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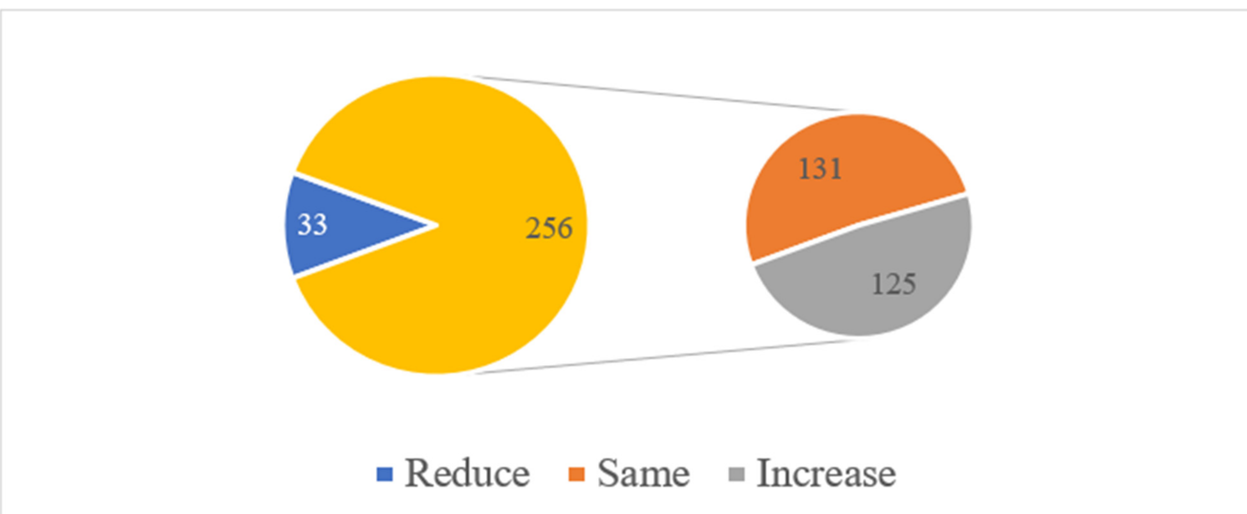
Small Beef-Packer Resilience During the COVID-19 Pandemic: Evidence and Policy Implications

As part of a larger research project on the economics of beef supply chain resilience to natural disasters, financed in part by a grant from the USDA National Institute of Food and Agriculture, we obtained information from 289 processing plants across the United States about their operations during the peak COVID-19 period of March to June 2020 via a telephone survey. We collected data on plant type (slaughter, processing, both), the dominant livestock processed by the plant (predominantly beef, pork, poultry, and sheep/goat), plant capacity (maximum and typical capacity in slaughter head/day), age of establishment, and, whether the plant ceased, reduced, maintained, or increased slaughter during the COVID-19 pandemic.

Based on the database of packers maintained by the USDA FSIS (2022), we initially identified 545 small beef packers (mainly those with less than 100,000 slaughter head per year) as potential candidates for conducting the survey. However, only 358 agreed to participate in the telephone survey conducted from June to August 2022. After removing data from predominantly pork, poultry, and sheep/goat processing plants and data with incomplete information, we ended up with data on 289 beef plants.

Survey responses related to plant operation during the pandemic outbreak from March through June 2020 are highlighted in Figure 1. Thirty-three out of 289 respondents (about 11%) reported reduced operation in response to COVID-19. None of the plants surveyed ceased operation. Of those 256 plants that did not report reduced operation, 125 (almost 50%) reported increased slaughter, and 131 plants—the other half—reported normal slaughter.



Note: The figures inside the pie chart show the number of plants
Figure 1: Operation adjustment of processing plants due to COVID

The reported processing capacity ranges from 1 to 5,200 head daily. Figure 2 shows processing operation adjustment to COVID-19 by plant size—processing plants with an average capacity of about 217 head/day reduced operation during COVID-19. In comparison, the capacity of plants that reported normal operation during COVID-19 averaged 60 head/day. Those who reported an increase in operation during COVID-19 have an average capacity of 20 head/day.

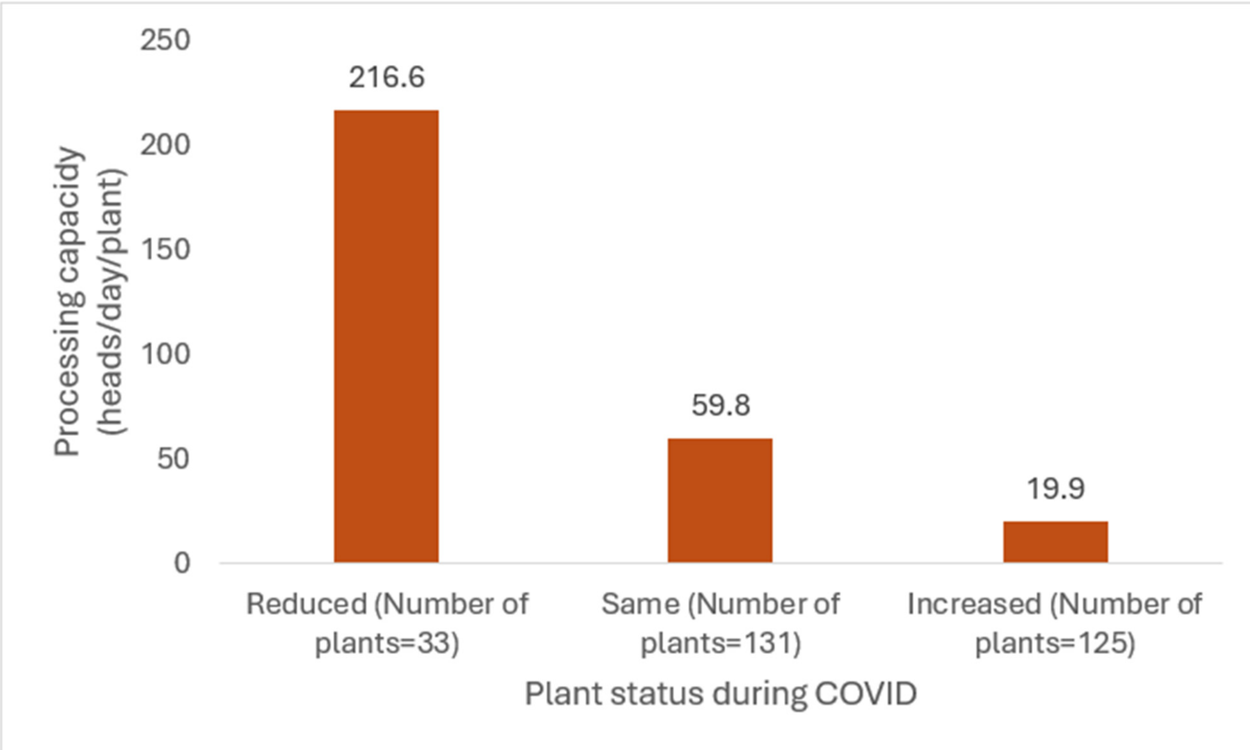


Figure 2: Operation adjustment due to COVID and plant size

Economic resilience is defined as "the ability of an entity or system to maintain function (e.g., continue producing) when shocked" (Rose, 2007). As such, an economically resilient business is a business that allocates its resources efficiently when a disaster exacerbates such allocation (Think of labor (a resource) not showing up for work for fear of infection). To accurately measure a beef processor's ability to continue functioning, however, one would need access to granular slaughter, cost, and price data—ideally daily during the pandemic—which obviously would be too much to ask in a survey. So, instead, we defined packers simply as resilient (maintained function) if they reported maintaining or increasing slaughter and nonresilient if they reported reducing slaughter as a response to COVID-19.

Based on that definition of resilience, we used the survey answers as input into a statistical model to verify some hypotheses about what drove resilience (or lack thereof) among small beef processors and draw implications from our findings for the USDA initiative for expanding the processors' capacity to mitigate the effect of future pandemics.

The statistical model we used is known as the Logit model. It predicts the probability of resilience determined by three primary drivers identified earlier in a meatpacking resilience study by Azzam et al. (2023): plant size, labor conditions, and public policy toward COVID-19. We used cattle processing capacity for plant size and added the plant age as reported in the survey. The hypothesis is that the larger the plant and the older the plant, the smaller the probability of resilience. For labor conditions, we used the meatpacking worker wage and the right-to-work (RTW) status of the state where the plant is located. The direction of the impact of wages and RTW is not clear-cut.

On the one hand, a higher wage could induce workers to return to work during a pandemic, keeping the plant in operation. On the other hand, workers may opt to stay home for fear of infection regardless of forgone wages. The impact of RTW laws, which give meatpacking workers the choice not to belong to a union, is also ambiguous, as workers may opt not to return to work because of a lack of industry requirements to protect workers. In Nebraska, for example, the governor at the time refused to implement state-level industry safety requirements, opposed temporary plant shutdowns, and halted reporting COVID-19 cases tied to meatpacking plants (Dineen, 2020, p. 23). To capture the variation of COVID-19 policies toward COVID-19 and the importance of the state in beef production, we considered whether there was a state mask mandate and whether a plant was located in a major beef-producing state.

The raw data we used to estimate the statistical model shows that 75% of the plants surveyed are in states with mask mandates. Figure 3 shows that more than 90% of plants in states with mask mandates during COVID-19 reported normal or increased operation. In comparison, around 80% reported increased or normal operation for the states without the mask mandate.

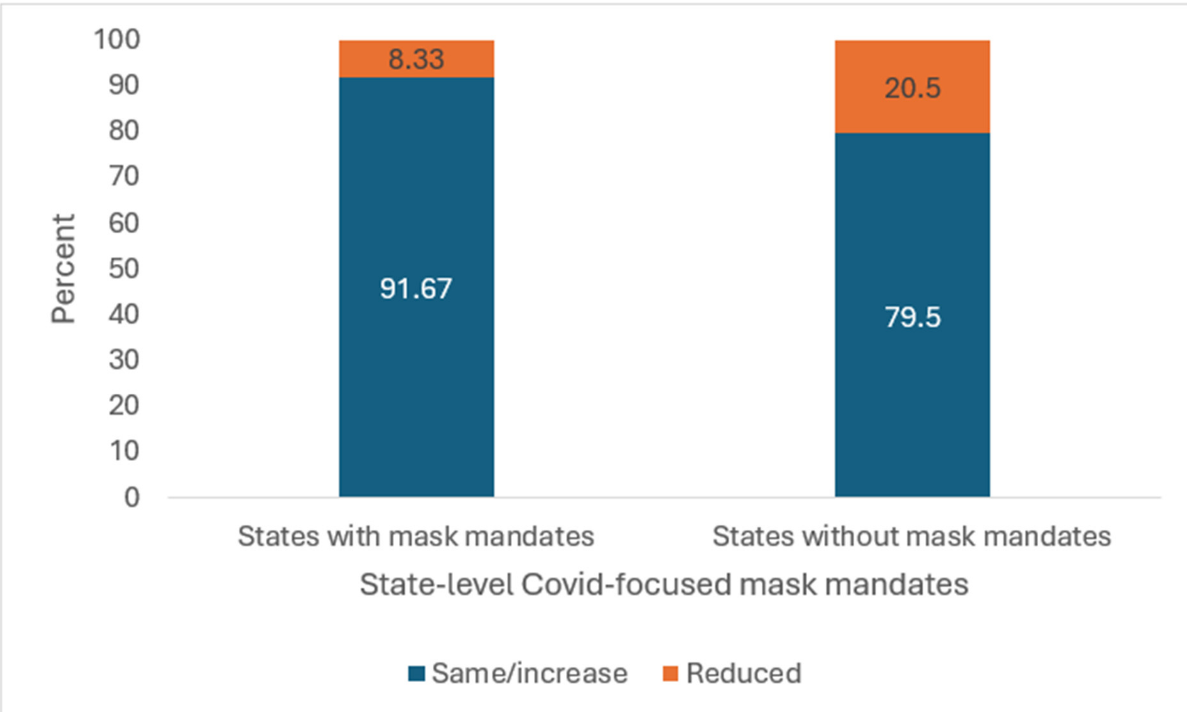


Figure 3: Operation adjustment during COVID by mask mandates

About 56% of the plants were in major packing states (Nebraska, Colorado, California, Texas, Iowa, Kansas, Nevada, Pennsylvania, Illinois, and Missouri). Figure 4 shows that the plants in major meatpacking states did not report having higher or normal operations differently than those in non-major packing states.

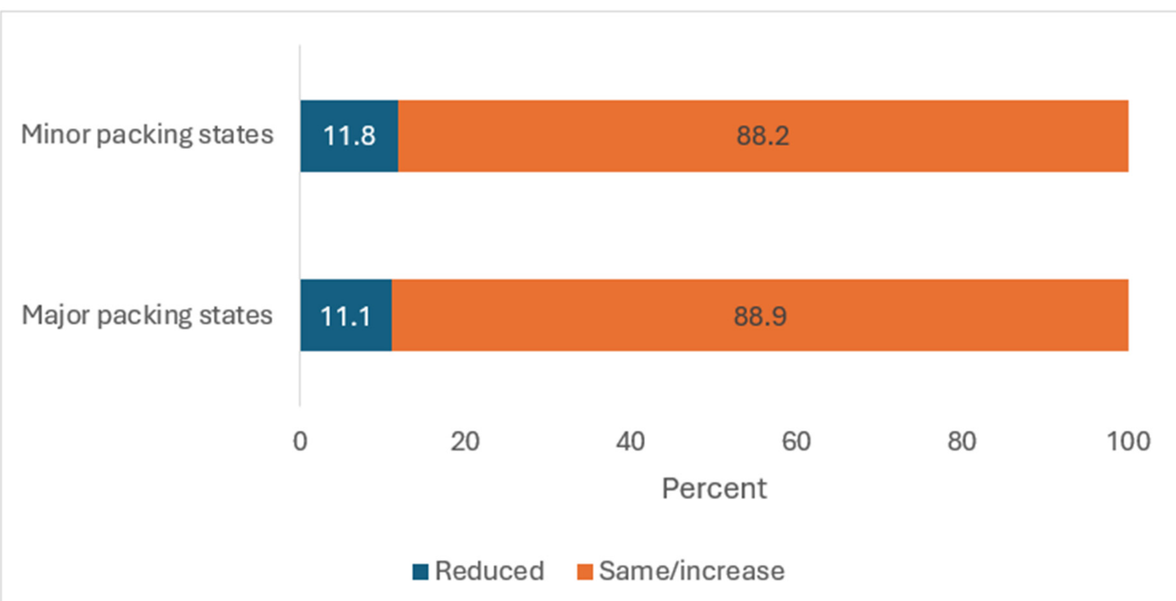


Figure 4: Operation adjustments during COVID by major packing states
* Major packing states are NE., CO, CA, TX, IA, KS, NV, PA, IL, and MI.

Figure 5 shows that a larger share (almost 15%) of processing plants in the states with RTW status reported reduced operation compared to those without RTW (nearly 9%).

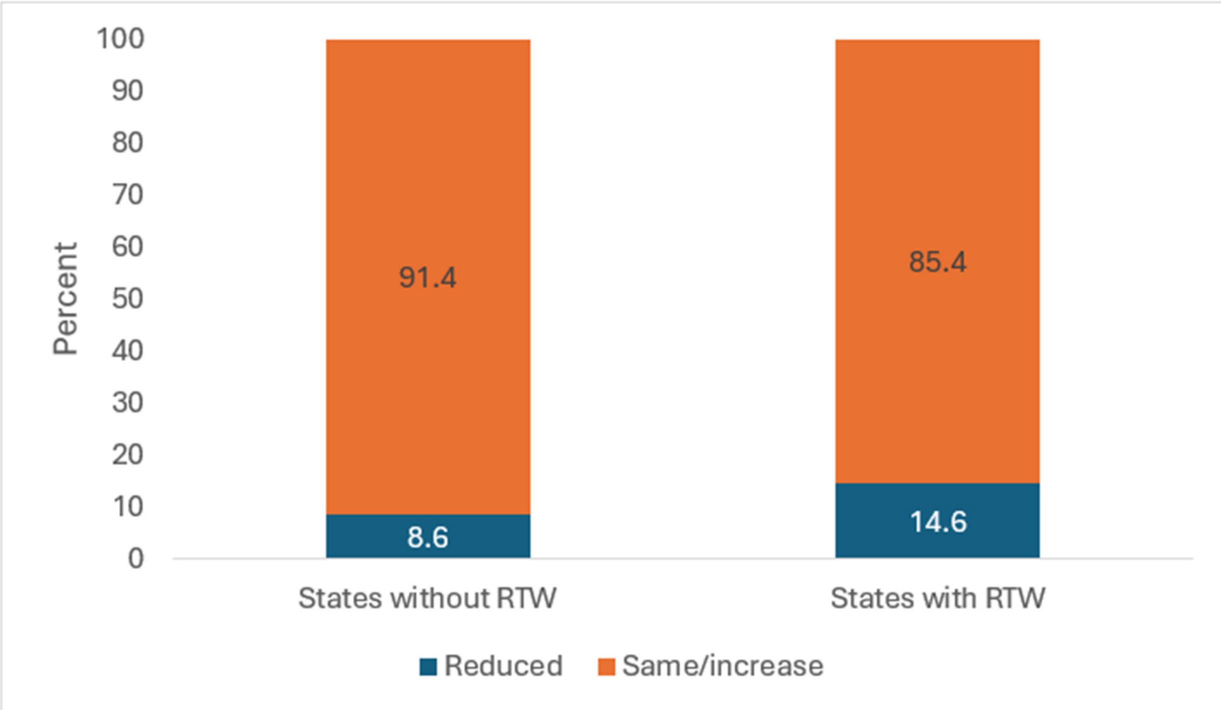


Figure 5: Operation adjustment by packers by states' RTW status.

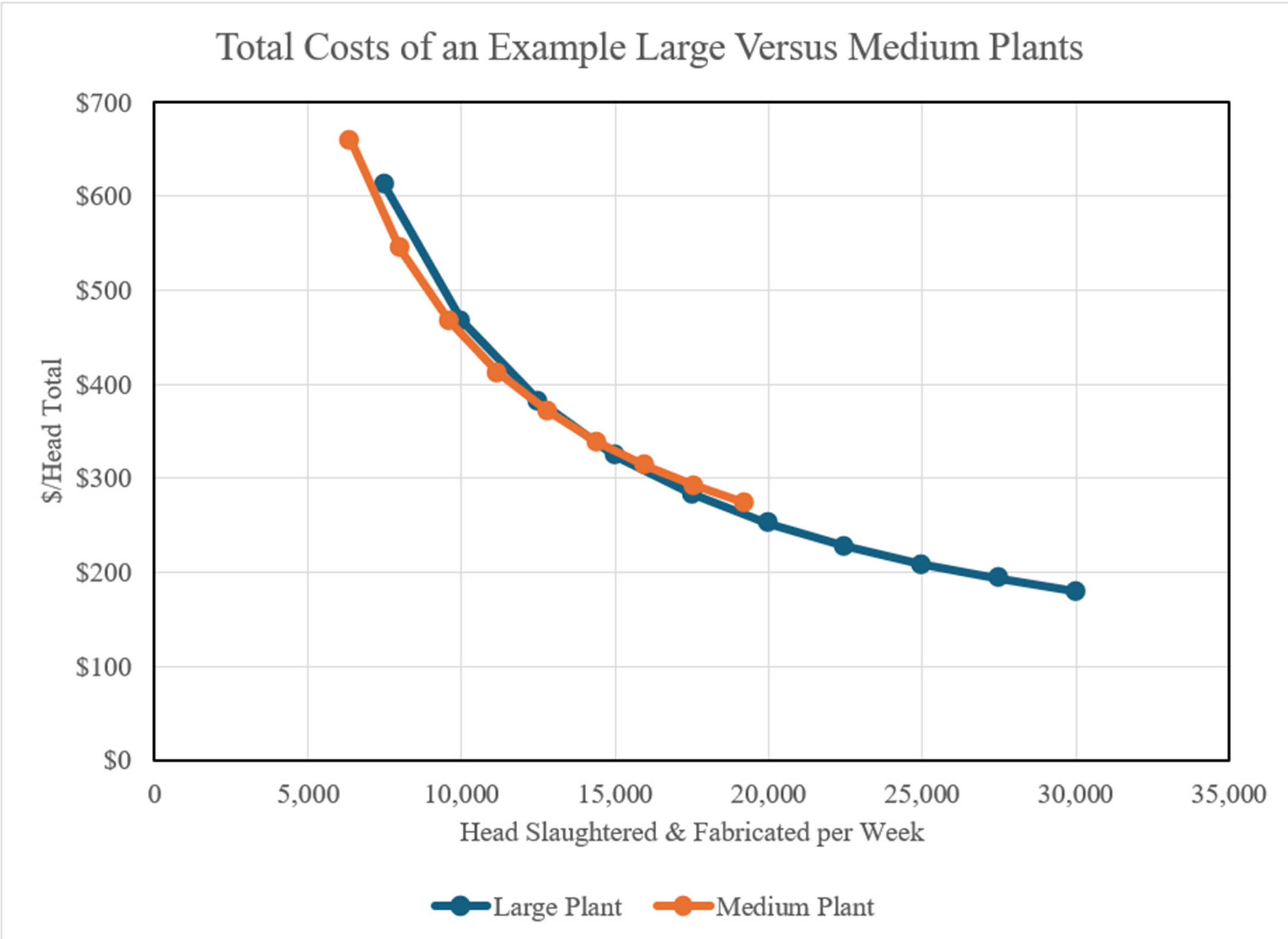
The five figures hint at the possible impact of the three factors on resilience but do not, in isolation, constitute support for any of the hypotheses we described earlier. So, we turn to the statistical model's prediction, which considers all the drivers together to predict the probability that a packer is resilient.

What did we find when we ran the statistical model? Unsurprisingly, we found that the larger the plant, the lower the probability of resilience, i.e., of maintaining or increasing slaughter during the pandemic. That could be because smaller plants have fewer workers and work in adequately spaced-out environments that limit the possibility of infection and operational disruption.

We also find that plants in states with a mask mandate are the most resilient. One plausible explanation is that states with mask mandates further helped minimize COVID-19 infections at plants and consequently helped the plants operate smoothly. Hence, the role of mask mandate in plant resiliency should be understood as an enabling factor rather than the cause of resilience.

One conclusion we can draw from our statistical results is that expanding the capacity of small packers may not necessarily enhance their resilience, especially in states without a mask mandate. Irrespective of state pandemic policy, the results also suggest that the program may be more efficacious if capacity is expanded by building new and smaller plants rather than existing ones, as expanding smaller plants into larger plants could diminish their resilience.

However, having many smaller plants reduces slaughter-cost efficiency because of their small scale. Figure 6 traces the relationship between the total slaughter cost per head for large versus medium plants. Large ones outperform the medium plants at some volumes, allowing them to bid more for cattle. So, to be more resilient, one has to give up on cost efficiency. There is no free lunch, as economists say.



Source: We are grateful to Professor Stephen Koontz at Colorado State University for providing us with the graph.

Furthermore, given that adding smaller plants could potentially increase industry beef supply, with price implications that can threaten the survival of less efficient smaller plants, some small packers may need additional support to stay in business during normal times. Hence, their survival ability during normal periods without government subsidy must also be considered while promoting the smaller plants.

According to a study by Saitone et al. (2022), another take on the relationship between plant size and resilience is that larger plants may provide disease-transmission efficiency. The authors examined the effect of the Tyson vaccine mandate on health outcomes in the counties where Tyson plants are located and found that the mandate resulted in more vaccinations, fewer infections, and fewer COVID-19-related deaths, generating billions of dollars in public health savings. That may be desirable, but with larger plants comes the potential of market power that has to be considered when figuring out the tradeoffs between plant size, cost efficiency, and disease transmission efficiency.

We have other ongoing research under the umbrella of the NIFA project that tries to understand the various tradeoffs that arise in government attempts to enhance the resilience of the beef supply chain. We will report the findings from that research once it is accepted for publication in a peer-reviewed academic journal.

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