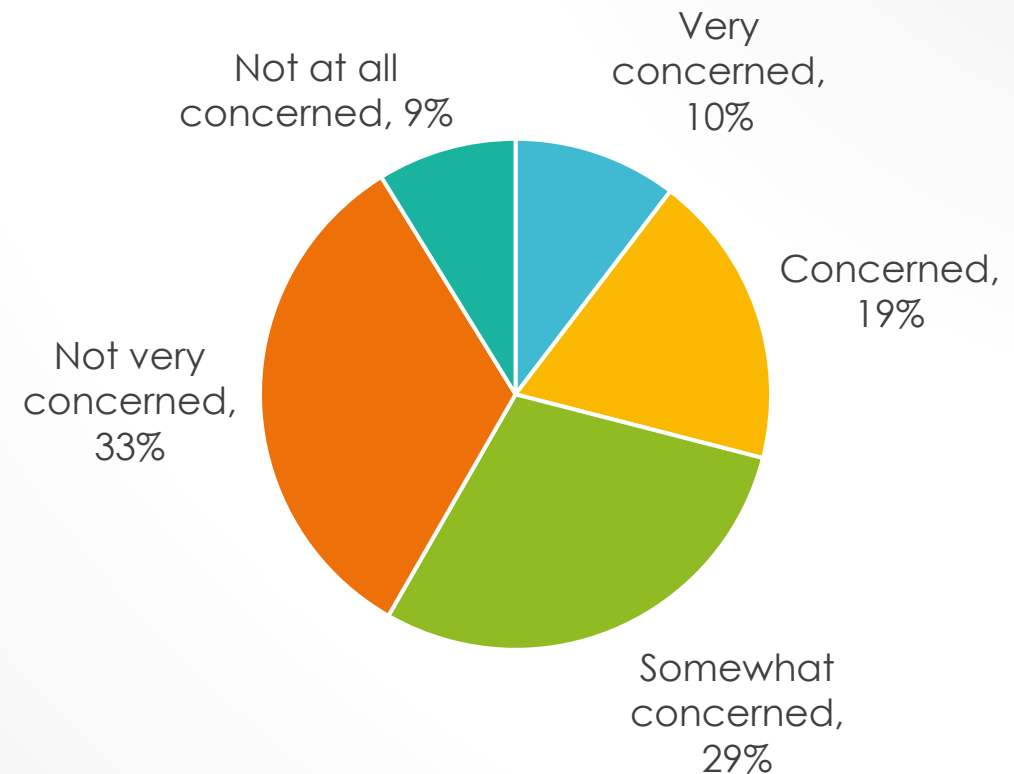
Q15. Which of the following best describes the policy your firm has adopted or will adopt relating to COVID-19 vaccines?

Wave 9 - n = 391

ALTHOUGH A MAJORITY OF FIRMS (58%) ARE AT LEAST SOMEWHAT CONCERNED ABOUT BEING HELD LIABLE FOR OFFICE WORKERS GETTING SICK, A LARGE PERCENTAGE (42%) ARE NOT.

- As firm size increases, so too does the level of concern about being held liable for workers getting sick in the office. For example, while 54% of firms with 25 FTEs or fewer are concerned, the figure rises to 68% for firms with more than 200 FTEs.

Concern Regarding Liability for Workers Getting Sick In Office



Q16. How concerned are you, if at all, about being held liable for workers getting sick in your office?

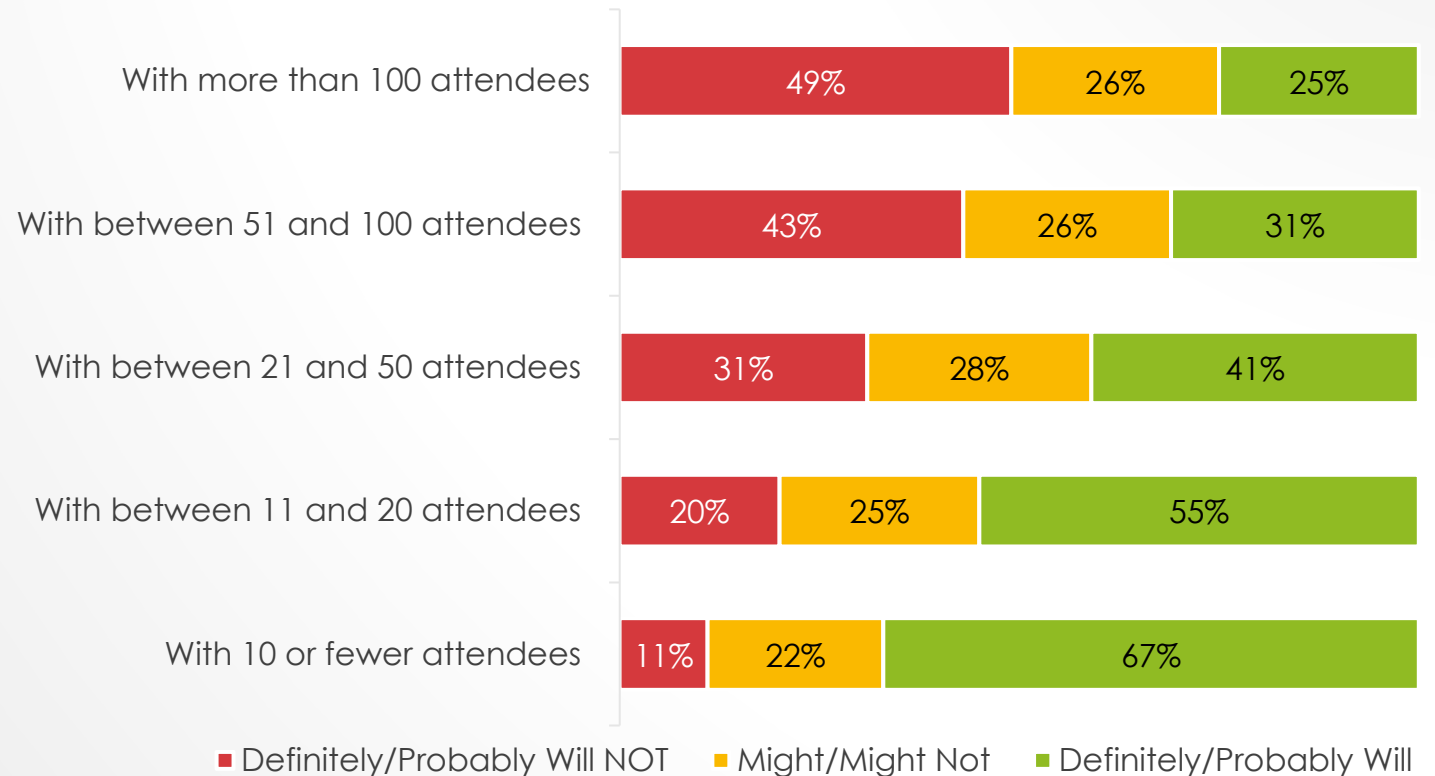
Wave 9 - n = 386

LIKELIHOOD OF TRAVELING

MORE THAN HALF OF FIRMS ARE LIKELY TO ALLOW TRAVEL TO EVENTS WITH 20 OR FEWER ATTENDEES WITHIN THE NEXT SIX MONTHS. THIS IS A LARGE IMPROVEMENT COMPARED TO A SIMILAR QUESTION ASKED IN 2020.

- Nearly half of firms are not likely to allow workers to attend large events with more than 100 attendees during the next six months, indicating that a return to normal may not occur until 2022.
- Firms with more than 500 FTE are much less likely than other firms to allow travel to any size event in the next six months.

Likelihood of Allowing Travel in Next Six Months to Conferences/Meetings/Events

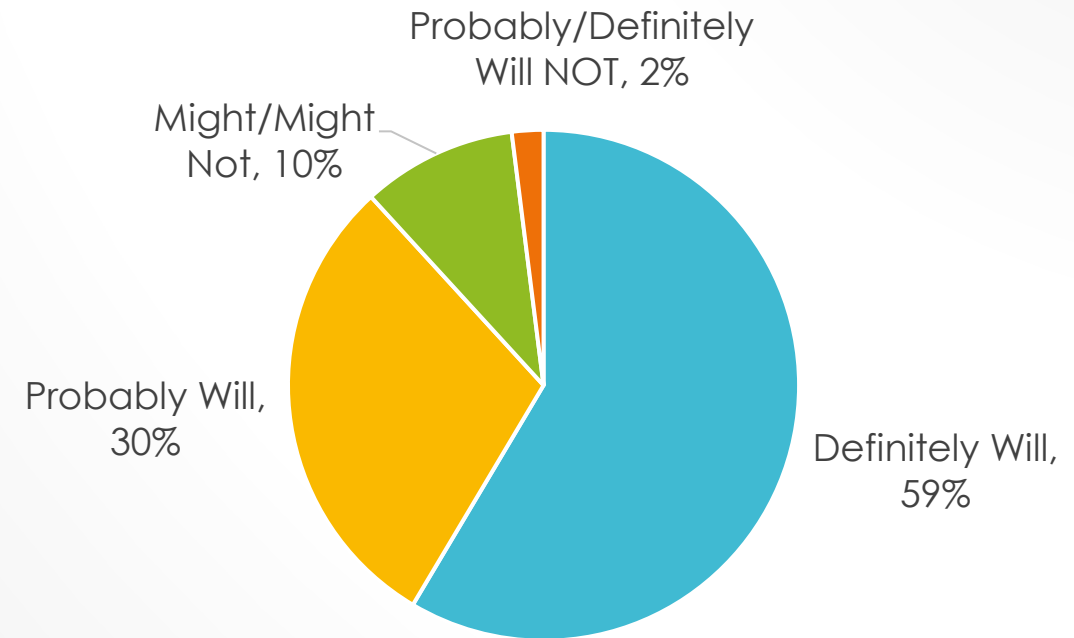


Q19. How likely is your firm to allow the following types of travel in the next six months?
Wave 9 - n = 388 - 386

FIRMS ARE MUCH MORE LIKELY TO PERMIT TRAVEL FOR CLIENT MEETINGS COMPARED TO TRAVEL FOR EVENTS. ROUGHLY NINE OUT OF TEN FIRMS PLAN TO ALLOW TRAVEL TO CLIENT MEETINGS IN THE NEXT SIX MONTHS.

- There are no meaningful, statistically significant differences by firm size.

Likelihood of Allowing Travel in Next Six Months to Meet With a Client

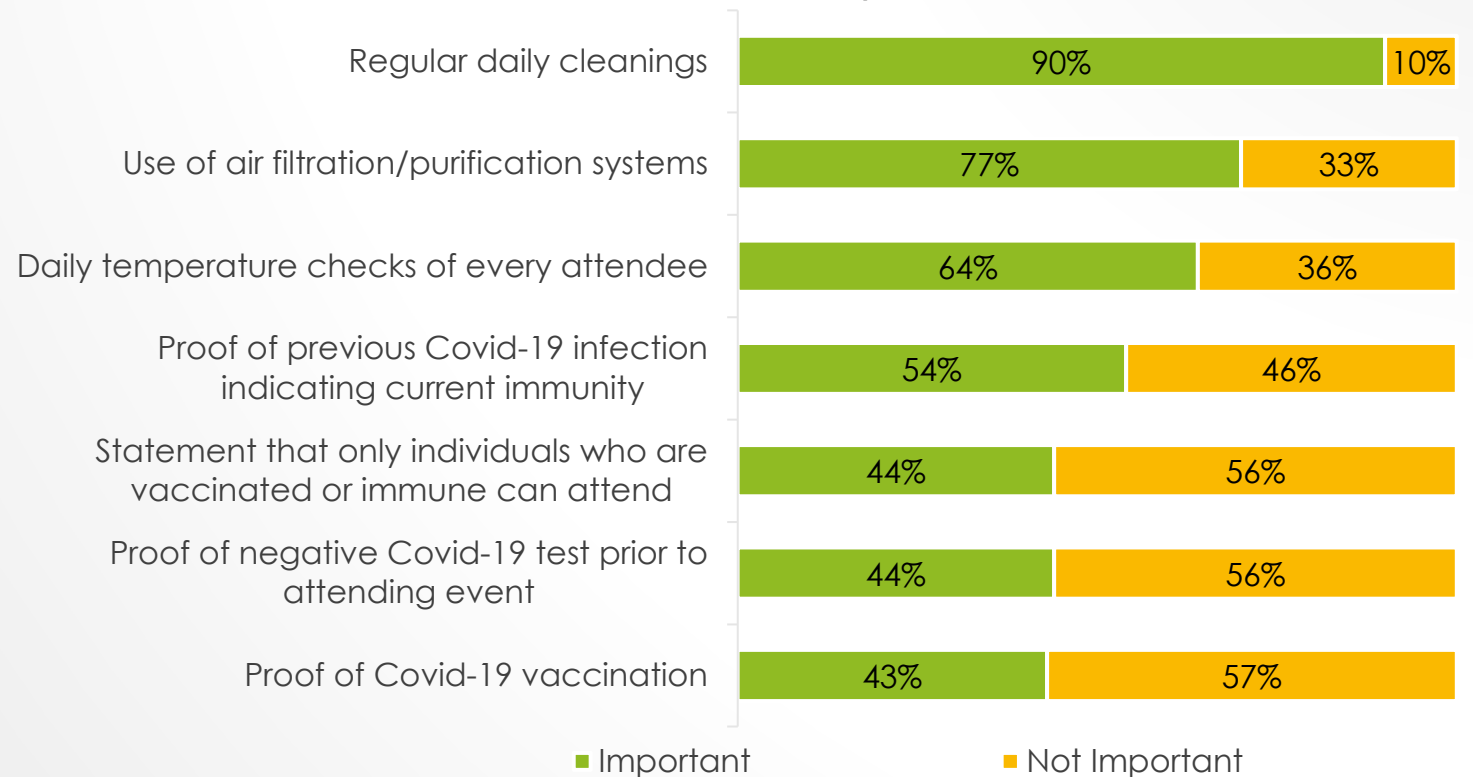


Q19.6 How likely is your firm to allow the following types of travel in the next six months? - In-person meetings with a client
Wave 9 - n = 387

ALTHOUGH A LARGE PERCENTAGE OF FIRMS FEEL IT IS IMPORTANT FOR EVENT ORGANIZERS TO IMPLEMENT ALL SAFETY MEASURES, THE MOST IMPORTANT ARE REGULAR DAILY CLEANINGS, USE OF AIR FILTRATION/PURIFICATION SYSTEMS AND DAILY TEMPERATURE CHECKS.

- Many respondents provided “other” safety measures they deem essential, such as requiring the wearing of face masks and social distancing.
- There are no meaningful, statistically significant differences by firm size.

Importance of Event Organizers Implementing Various Safety Measures



Q20.1 How important is it that event organizers implement the following safety measures?
Wave 9 - n = 386 - 381

APPENDIX

METHODOLOGY – WAVE 9

- The Institute for Association and Nonprofit Research (IFANR) invited individuals from among the database list of member companies provided by the American Council of Engineering Companies (ACEC) to participate in this survey. One invitation was sent per member company.
 - Data collection occurred between February 25 and March 5, 2021.
 - A total of 3,351 invitations were emailed, although 303 bounced and 8 opted-out, resulting in a total of 3,040 potential respondents.
 - Individuals who did not respond to the first email were sent a follow-up reminder. Those who did not respond to the reminder email were sent a second reminder email.
 - In all, 408 individuals responded to the email invitations for an overall **response rate of 13%**.
- Individuals could respond using a laptop/desktop computer, tablet or smartphone; 9% of respondents completed the survey using a mobile device.
- Throughout this report meaningful, statistically significant differences are noted by number of FTEs.

STATISTICAL NOTES

- Statistically significant differences are evaluated at a 95% confidence interval (for a description of tests used, please see the Appendix).
- There is no margin of sampling error as this was a census of all individuals in the ACEC database.
- Although every effort was taken to minimize survey bias, there is no way to completely eliminate all sources of potential bias. Sources of potential bias include, but are not limited to, the following:
 - Non-response bias
 - Confounding bias
 - Question wording bias
 - Question order bias
 - Habituation
 - Sponsor bias
 - Confirmation bias

TESTS OF SIGNIFICANCE FOR MEANS

F-test

When the mean is displayed for a row variable, MarketSight first runs an Analysis of Variance (ANOVA) using an F-test. Doing so tests the hypothesis that the means of multiple normally distributed populations, all having the same variance, are equal.

MarketSight tests whether or not the row variable's means are equal to one another for all columns in the crosstab. Rejecting the test hypothesis implies that at least one of the column means is significantly different from the others.

Fisher's Least Significant Difference (LSD) test

If the statistics option to "Correct for Type I errors in all comparisons" is disabled, MarketSight will run Fisher's LSD test for both Pairwise tests and Contrast tests of means. MarketSight only runs Fisher's LSD test if the ANOVA F-test first rejects the null hypothesis that all column means are equal to one another.

Fisher's LSD test is a relatively powerful test because it uses the pooled variance estimate from the F-test, thus taking advantage of the increased sample size of all columns in the crosstab. Pooling the variance is valid because MarketSight explicitly tests for equality of variance among all columns prior to running the associated F-test.

Although the test is more powerful than either the Tukey HSD or Scheffé tests, it is more susceptible to Type I error when running multiple simultaneous tests.

TESTS OF SIGNIFICANCE FOR MEANS (CONT'D)

Scheffé test

If the statistics option to "Correct for Type I errors in all comparisons" is enabled, MarketSight will run the Scheffé test for Contrast tests of means. MarketSight only runs the Scheffé test if the ANOVA F-test first rejects the null hypothesis that all column means are equal to one another.

The Scheffé test is a conservative test for running multiple Contrast tests of Means which controls the overall Type I error rate for all possible contrasts based on the selected Confidence Level.

Tukey-Kramer tests

MarketSight will run Tukey-Kramer test for Pairwise tests of means. MarketSight only runs Tukey-Kramer test if the ANOVA F-test first rejects the null hypothesis that all column means are equal to one another.

Tukey-Kramer test is a conservative test for running multiple Pairwise comparisons of Means. It controls the overall Type I error rate across a number of related Pairwise tests based on the selected Confidence Level.

TESTS OF SIGNIFICANCE FOR PROPORTIONS

Chi-squared

When a Row Variable displays the Column % or Count option for individual Values, MarketSight runs a Chi-squared test. This test examines whether there is a relationship between the Column Variable(s) and the Row Variable.

Chi-squared tests involve a comparison of "actual" cell counts to "expected" cell counts in a crosstab.

The expected count for each cell is derived from a Row Variable's actual counts as follows: multiply the cell's row total by its column total, then divide by the sum total of all observations.

If the actual cell counts for one or more cells differ materially from their expected counts, the Chi-squared test may produce a statistically significant result which implies there is a relationship between the Column Variable(s) and the Row Variable.

A modified version of a Chi-Squared test is run for Multiple Response Variables.

TESTS OF SIGNIFICANCE FOR PROPORTIONS (CONT'D)

Fisher's Exact

For 2x2 crosstabs with small sample sizes, the Chi-squared test may be unreliable. Therefore, MarketSight runs an alternate test, Fisher's Exact Test, if more than 20% of the cells in a 2x2 crosstab have an expected cell count less than 5, or if any cells in a 2x2 cross-tab have an expected cell count less than 1.

Fisher's Exact Test calculates the true probability of observing a particular set of actual cell counts in a 2 x 2 crosstab, assuming that row and column totals are held constant.

Fisher's Exact Test is not run for Multiple Response Variables.

z-test

MarketSight runs Z-tests for both Contrast and Pairwise tests of Column Proportions. A Z-test is used to test for a difference between two column proportions. The column proportions involved in the test are the cell counts divided by their respective column totals.

A Z-test is only run when the cells being compared have actual counts greater or equal to 5 and the column sample size minus the actual cell counts is greater than or equal to 5. If these data sufficiency conditions are not met, MarketSight runs Fisher's Exact Test instead.

A modified version of a Z-test is run for Multiple Response Variables.

THANK YOU!



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