Digital Lifelines: Mobile Information and Peer Networks for Small Businesses in India*

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Abstract

This study examines the impact of two interventions on micro, small, and medium enterprises (MSMEs) in India during the COVID-19 pandemic, and how these varied by gender of firm owner. The first intervention provides information via SMS about government support schemes and simplified business registration processes. The second creates WhatsApp groups to facilitate peer-to-peer information sharing. Using a randomized controlled trial with 1,446 firms across multiple Indian states, we find positive interaction effects between the two interventions. Firms receiving both treatments were more likely to register their businesses, plan to apply for government programs, and engage with business connections. These effects were primarily driven by female-owned firms, suggesting the interventions addressed preexisting information and network gaps. Our findings highlight the potential of low-cost, mobile-based interventions in supporting MSMEs during economic crises.

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1 Introduction

Systemic crises and aggregate shocks and uncertainty can severely impact firm outcomes in the short- and long-run (De Mel et al., 2011; Guerrero-Amezaga et al., 2022; Apedo Amah et al., 2020; Bartik et al., 2020). To cope effectively, firms need to adapt quickly on several margins including adoption of new technologies and practices, securing alternative financing among others (Crescenzi et al., 2024). Micro, small and medium enterprises (MSMEs), which play a crucial role in economic growth and employment generation in developing countries, are particularly vulnerable due to widespread informality and their limited access to formal financial and insurance markets (Hsieh and Olken, 2014; Apedo-Amah et al., 2020). Informal networks may be limited and break down when shocks are correlated. Government support is then important to protect firms; but take-up may be low due to information gaps, complex application processes and requirements for firms to be formally registered. It is thus essential to identify effective policies to support firms during crises.

In this paper, we study the effects of two mobile-based interventions which sought to close information gaps via SMS messages and encourage formation of network connections on MSME firms in India during a large aggregate shock – the COVID-19 pandemic. We leverage a 10-state randomised controlled trial to answer four key questions: First, can mobile-based interventions help firms access government support? Second, how do SMS information provision and opportunities to network with other firms interact with each other? Third, are the interaction effects heterogeneous by gender? Fourth, what are the mechanisms through which these effects are realised?

The first intervention – SMS messages – provided information on the key Government support program for MSMEs, the Emergency Credit Line Guarantee program which offered formally registered firms with a pre-existing loan the option of obtaining a 20% top-up loan. We also provided information on a new simplified business registration process introduced by the Government, as firm registration was a pre-requisite for obtaining the aid. Conceptually, providing information via SMS messages can help correct knowledge gaps and provide reminders at a relatively low cost. However, the short format of the messages limit the detail that can be provided, potentially leading to confusion. Moreover, firms may be inundated with SMS messages from various sources, including spam and scam messages. Thus, they may overlook the messages or dismiss

them due to a lack of trust.

The second intervention offered firms the opportunity to form connections with other firms through random assignment to groups of firms on the popular social media platform, WhatsApp. On the one hand, these groups offer the opportunity to form business connections, share information and ideas, and learn from each other. However, these groups could crowd-out existing networks, so that the overall impacts of this intervention are ambiguous.

Combining the two interventions could lead to either *re-inforcement* or *reversal* of the effects of the individual interventions. For instance, knowledge imparted by the SMS messages could be reinforced by examples of success in obtaining Government support shared in the WhatsApp groups, leading to greater awareness and take-up of the support. Equally, discussions on the WhatsApp groups may clarify confusion caused by the SMS messages. The overall impacts of each intervention, and their combination, are thus an empirical question.

Moreover, the impacts of these interventions are likely to vary by gender. Female-led firms differ from male-led firms on several dimensions, including access to information and networks. Previous literature has documented that female-led firms have smaller business networks, which are more likely to be concentrated among relatives and friends (World Bank, 2019). They thus lack the "weak" links (Granovetter, 1973), which are important sources of novel information. Thus, the two interventions may have differential effects by gender.

To rigorously evaluate the impacts of these interventions, we conducted a randomized controlled trial (RCT) among a sample of firms who were part of the IFMR/LEAD GAME panel phone survey. This survey aimed to track the impacts of the COVID-19 pandemic and control policies on MSMEs in India. We conducted the RCT between two rounds of the survey. Our experimental design allows us to identify the impacts of each intervention individually, as well as potential interventions between the two interventions. This approach enables us to provide valuable insights into the effectiveness of different strategies for supporting MSMEs during economic crises.

Firms were randomly allocated into one of four arms, with stratification based on language and whether the owner consented to being part of the WhatsApp intervention

(70% of the sample). Our study sample comprises 1,446 firms located across 10 states in India. While this sample is not intended to be representative of all MSMEs in India, it provides valuable information about a diverse range of firms. The sample includes businesses engaged in manufacturing (47%), services (26%), and trading sectors (26%). These firms are characteristically small, with an average of 3.5 employees, and 60% are led by male owners. Our sample thus has sufficient variation to allow us to examine how intervention impacts vary by firm owner gender, firm sector and firm size.

We rolled out our interventions between April 2021 and June 2021, a period that coincided with the second wave of COVID-19 in India. To analyze the impacts of the interventions, we rely on data collected in January 2021 (pre-intervention) and July/August 2021 (post-intervention). This timing allows us to capture the immediate effects of our interventions during a critical period for these firms. However, since this period coincided with lockdowns where many firms were temporarily shut, we are unable to study intervention impacts on outcomes such as sales and profits.

The findings show that while two interventions did not individually impact firm registration status on average, there is a large and statistically significant positive interaction between the two interventions, so that firms that received both interventions increased their likelihood of being registered by 7.4 percentage points relative to the control group mean of 50.4%. The lack of an impact of the SMS intervention on its own is in line with de Mel et al. (2013) who find that providing information about the firm registration process doesn't increase registration rates in Sri Lanka. The positive interaction between the two interventions is not a result of increased awareness of the simplified registration process: among non-registered firms, we find no similar positive interaction between the two interventions in awareness of the new process or plans to register. Interestingly, the SMS intervention on its own had no impact on awareness or plans to register the business, while firms receiving the WhatsApp Groups intervention only had less knowledge about the registration process (relative to the control group) but no significant impact on plans to register.

Turning to awareness and application plans for government aid programs, we find no impacts of the interventions on program awareness, though the coefficients on the individual programs are negative. However, the SMS messages on their own lower firms' plans to apply for government aid. Though the WhatsApp groups on their own

did not impact firms' plans to apply for government aid, we find a positive interaction between the two interventions, which reverses the negative impact of the SMS messages on their own for firms which received both interventions.

We also find evidence that the interventions impacted overall firm outcomes. In particular, the WhatsApp groups on their own lowered firms' likelihood of laying off workers. However, we also find a positive interaction between the two interventions which reverses this pattern for firms receiving both interventions, while receiving the SMS messages on their own had no impacts. We detect no significant impacts on number of employees or loan applications for either intervention.

Our findings also show that the two interventions alter firm owners' networks: each intervention on its own reduce the likelihood of firm owners consulting business contacts such as clients, suppliers and lenders for business matters, suggesting potential substitution effects between the interventions and network connections. However, there is a positive interaction between the two interventions which partially reverses these negative effects for firms which received both interventions.

We then explore the heterogeneity of the intervention impacts by gender of the firm owner and firm size. We find that the intervention impacts are primarily concentrated among small firms. We also find that the intervention impacts vary by gender of firm owner. In particular, the two interventions each had negative impacts on female-led firms' likelihood of being registered, and their awareness and plans to apply for government aid, which are overturned by a large, positive interaction when offered together. We see no similar effects for male-led firms.

The interventions also had varying impacts by gender on the networks consulted by firm owners for business matters. Female-led firms are 11.2 percentage points and 12.8 percentage points less likely to consult business contacts when they receive the SMS messages or are part of the WhatsApp groups only. However, when they are offered both interventions, a large positive interaction reverses these negative effects. Female-led firms are also less likely to consult friends and family when they are placed in WhatsApp groups only (by 9.2 percentage points) or when they receive the SMS messages only (by 6.2 percentage points, though this is not statistically significant). However, there is a positiv interaction if they receive both interventions, which leads to an overall increase in the likelihood of consulting friends and family for business matters.

By contrast, there is no change in male firm owners' consultation of their networks for business matters in response to our interventions.

By examining these mobile phone-based interventions, our study contributes to the broader literature on supporting MSMEs during economic crises. We aim to shed light on the effectiveness of low-cost, scalable interventions in improving firms' access to government support, encouraging formalization, and enhancing overall business outcomes. Our findings have important implications for policymakers and development practitioners seeking to design effective support mechanisms for MSMEs, not only during the ongoing pandemic but also in preparation for future economic shocks.

Our study contributes to a small and growing literature investigating the effects of different policy interventions on improving firm resilience to crises. This literature highlights the roles of information frictions in constraining access to Government support programs (e.g. Humphries et al., 2020 for the US), access to infrastructure to allow for rapid adaptation in response to shocks (e.g. Crescenzi et al., 2024 who show that availability of high speed broadband affected firms' adaptation to the COVID-19 pandemic in Italy) and actions to reduce riskiness of supply chain networks (e.g. Balboni et al., 2024). We provide evidence on the effectiveness of two interventions and their combination on increasing awareness and access to Government support and firm outcomes among MSMEs in a low-income setting.

We also sheds novel insights into interventions seeking to facilitate the formation of network connections between firms in developing countries. Cai and Szeidl (2018) find large, positive effects of grouping MSMEs into business associations in China. However, other studies (e.g., Fafchamps and Quinn (2018)) show a limited effect of creating networks on entrepreneurs in Africa, or varied effects by country (The World Bank, 2019). Recent studies in Africa show promising evidence of effectiveness of digital platforms to increase bsuiness connections. In a pan-African RCT, Vega-Redondo et al. (2019) analyze the effect of allocating established and new entrepreneurs attending a business training course to different types of groups – in-person or virtual, and of either homogeneous or diverse nationalities – with around 60 entrepreneurs interacting on a bespoke online platform. Their findings show that the virtual interactions increase the submission of business proposals and that while group homogeneity improves proposal submission, there was a larger improvement in proposal quality from groups with na-

tionally diverse members. Asiedu et al (2025) show that female-led firms increase their business collaborations and networks when they are placed in WhatsApp Groups with other firms and encouraged to meet with each other in pairs, which in turn leads to improvement in business outcomes at least one year later. However, these effects are not sustained three years later. We complement these papers by studying the effects of randomly allocating MSMEs to WhatsApp Groups among a more diverse sample (by gender, size and sector) in India, and how these effects vary when combined with an information intervention.

2 Context and Interventions

Our study took place during the COVID pandemic in India. The Government of India introduced one of the strictest nationwide lockdowns globally with little notice on 24 March 2020, at a time when COVID cases were low. The lockdown severely restricted the operation of businesses in most sectors. It was relaxed subsequently and replaced with more localised policies. However, the lockdown had significant negative economic impacts, leading to a loss of 120 million jobs (Vyas, 2020). The Indian economy contracted by 7.9% during the 2020-21 Financial Year.

In response, the Government introduced a range of support measures. The key scheme for MSMEs was the Emergency Credit Line Guarantee Scheme (ECLGS), which provided a 20% top-up loan for enterprises with an annual turnover of less than INR 1 billion that held a loan from a bank, non-banking financial company (NBFC) or microfinance institution (MFI).

2.1 SMS Intervention

The SMS intervention (T1) involved sending two text messages to sampled business owners, providing information on the ECLGS scheme and the simplified online business registration process. The messages were translated into Tamil, Hindi, or Marathi, depending on the region, and sent to recipients sequentially. The first message focused on the simplified business registration process:

> "If you have an unregistered enterprise, you may wish to register your business as an MSME with the government. Registration can offer benefits

such as making it easier to access loans, loan extensions and capital subsidies. The process is entirely free and requires no information other than your Adhaar Number. Please use the following government-sponsored link to register: https://udyamregistration.gov.in/Government-India/Ministry-MSME-registration.htm [Note: This message was sent by IFMR as part of a research study on increasing awareness of government relief efforts.]"

The second message provided information about the ECLGS:

"If you own an MSME with annual turnover less than Rs 100 crore, and you currently hold a loan from a bank, NBFC or microenterprise, you are likely to be eligible for a 20% loan top-up through the government's 'Emergency Credit Line Guarantee Scheme' (ECLGS). If you wish to apply for this additional loan / top-up, please contact your current loan provider and ask them about the ECLGS. More information on the scheme can be found here: https://msme.gov.in/whatsnew/emergency-credit-line-guarantee-scheme-eclgs-modification-operational-guidelines [Note: This message was sent by IFMR as part of a research study on increasing awareness of government relief efforts.]"

2.2 WhatsApp Groups Intervention

The WhatsApp groups intervention (T2) aimed to exogenously group firms into WhatsApp groups of 10 members to facilitate organic conversations among business owners. This intervention provided firms with contacts for sharing information and learning about business-related issues, such as suppliers, COVID support, and coping strategies during lockdowns. The groups were created among firms that consented to being put in touch with other businesses to share information and provide support through WhatsApp during a pre-intervention round of the survey.[1]

The groups were facilitated by a local research assistant who initially called each potential group member to explain the purpose of the group and obtain their consent a

[1] Firms were asked the following question: *We are offering to put businesses like yours in touch with similar businesses in order to share information and provide support to one another through 'Whatsapp'. You will be able to participate in the group in a completely anonymous way and you will be able to leave the group whenever you want. Would you like to be put into such a group? Yes or No*

second time. Once formed, the groups were named "Krea University" for credibility. An introductory voice note was sent to each group explaining the purpose and encouraging members to introduce themselves and their businesses. Appendix A.2 provides further details of the operation of the groups.

The timing of the group formation coincided with the peak and immediate aftermath of the second COVID-19 wave in India (April in Tamil Nadu, and June in Maharashtra and the Northern states). Given the varying COVID-19 control policies across states and cities, as well as the recent opening of vaccine access to adults over 18, the groups were also used to disseminate information about vaccine appointment booking through the government's COWIN app.

The facilitator encouraged conversation by asking named business owners to share their experiences coping with COVID lockdowns, business plans as restrictions eased, any changes made relative to 2019, and how their families were spending time during lockdown, schooling disruptions for children and reactions to school re-opening. The facilitator also sought feedback from group members, ensured conversations remained focused on the core purpose of the group, and addressed any misinformation shared within the groups.

3 Experimental Design and Data

The study sample consists of 1,446 firms from various regions of India, drawn from an ongoing survey by IFMR-LEAD (IFMR-GAME survey) tracking the impacts of COVID-19 and associated control policies. The sample includes micro, small, and medium-sized enterprises (MSMEs) based in Tamil Nadu, Maharashtra, and various states in North India. It is important to note that this is a convenience sample and may not be representative of the MSME sector as a whole. Our experiment took place between the fourth and fifth rounds of the survey with 1446 firms.

Firms were randomly assigned to one of four treatment/control combinations in a stratified design:

1. $T1 = 1$, $T2 = 1$: 254 firms received the SMS information intervention and were placed in WhatsApp groups.

2. T1 = 1, T2 = 0: 470 firms received the SMS information intervention but were not placed in WhatsApp groups.

3. T1 = 0, T2 = 1: 253 firms were placed in WhatsApp groups but did not receive the SMS information intervention.

4. T1 = 0, T2 = 0: 470 firms served as the pure control group, receiving neither intervention.

The randomization was stratified by language group (Tamil, Marathi, or Hindi) and consent to receive WhatsApp messages and be placed in groups with similar firms. 70% of the 1,446 firms consented to being placed in the WhatsApp groups. Within T2, firms were randomly allocated into groups of 10 firms within the language group stratum.[2]

The interventions were rolled out in a staggered manner by region, starting in Tamil Nadu in April 2021, followed by Maharashtra and the Northern states in June 2021.[3]

3.1 Data

We draw on the fourth and fifth rounds of the IFMR-GAME survey, conducted in January 2021 and July/August 2021 respectively, for our analysis. The surveys collected information on firm status and characteristics (sector, gender of firm owner, operational status, firm size, registration status), firm performance (sales and profits as a percentage of pre-COVID sales and profits), firm practices and any changes in response to the COVID crisis, how firms were coping to the COVID crisis including awareness of and take-up of government programs, sources of information and networks, and firm owners' wellbeing.

1,446 firms were surveyed in round 4. Of these, 74 firms had permanently closed by round 5, and a further 195 (13%) attrited between rounds 4 and 5. The attrition is not significantly different across the treatment groups. Moreover, we do not find any significant differences in the characteristics of those who attrit and those who do not attrit.

[2]Firms were from a range of sectors and were widely distributed in space so firms in the same group are likely to be from a range of sectors and locations.

[3]The Northern states and Maharashtra were hit very severely by the Delta wave of COVID in April-May 2021, delaying intervention rollout in these states.

3.2 Balance Tests

To ensure the randomization was successful, we conducted balance tests computing pairwise t-tests for the difference in means across the four groups. The variables used for these tests include baseline outcome variables, such as information on whether the firm was registered, or applied for a loan, and firm characteristics, such as owner's gender, firm size and sector.

Table 1: Sample Balance

	(1) 0	(2) 1	(3) 2	(4) 3	T-test Difference					
Variable	Mean/SE	Mean/SE	Mean/SE	Mean/SE	(1)-(2)	(1)-(3)	(1)-(4)	(2)-(3)	(2)-(4)	(3)-(4)
Male	0.608	0.598	0.545	0.528	0.010	0.062	0.080	0.052	0.070	0.018
	(0.023)	(0.023)	(0.031)	(0.031)						
Firm is registered	0.473	0.498	0.628	0.535	-0.025	-0.155*	-0.062	-0.131	-0.038	0.093**
	(0.023)	(0.023)	(0.030)	(0.031)						
Sector: Manufacturing	0.478	0.404	0.518	0.433	0.073**	-0.040	0.045	-0.114**	-0.029	0.085**
	(0.023)	(0.023)	(0.031)	(0.031)						
Sector: Services	0.262	0.296	0.292	0.335	-0.033	-0.030	-0.072	0.003	-0.039	-0.042
	(0.020)	(0.021)	(0.029)	(0.030)						
Sector: Trading	0.260	0.300	0.190	0.232	-0.040	0.070	0.028	0.110**	0.068	-0.043
	(0.020)	(0.021)	(0.025)	(0.027)						
Number of Employees	3.531	2.910	3.632	3.391	0.621	-0.101	0.140	-0.722	-0.481	0.241
	(0.306)	(0.238)	(0.539)	(0.324)						
Applied for loan	0.335	0.340	0.383	0.311	-0.006	-0.049	0.024	-0.043	0.029	0.072*
	(0.022)	(0.022)	(0.031)	(0.029)						
N	469	470	253	254						
F-test of joint significance (F-stat)					1.460	1.084	1.226	1.670	1.092	1.771
F-test, number of observations					939	722	723	723	724	507

Notes: The value displayed for t-tests are the differences in the means across the groups. The value displayed for F-tests are the F-statistics. Standard errors are robust. The covariate variables MH_dum, TN_dum, and whatsapp_consent are included in all estimation regressions. All missing values in balance variables are treated as zero.***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

Table 2: Sample Balance

	(1) 0	(2) 1	(3) 2	(4) 3	T-test Difference					
Variable	Mean/SE	Mean/SE	Mean/SE	Mean/SE	(1)-(2)	(1)-(3)	(1)-(4)	(2)-(3)	(2)-(4)	(3)-(4)
Received loan	0.694	0.700	0.680	0.671	-0.006	0.014	0.023	0.020	0.029	0.010
	(0.012)	(0.012)	(0.018)	(0.016)						
Aware of gov. progr.	0.239	0.223	0.304	0.307	0.015	-0.066	-0.068	-0.081	-0.084	-0.003
	(0.020)	(0.019)	(0.029)	(0.029)						
Received gov. progr.	0.030	0.038	0.043	0.047	-0.008	-0.014	-0.017	-0.005	-0.009*	-0.004
	(0.008)	(0.009)	(0.013)	(0.013)						
Fully Operational	0.503	0.489	0.470	0.476	0.014	0.033	0.027	0.019	0.013	-0.006
	(0.023)	(0.023)	(0.031)	(0.031)						
Partly Operational	0.409	0.423	0.403	0.409	-0.014	0.006	-0.000	0.020	0.014	-0.006
	(0.023)	(0.023)	(0.031)	(0.031)						
Temporarily Closed	0.087	0.087	0.126	0.114	0.000	-0.039	-0.027	-0.039	-0.027	0.012
	(0.013)	(0.013)	(0.021)	(0.020)						
Perc. of pre-C19 revenue	42.219	42.437	43.571	41.874	-0.218	-1.352	0.345	-1.134	0.563	1.697
	(1.142)	(1.117)	(1.603)	(1.495)						
Perc. of pre-C19 profit	29.530	30.388	29.475	26.282	-0.858	0.055	3.248	0.912	4.105	3.193
	(1.187)	(1.154)	(1.546)	(1.432)						
N	469	470	253	254						
F-test of joint significance (F-stat)					0.259	0.922	0.878	1.360	1.498	0.629
F-test, number of observations					939	722	723	723	724	507

Notes: The value displayed for t-tests are the differences in the means across the groups. The value displayed for F-tests are the F-statistics. Standard errors are robust. The covariate variables MH_dum, TN_dum, and whatsapp_consent are included in all estimation regressions. All missing values in balance variables are treated as zero.***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

The results of the balance tests are presented in Tables 1 and 2. While randomization was overall successful, there are a few statistically significant differences across treatment groups. These differences are small in magnitude and are unlikely to significantly affect our results. However, we will control for these variables in our main analysis to account for any potential imbalances.[4]

4 Empirical Strategy

To assess the causal impact of our interventions on the various outcomes of interest, we exploit the random variation from our RCT design to disentangle the effects of each intervention individually as well as their combined impact in supporting MSMEs during the COVID-19 pandemic.

Our main specification is designed to capture the effects of both the SMS intervention (T1) and the WhatsApp group intervention (T2), as well as their potential interaction. This approach allows us to not only understand the individual impacts of each intervention but also to explore whether there are complementarities or substitution effects between the two. The specification is as follows:

$$Outcome_{it} = \alpha + \beta_1 T1_{it} + \beta_2 T2_{it} + \beta_3 T1 * T2_{it} + G'_{it}\gamma + R'_i + \varepsilon_{it} \quad (1)$$

In this equation, $Outcome_{it}$ represents the outcome variable for firm or business owner i at time t. This could be any of our key outcomes of interest, such as business registration status, awareness of government programs, or measures of who do firm owners consult with. The variables $T1_{it}$ and $T2_{it}$ are indicator variables for the SMS and WhatsApp interventions respectively, taking the value 1 if the firm was assigned to that intervention and 0 otherwise. The interaction term $T1 * T2_{it}$ captures the combined effect of both interventions, allowing us to assess whether there are synergies between the two approaches.

We include a vector of control variables, G'_{it}, which encompasses various firm-level characteristics that may influence our outcomes of interest. These controls help to

[4]Results in the Appendix show that removing these control variables from the regressions does not significantly affect our results significantly

improve the precision of our estimates and account for any potential imbalances across treatment groups. The term R_i' represents a set of strata dummies that account for our randomization strategy, including factors such as consent to participate in WhatsApp groups, and the primary language spoken by the firm owner.

For certain outcomes, particularly those where we have baseline data, we employ an ANCOVA (Analysis of Covariance) approach by including the baseline value of the outcome variable in our set of controls, G_{it}'.

Our main outcomes are the firms' registration status, whether they are aware of the government programs, whether they plan to apply to government programs, awareness of registration and whether they have plans to register. Our secondary outcomes are the number of employees, a dummy for whether they had to lay off employees, whether they have applied for a loan, whether they consult about business with friends and family and whether they consult about business with their existing business connections, such as their clients, suppliers and lenders.

5 Results

Table 3: Main outcomes

	registration status	aware gov prog	plan apply gov prog	aware register (c)	plan register (c)
T1 (info)	0.009	-0.045	-0.042*	0.002	0.014
	(0.033)	(0.032)	(0.022)	(0.044)	(0.048)
T2 (WG)	-0.038	-0.061	-0.010	-0.148***	-0.033
	(0.042)	(0.042)	(0.031)	(0.057)	(0.064)
T1 x T2	0.103*	0.039	0.068*	0.026	-0.074
	(0.056)	(0.055)	(0.041)	(0.075)	(0.087)
Observations	1177	1177	1177	550	550
control mean	0.503	0.374	0.129	0.265	0.339
control sd	0.501	0.484	0.336	0.442	0.474
dep var (R4)	Yes	Yes	No	No	No

Note: Robust standard errors are in parentheses. **p <0.10, ** p <0.05, *** p <0.01.*

Our analysis reveals several key findings regarding the impact of the SMS information

Table 4: Secondary outcomes

	num employees	laid off	apply loan	consult busin friends family	consult busin business con
T1 (info)	0.095	-0.005	-0.014	-0.034	-0.057**
	(0.321)	(0.027)	(0.030)	(0.031)	(0.028)
T2 (WG)	0.702	-0.078**	-0.042	-0.042	-0.068*
	(0.517)	(0.034)	(0.037)	(0.038)	(0.035)
T1 x T2	-0.591	0.095**	0.068	0.076	0.079*
	(0.569)	(0.046)	(0.050)	(0.050)	(0.046)
Observations	1168	1177	1177	1177	1177
control mean	2.508	0.184	0.221	0.771	0.229
control sd	5.913	0.388	0.416	0.421	0.421
dep var (R4)	Yes	Yes	Yes	Yes	Yes
T1 FWER p-val	0.960	0.960	0.960	0.841	0.358
T2 FWER p-val	0.754	0.233	0.841	0.841	0.413
T1 x T2 FWER p-val	0.841	0.358	0.754	0.664	0.525

Note: Robust standard errors are in parentheses. *$p<0.10$, ** $p<0.05$, *** $p<0.01$.

intervention (T1) and the WhatsApp groups intervention (T2) on MSMEs in India. Table 5 presents the main results, while Table 5 presents results for the secondary outcomes.

Results show that neither intervention individually had a significant impact on firm registration status. However, we observe a positive and statistically significant complementarity between the two interventions for this outcome. This complementarity does not appear to stem from increased awareness of the simplified registration process. Among non-registered firms, we find no complementarity between the two interventions in awareness of the new process or plans to register. The SMS intervention alone did not affect awareness or plans to register the business. Firms receiving only the WhatsApp Groups intervention showed less knowledge about the registration process compared to the control group, but this did not significantly impact their plans to register.

Regarding awareness and application plans for government aid programs, we find no significant impacts of the interventions on program awareness, although the coefficients

for the individual interventions are negative. The SMS messages alone were associated with a decrease in firms' plans to apply for government aid. While the WhatsApp groups by themselves did not significantly affect firms' plans to apply for government aid, we again observe a positive complementarity between the two interventions. This interaction effect counteracts the negative impact of the SMS messages for firms that received both interventions.

We find that firms receiving both interventions (T1 and T2) were more likely to be registered and plan to apply for government programs. The coefficient for the interaction term (T1 x T2) is positive and statistically significant for both registration status (0.103 (0.056)), and planning to apply for government programs (0.068(0.041)).These findings highlight the complex nature of information dissemination and its effects on firm behavior. They suggest that while individual interventions may have limited or even unexpected effects, combining different approaches can yield distinct outcomes. This underscores the importance of considering multi-faceted strategies when designing support programs for small businesses, particularly in challenging economic environments.

Our analysis also reveals impacts of the interventions on broader firm outcomes. Notably, firms participating solely in the WhatsApp groups exhibited a lower likelihood of laying off workers. However, we observe an interesting complementarity between the two interventions: firms receiving both the SMS messages and WhatsApp group access showed a reversal of this trend. The SMS intervention alone did not yield significant effects on employee retention, or on applying for loans. It's worth noting that we do not detect any statistically significant impacts on the overall number of employees or on loan application behavior for either intervention.

Furthermore, our findings suggest that the interventions influenced firm owners' professional networks. Both interventions, when implemented individually, were associated with a reduced likelihood of firm owners consulting business contacts such as clients, suppliers, and lender on business matters. This observation hints at potential substitution effects between the interventions and the firms' existing network connections. Interestingly, we find a positive complementarity between the two interventions in this regard. For firms that received both the SMS messages and participated in WhatsApp groups, this complementarity substantially mitigated the negative effects observed in the single-intervention groups, almost returning consultation rates to baseline levels.

Firms in the combined treatment group (T1 and T2) were more likely to lay off employees (0.095(0.046)) but also more likely to consult with business connections about business issues (0.079(0.046)). This suggests that while the interventions may have led to some short-term employment adjustments, they also encouraged firms to engage more with their business networks. As before, these results offer evidence of the complex interplay between information provision, peer networking, and firm behavior. They suggest that while individual interventions may alter firms' reliance on traditional business networks, combining interventions can lead to more nuanced outcomes. This highlights again the importance of considering both the individual and combined effects of support mechanisms when designing programs for small businesses.

5.1 Heterogeneity by Gender

Our analysis reveals significant heterogeneity in the impact of the interventions when considering the gender of the firm owner, see Tables 5 and 6. This heterogeneity provides important insights into how different groups respond to information provision and networking opportunities, and highlights the need for tailored approaches in supporting micro, small, and medium enterprises (MSMEs).

For female-led firms, we observe a complex pattern of effects. When offered individually, both the SMS intervention and the WhatsApp group participation had negative impacts on several key outcomes. Specifically, female-led firms receiving either intervention in isolation were slightly less likely to be registered and showed reduced awareness of and plans to apply for government aid programs. This finding is particularly noteworthy as it suggests that isolated interventions might inadvertently disadvantage female entrepreneurs.

However, a striking reversal occurs when female-led firms receive both interventions simultaneously. Female-owned firms benefited from both the interventions in terms of business registration and awareness of government programs. The coefficient for T1 x T2 for females is positive and significant for registration status (0.149 (0.085)) and planning to apply for government programs (0.104(0.052)). We find a large, positive complementarity effect that not only negates the negative impacts of the individual interventions but potentially leads to improved outcomes. This synergy between the SMS messages and WhatsApp group participation for female-led firms shows the importance

Table 5: Main outcomes by gender

	registration status	aware gov prog	plan apply gov prog	aware register (c)	plan register (c)
T1 (info)	-0.013	-0.085*	-0.040	-0.081	-0.046
	(0.050)	(0.043)	(0.031)	(0.062)	(0.072)
T2 (WG)	-0.060	-0.071	-0.045	-0.166**	-0.069
	(0.062)	(0.057)	(0.036)	(0.077)	(0.089)
T1 x T2	0.149*	0.091	0.104**	0.037	-0.031
	(0.085)	(0.075)	(0.052)	(0.101)	(0.123)
T1 x male	0.040	0.072	-0.004	0.171*	0.116
	(0.066)	(0.061)	(0.043)	(0.089)	(0.095)
T2 x male	0.048	0.029	0.066	0.034	0.063
	(0.079)	(0.077)	(0.056)	(0.104)	(0.120)
T1 x T2 x male	-0.077	-0.086	-0.064	0.003	-0.088
	(0.111)	(0.107)	(0.080)	(0.154)	(0.171)
Male	0.170***	0.220***	0.036	-0.025	-0.219***
	(0.051)	(0.048)	(0.038)	(0.070)	(0.076)
Observations	1177	1177	1177	550	550
control mean	0.503	0.374	0.129	0.265	0.339
control sd	0.501	0.484	0.336	0.442	0.474
dep var (R4)	Yes	Yes	No	No	No

Note: Robust standard errors are in parentheses. *$p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: Secondary outcomes by gender

	num employees	laid off	apply loan	consult busin friends family	consult busin business con
T1 (info)	0.307	0.009	-0.021	-0.062	-0.112***
	(0.215)	(0.045)	(0.046)	(0.045)	(0.039)
T2 (WG)	0.106	-0.123***	-0.048	-0.092*	-0.128***
	(0.389)	(0.047)	(0.055)	(0.052)	(0.046)
T1 x T2	-0.148	0.183***	0.055	0.206***	0.201***
	(0.474)	(0.071)	(0.075)	(0.069)	(0.063)
T1 x male	-0.363	-0.026	0.011	0.049	0.095*
	(0.580)	(0.057)	(0.060)	(0.061)	(0.055)
T2 x male	1.114	0.078	0.011	0.094	0.110*
	(0.874)	(0.062)	(0.070)	(0.071)	(0.065)
T1 x T2 x male	-0.751	-0.169*	0.028	-0.239**	-0.217**
	(1.057)	(0.092)	(0.101)	(0.099)	(0.091)
Male	1.432***	-0.083*	0.023	0.073	0.028
	(0.459)	(0.046)	(0.046)	(0.047)	(0.044)
Observations	1168	1177	1177	1177	1177
control mean	2.508	0.184	0.221	0.771	0.229
control sd	5.913	0.388	0.416	0.421	0.421
dep var (R4)	Yes	Yes	Yes	No	No

Note: Robust standard errors are in parentheses. *$p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

of multi-faceted support strategies for women entrepreneurs.

Interestingly, we do not observe similar effects for male-led firms. The lack of significant impacts - either positive or negative - on male-led firms across these outcomes suggests that male entrepreneurs might be less sensitive to these types of interventions, or that they may have alternative sources of information and support.

The interventions also had notable impacts on the business networks utilized by firm owners, with clear gender-based differences. Female-led firms receiving either the SMS messages or WhatsApp group access alone were less likely to consult business contacts such as clients, suppliers, or lenders for business matters. This reduction in professional network utilization could potentially be detrimental to their business operations. However, when female entrepreneurs received both interventions, we again observe a large positive complementarity. This combined effect not only nullifies the negative impact of individual interventions but leads to an overall increase in the likelihood of consulting business contacts.

A similar pattern emerges in female entrepreneurs' interactions with friends and family for business matters. When exposed to either the SMS intervention or WhatsApp groups individually, female-led firms showed a decreased likelihood of consulting friends and family. Yet, the combination of both interventions produced a positive complementarity, resulting in an increased probability of seeking advice from personal networks for business-related issues. Results for the probability of laying off employees also go in the same direction.

In stark contrast, male firm owners showed no significant changes in their consultation patterns with either professional or personal networks in response to our interventions. This gender disparity in network utilization responses highlights the different ways in which male and female entrepreneurs may leverage and respond to new information and networking opportunities.

These findings have important implications for policy design and implementation. They suggest that female entrepreneurs may be more responsive to interventions aimed at providing information and expanding networks, but that these interventions need to be carefully designed and implemented. The negative effects of individual interventions on female-led firms are concerning and warrant further investigation. However, the

strong positive complementarities observed when combining interventions point to the potential benefits of comprehensive support programs for women entrepreneurs.

Our results show the importance of considering gender-specific needs and responses when designing support programs for MSMEs. While our interventions showed limited impacts on male-led firms, they significantly influenced the behavior and outcomes of female-led businesses, suggesting that targeted approaches may be necessary to effectively support diverse groups of entrepreneurs.

6 Robustness

Table 7: Main Outcomes: Small Firms

	registration status	aware gov prog	plan apply gov prog	aware register (c)	plan register (c)
T1 (info)	0.002	-0.053	-0.045*	-0.010	-0.002
	(0.034)	(0.033)	(0.023)	(0.045)	(0.050)
T2 (WG)	-0.039	-0.071	-0.021	-0.179***	-0.044
	(0.044)	(0.044)	(0.032)	(0.058)	(0.066)
T1 x T2	0.120**	0.042	0.087**	0.056	-0.052
	(0.058)	(0.058)	(0.043)	(0.078)	(0.090)
Observations	1065	1065	1065	516	516
control mean	0.486	0.373	0.130	0.275	0.348
control sd	0.501	0.484	0.337	0.448	0.478
dep var (R4)	Yes	Yes	No	No	No

Note: Robust standard errors are in parentheses. *$p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

In this section we will discuss some robustness checks we run. First, in table 7 we restrict the sample to very small firms, those without employees, and reassuringly we find that results for our main outcome variables remain the same, if not stronger. We also find this complementarity between both interventions. Second, in table 8 we first check whether our interventions affected the probability that in April the firm was temporarily closed. Given that our interventions started in April, we would not expect to observe effects in this variable, and it could then be used as a placebo. Reassuringly, the coefficients we estimate are very small and not statistically significant. In the

Table 8: Robustness

	April temp closed	permanently closed	consult C19 friends family	Consult C19 business con
T1 (info)	-0.021	-0.007	-0.045	-0.016
	(0.032)	(0.014)	(0.027)	(0.021)
T2 (WG)	0.014	-0.011	-0.006	-0.014
	(0.041)	(0.017)	(0.034)	(0.029)
T1 x T2	-0.002	0.032	0.058	-0.004
	(0.054)	(0.025)	(0.045)	(0.037)
Observations	1177	1446	1177	1177
control mean	0.395	0.000	0.850	0.103
control sd	0.489	0.000	0.358	0.304
dep var (R4)	No	No	No	No

Note: Robust standard errors are in parentheses. *$*p <0.10$, ** $p <0.05$, *** $p <0.01$.

second column we use a dummy variable for whether the firm is permanently closed in round 5 as a dependent variable. As before, it is reassuring that we find no effects of our interventions in this variable. Finally, we use as dependent variables whether respondents claimed to have discussed issues related to COVID-19 with family and friends, or with their business contacts. The fact that we find no effects shows that our interventions, while encouraging communications related to business issues, did not encourage other types of communication.

7 Discussion and Conclusion

Our study provides valuable insights into the effectiveness of mobile-based information provision and peer networking interventions in supporting micro, small, and medium enterprises (MSMEs) during the COVID-19 pandemic in India. The findings reveal a complex picture of how these interventions impact firm behavior, awareness of government programs, and overall business outcomes, with particularly noteworthy heterogeneity across gender lines.

One of the most striking results of our study is the complementarity between the SMS information campaign and the WhatsApp networking groups. While these interventions

often had limited or even negative effects when implemented in isolation, their combination frequently led to positive outcomes. This synergy was particularly evident in firm registration status and plans to apply for government aid programs. These findings suggest that a holistic approach to information dissemination and networking may be more effective than single-pronged interventions.

Our results indicate that providing information through SMS or creating peer networks via WhatsApp groups does not automatically translate into increased awareness or uptake of government programs. In fact, in some cases, these interventions when implemented alone appeared to discourage firms from engaging with government aid. This unexpected finding highlights the complexity of information processing and decision-making among small business owners, and cautions against assuming that merely providing information will lead to desired outcomes.

Perhaps the most significant contribution of our study lies in uncovering the substantial gender disparities in how firms respond to these interventions. Female-led businesses showed markedly different responses compared to their male-led counterparts. The negative impacts of individual interventions on female-led firms' registration status, awareness, and plans to apply for government aid are concerning and merit serious consideration. However, the strong positive effects observed when these women entrepreneurs received both interventions point to the potential for well-designed, comprehensive support programs to significantly benefit female-led MSMEs.

The gender differences extended to networking behaviors as well. Our interventions significantly altered how female entrepreneurs interacted with their business and personal networks, while male-led firms showed little change in this regard. These findings suggest that female entrepreneurs, being less exposed to information and useful networks, may be more responsive to external support and information, but also potentially more vulnerable to unintended negative consequences of poorly designed interventions.

From a policy perspective, our results carry several important implications. First, they highlight the need for careful design and testing of support programs for MSMEs. Second, our findings strongly argue for gender-sensitive approaches in MSME support programs. The stark differences in responses between male and female-led firms suggest that one-size-fits-all policies may be ineffective or even detrimental for certain groups. Policymakers and program designers should consider the specific needs and behaviors

of female entrepreneurs when crafting support measures. Third, the complementarities we observed between different types of interventions advocate for more integrated, multi-faceted support strategies. While more complex to implement, such approaches may yield significantly better outcomes, particularly for vulnerable groups like female entrepreneurs.

Our study also opens up several avenues for future research. The mechanisms behind the observed gender differences in responses to interventions warrant further investigation. Additionally, longer-term studies could shed light on whether the impacts we observed persist over time and translate into sustained improvements in firm performance and resilience.

Furthermore, while our study focused on the context of the COVID-19 pandemic in India, future research could explore whether similar patterns hold in different economic contexts or geographic regions. The potential for mobile-based interventions to support MSMEs in other developing countries, particularly in times of economic stress, is a promising area for further studies.

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APPENDIX

A Intervention Details

A.1 SMS Intervention

The moderator sent the SMS messages to the firms in treatment group T1 prior to the creation of the WhatsApp Groups for treatment group T2. In addition, we sent SMS messages on new information provided in the WhatsApp Groups on how to access the COVID-19 vaccine via the Government of India's COWIN app at a similar time as when it was sent to the groups.

A.2 WhatsApp Group Intervention

The procedure for setting up WhatsApp groups was as follows. First, over the course of a week, the moderator called all firms that (i) had agreed to be put in contact with other similar firms via WhatsApp, and (ii) were randomly allocated to T2. During this intial call, the moderator followed this script: *"Hello xxx! How are you doing? Hope you and your family are keeping well. I hope you remember us, we called you during November 2020 to ask you about your business and we conducted a survey. We are calling from Krea University. During the survey you had said that you wanted to be a part of a WhatsApp group with other businesses to discuss recent news and updates. We will be adding you to a group now with 9 other businesses from all over your state. Hope that is ok? Please know that this group is created just for you and all other businesses like yours. Please feel free to send any latest news you hear about businesses, how you recovered from the pandemic, what you are doing about your employees etc. We created small groups so that it is easy for everyone to talk and discuss. You can send your messages as voice notes, texts, anything. If you have any questions, please do feel free to ask me. Thank you for your time and I look forward to the discussions on the group!"*

Thereafter, the moderator created the WhatsApp Groups according to groups created randomly (within State) by the research team.

Once the groups were created, the moderator sent the following voice note created with

a female voice: *"Hi Everyone. Good afternoon/evening, hope you and your families are all keeping safe! :) I hope you remember us, we had contacted you all during November for a survey on your business. My name is X and I am from Chennai. My company's name is LEAD at Krea University, and we want to help small businesses grow. For our survey we spoke to over 2000 businesses from all over India. We have created this WhatsApp group as all of you are from xx state. Thank you again for your time when you spoke to us in November, we used all your answers to write many articles in magazines, newspapers and even reports for the Government so we can help small businesses. This group is created because we are all from xxx state, and we can share the latest information and news about our businesses and help each other. It is completely free! This group is only created so we can discuss ideas and the latest information. We are not from the Government. :) Let us keep this group active! Please feel free to share any news, WhatsApp messages, etc. that you think will help other businesses. But let's start with introducing ourselves- Everyone, please tell others your name and what business you have."*

Since small firm owners may not be very technologically savvy, the moderator shared a video (https://www.youtube.com/watch?v=Zh2QROg5aMA) explaining how one can send a voice note on WhatsApp. The moderator then sent a message to each group encouraging members to send voice notes as shown in the video or messages to communicate with fellow group members. The exact message in the voice note was: *"Hi everyone! Please send voice messages like how it is shown in the video to discuss in the group, or you can also send messages. Whatever you feel comfortable with."*

To encourage interaction in the groups, the moderator then sent the following message/voice note, tagging each group member in turn: *"Hi! So nice to meet you, can you please tell us your name and a little bit about your business, please? If you'd like you can also share your business experience during last year and you can also ask everyone some questions. feel free :) "*

The moderator also sent information and questions to all groups on a weekly basis to encourage interactions. The content of the questions focused on issues such as: (i) how to avail of COVID vaccines via the Government of India's COWIN App, (ii) the impacts of COVID and lockdown on group members' families and businesses, (iii) business related ideas (changes in customer preferences, challenges faced by firms and

ideas for adapting), (iv) firm owners' reactions to the lifting of the second lockdown; and (v) how firm owners' families were coping with the pandemic related disruption (e.g. disruption to children's education, school re-opening and safety, covid vaccination status, how families were spending their time during the second lockdown).

There was active moderation of the groups for between 3 (in the Northern states and Maharashtra) and almost 6 months (Tamil Nadu). Moderation ceased in September 2021, but the groups will continued beyond this period. In March 2022, we sent a message to group members and called them to check whether they wanted to continue to be part of the groups.

B Additional Tables

Table B1: Main outcomes: Results without controls

	registration status	aware gov prog	plan apply gov prog	aware register (c)	plan register (c)
T1 (info)	0.003	-0.055*	-0.047**	-0.003	0.003
	(0.033)	(0.033)	(0.022)	(0.045)	(0.049)
T2 (WG)	-0.037	-0.054	-0.007	-0.137**	-0.030
	(0.042)	(0.043)	(0.031)	(0.056)	(0.064)
T1 x T2	0.102*	0.035	0.067	0.021	-0.058
	(0.056)	(0.056)	(0.041)	(0.075)	(0.086)
Observations	1177	1177	1177	550	550
control mean	0.503	0.374	0.129	0.265	0.339
control sd	0.501	0.484	0.336	0.442	0.474
dep var (R4)	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors are in parentheses. **p <0.10, ** p <0.05, *** p <0.01*. Only strata control variables are included in the regressions