Management as a basis for innovation: Evidence from randomized experiments and repeated surveys in Vietnam

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Background

- Mixed impact of business training intervention
  - ✓ McKenzie and Woodruff [2014 WBRO]

- Long-term firm dynamics after intervention
  - ✓ Quasi-experiment: Giorcelli [2016 mimeo]
  - ✓ Experiment: Bloom et al. [2017 mimeo]; Bruhn et al. [2017 JPE]

- Managerial capability as a basis for innovation
  - ✓ World Bank [2017] "Innovation Paradox"

What We Do

- RCT of management training for Vietnamese small manufacturers in 2010
- Standard ILO module and production management
- Follow-up survey in 2011, 2013, and 2016

Findings

5 years after the training, treated enterprises are

- more likely to survive
- having higher business performance

Mechanism: Sustainably improved management skill, continued learning, and innovative activity

Related Literature

Established literature on enterprise survival

- Dunne et al. [1989 QJE], Evans [1987 JPE], and many more (both theory and empirics) mostly focusing on enterprise size, age, and human capital of entrepreneurs

- Recently, Bloom et al. [2012 AMP] find that better management is associated with enterprise survival among medium to large manufacturers

-> This is the case for small manufacturers in the developing world

Small but growing literature on identification of "gazelles"

- Diao et al. [2016 mimeo]; Fafchamps and Woodruff [2017 WBER]; Grimm et al. [2012 WD]; McKenzie [2017 AER]

-> Training works as a screening device

Outline

Experimental design
- ✓ Study site
- ✓ Timeline
- ✓ Intervention

Empirical specification

Results

Next step

Study Site

- Over 2,000 village-based <u>industrial clusters</u> all over Vietnam have contributed to economic growth after Doi moi [Oostendorp et al., 2009 WD]

- We focus on two industrial clusters in the suburb of Hanoi: knitwear and construction steel

-> Heterogeneity to be controlled is relatively small

-> Innovation is observable (to some extent)

- We have benchmark information collected by repeated visits and surveys [Nam et al., 2009 JDS; 2010 JCE]

Crafts villages in
Hà Tây, Hà Nội and Bac Ninh Provinces in 2006

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Steel cluster

Knitwear cluster

The various crafts:

- ● Bamboo, rattan, rush
- ● Wickerwork and palm leaves
- ● Wooden furniture
- ○ Mother-of-pearl inlaying and lacquers

- ◆ Embroidery
- ◆ Textiles
- ◇ Food processing and processed foods

- ■ Metalwork
- ■ Building trades
- □ Paper

- ■ Multi-activity
- □ Other

Hà Nội urbanized zone
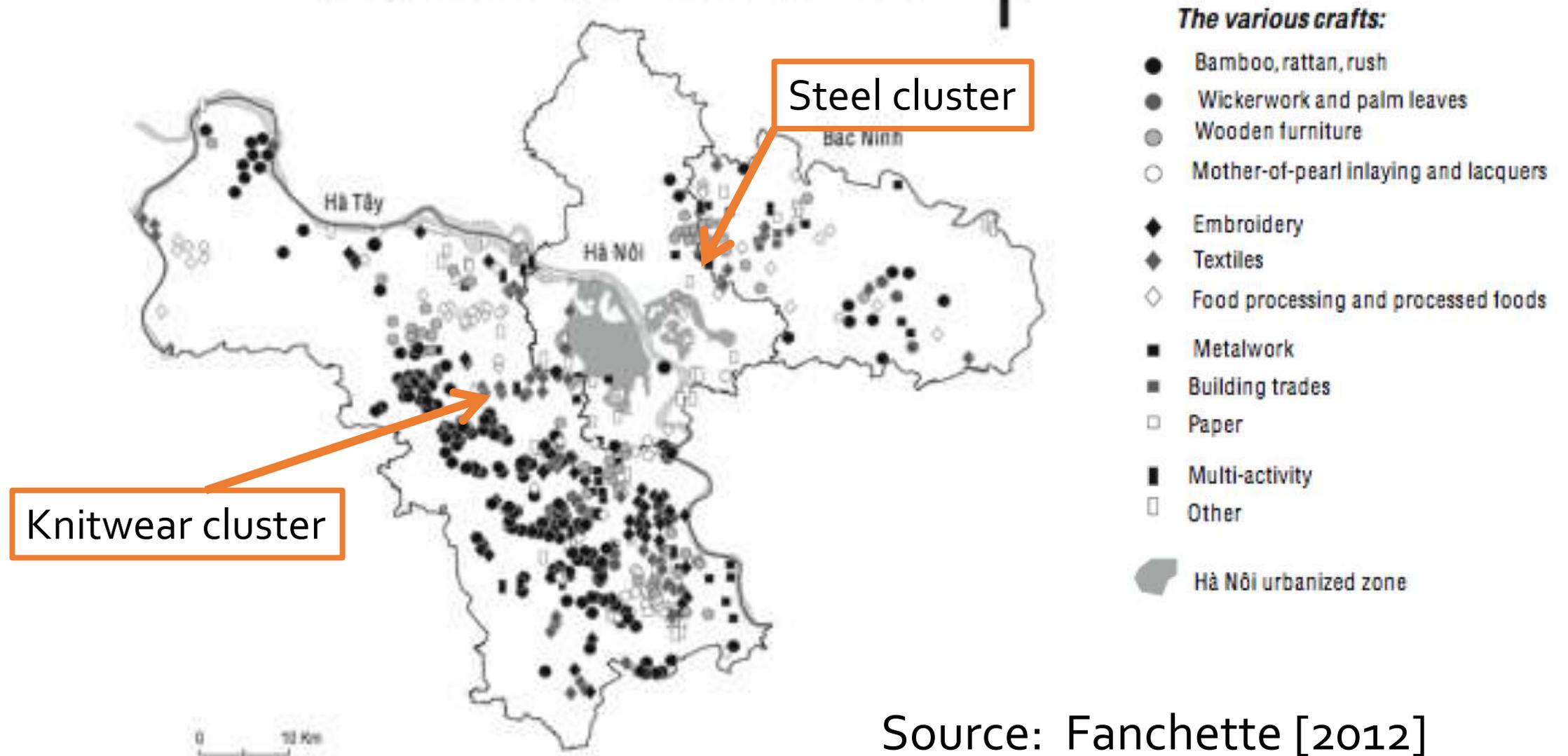
Source: Fanchette [2012]

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Basic Statistics

	Knitwear (mean) [median]	Steel (mean) [median]
	N=159	N=153
Years of education	8.1	6.8
Past training experience [=1 if yes]	0.13	0.03
Real sales revenue in 2008 [1,000 USD]	259 [113]	1,767 [1,197]
Real value added in 2008 [1,000 USD]	75 [29]	114 [69]
# of employees in 2008	18 [8]	20 [19]

Timeline

- Baseline survey (2010 Jun.)
- Classroom training (2010 Jun. - Sep.)
- Interim survey (2010 Sep.)
- On-site training (2010 Dec. - 2011 Feb.)
- 1st follow-up survey (2011 Apr.)
- 2nd follow-up survey (2013 Jan.) [Higuchi et al., 2015 JEBO]
- 3rd follow-up survey (2016 Jan.)

Training

Classroom training

- Lectures and workshop: 40 hours
- ILO module (entrepreneurship, marketing, and record keeping) and production management
- 93 / 197 participated (ITT < TOT)

On-site training

- Instructors visited each enterprise: half day * several rounds
- Mostly production management
- 90 / 90 received the consultation (ITT = TOT)

Training

- Japanese expert of *Kaizen*: Japan-pioneered production management
- Basis of Toyota production system and origin of lean manufacturing
- Common-sense, low-cost, and human-friendly approach (capital investment is not necessarily required)
- Local consultants with ILO's qualification
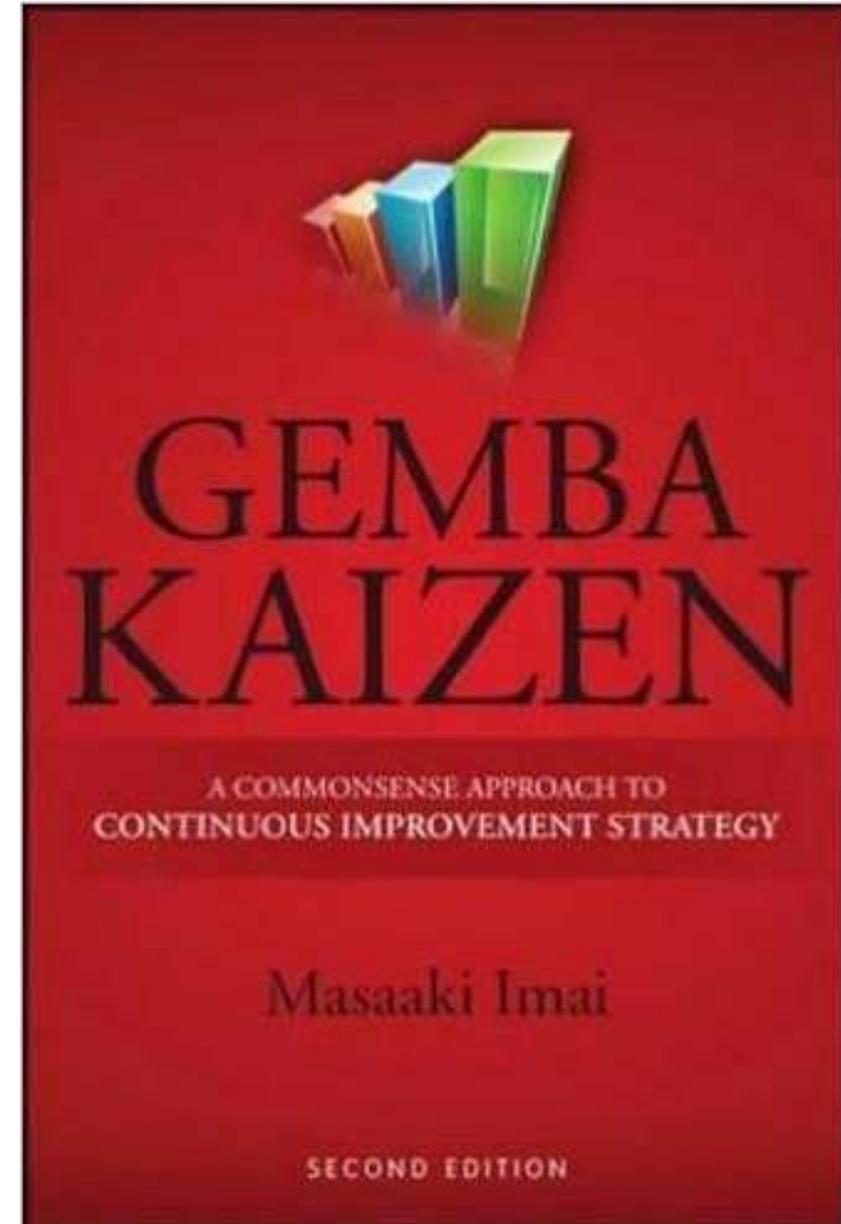
Sample Size

Group	Classroom	On-site	Knitwear	Steel
Class + Onsite	Invited	Invited	32	32
Class-only	Invited	Not	57	76
Onsite-only	Not	Invited	16	10
Control	Not	Not	54	35
Total			159	153

TABLE 2—BALANCE CHECK

	(1) Steel Class + On-site mean	(2) Steel Class-only mean	(3) Steel On-site-only mean	(4) Steel Control mean	(5) Steel (1), (2), (3) v.s. (4) p-value	(6) Knitwear Class + On-site mean	(7) Knitwear Class-only mean	(8) Knitwear On-site-only mean	(9) Knitwear Control mean	(10) Knitwear (6), (7), (8) v.s. (9) p-value
Panel A: Control variable										
Age	40.19	38.47	38.60	37.74	0.43	38.81	39.19	37.31	39.20	0.80
(as of the baseline)	(6.84)	(7.77)	(7.76)	(8.88)		(8.05)	(9.50)	(8.56)	(11.22)	
Male	0.47	0.43	0.50	0.57	0.21	0.28	0.42	0.44	0.35	0.72
(yes = 1)	(0.51)	(0.50)	(0.53)	(0.50)		(0.46)	(0.50)	(0.51)	(0.48)	
Years of education	6.81	6.79	6.20	7.17	0.43	7.75	7.98	8.63	8.50	0.32
	(2.86)	(2.60)	(2.94)	(3.25)		(2.27)	(2.88)	(3.40)	(3.21)	
Business training experience	0.03	0.01	0.10	0.03	0.92	0.16	0.14	0.25	0.06	0.06
(yes = 1)	(0.18)	(0.11)	(0.32)	(0.17)		(0.37)	(0.35)	(0.45)	(0.23)	
Panel B: Outcome variable										
Baseline *Kaizen* score	7.25	6.63	6.60	6.17	0.03	3.63	3.58	4.44	3.80	0.76
(0-11)	(1.44)	(1.45)	(1.84)	(1.46)		(1.16)	(1.28)	(2.19)	(1.28)	
Baseline management score	N.A.	N.A.	N.A.	N.A.	N.A.	13.22	12.81	15.25	13.30	1.00
	N.A.	N.A.	N.A.	N.A.		(2.72)	(2.13)	(5.11)	(2.93)	
Baseline employment size	25.19	18.70	22.70	19.37	0.59	18.09	11.74	31.75	22.41	0.33
	(15.88)	(11.88)	(18.26)	(12.43)		(30.50)	(13.97)	(48.35)	(45.58)	
Baseline sales revenue	31,509	25,757	40,529	26,316	0.67	4,094	2,783	5,697	4,340	0.40
	(23,117)	(29,649)	(39,269)	(20,369)		(3,694)	(3,323)	(7,823)	(7,150)	
Baseline value added	1,876	1,690	2,367	1,744	0.89	1,162	733	1,468	1,438	0.25
	(1,505)	(2,425)	(2,195)	(1,641)		(1,393)	(1,121)	(2,615)	(3,496)	
Joint orthogonality p-value					0.54					0.47
No. enterprises in the group	32	76	10	35	153	32	57	16	54	159

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Regression Specification

$$y_{it} = \alpha + \beta^{BOTH}_t Z^{BOTH}_i + \beta^{CLASS}_t Z^{CLASS}_i + \beta^{ONSITE}_t Z^{ONSITE}_i + y_{i0} + \eta_t + \varepsilon_{it}. \qquad (1)$$

- y_{it} = outcome variable
- Z_i = 1 if invited to our training program (ITT)
- y_{i0} = baseline value of outcome variable (if available) [McKenzie, 2012 JDE]: ANCOVA specification
- η_t = time dummies
- ε_{it} = error term clustered at the enterprise-level
- We also estimate LATE-type specification [Imbens and Angrist, 1994 ECMA]: Replace Z_i with P_i, which takes one 1 if participated in training program and use Z_i as an instrument of P_i

Survival (Knitwear|Steel)
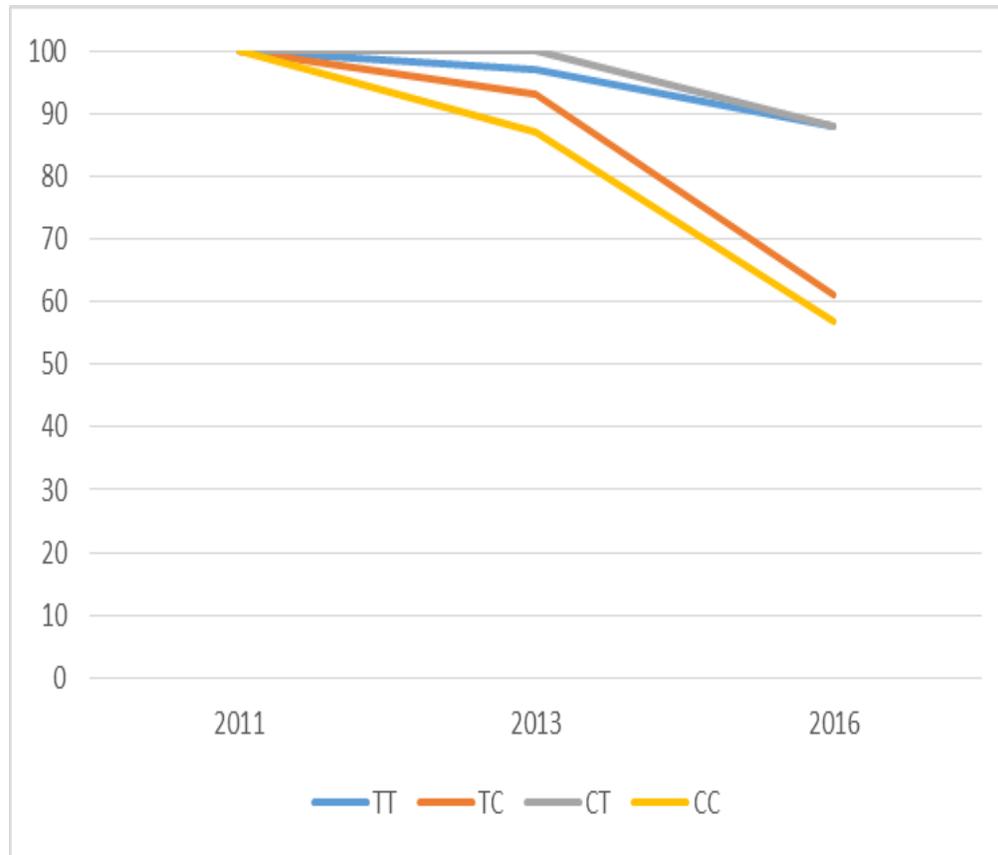
- 5 year survival rate: 68% in knitwear and 58% in steel cluster
- Information from the exit enterprises ("missing" enterprises in the 3rd follow-up survey was only 5 in knitwear and 0 in steel cluster)

Results (survival)

TABLE 4—TRAINING IMPACT (TWO CLUSTERS POOLED, ITT)

	Sample size	1st follow-up	2nd follow-up	3rd follow-up	P-value equality	P-value all zero
Panel A: Survival (yes = 1)						
Class+Onsite	619		0.13***	0.32***	0.03	0.00
			(0.049)	(0.080)		
Class-only			0.036	0.17**	0.10	0.06
			(0.050)	(0.072)		
Onsite-only			-0.029	0.29***	0.00	0.00
			(0.086)	(0.10)		
Control mean			0.84	0.48		

- Class+Onsite had largest impacts in both clusters
- In the knitwear cluster, onsite-only had significant impacts whereas classroom-only did not
- In the steel cluster, class-only had significant impacts whereas onsite-only did not

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Results (value added)

	Sample size	1st follow-up	2nd follow-up	3rd follow-up	P-value equality	P-value all zero
Panel B: Unconditional Value Added (in mil. VND = 50 USD)						
Class+Onsite	931	550.1*	483.4**	526.5*	0.97	0.02
		(328.5)	(188.9)	(342.1)		
Class-only		119.9	160.5	270.8	0.87	0.39
		(233.1)	(133.2)	(197.6)		
Onsite-only		235.5	165.6	598.4	0.56	0.47
		(536.7)	(240.9)	(401.1)		
Control mean		1637.8	696.7	298.2		
Panel C: Conditional Value Added (in mil. VND = 50 USD)						
Class+Onsite	783	557.0*	360.1*	496.1	0.81	0.09
		(298.2)	(197.5)	(477.0)		
Class-only		162.9	202.5	416.8	0.82	0.33
		(203.8)	(134.8)	(352.4)		
Onsite-only		250.1	466.3**	761.6	0.74	0.07
		(500.6)	(199.3)	(501.6)		
Control mean		1637.8	826.0	637.9		

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Results (value added: training pooled)

	Sample size	1st follow-up	2nd follow-up	3rd follow-up	*P*-value equality	*P*-value all zero
Panel B': Unconditional Value Added (in mil. VND = 50 USD)						
Training (any)	931	252.9	250.3**	381.0**	0.83	0.04
		(219.9)	(120.6)	(189.7)		
Control mean		1637.8	696.7	298.2		
Panel C': Conditional Value Added (in mil. VND = 50 USD)						
Training (any)	783	283.8	276.0**	491.2	0.81	0.06
		(196.2)	(123.0)	(330.8)		
Control mean		1637.8	826.0	637.9		

Robustness (value added)

- In log-like transformation
- Winsorizing/trimming top 1/5 percent
- Controlling for record keeping score
- Randomization inference

Management Score

Kaizen score [Higuchi et al. 2015]

- Information on adopted production management practices
- Based on 11 yes/no diagnostic criteria
- Enumerators' visual inspection and/or entrepreneurs' response

McKenzie and Woodruff (MW) score [2016 *Management Science*]

- Information on adopted marketing, procuring, record keeping, and financial planning practices
- Based on 26 yes/no diagnostic criteria
- Entrepreneurs' response

Kaizen Score

The enterprise has a designated area for each production/activity within the workshop.
The enterprise has a fixed place where major tools are stored.
The storage of tools is put in order by kinds.
The enterprise has a fixed place where raw materials are stored.
The raw materials are stored separately from the scrap.
The work flow line is determined.
The defectives of raw materials and finished products are clearly segregated from good ones.

Based on the owners' response

The scraps are removed and the floor is cleaned every day.
The workers maintain machines every day.
The enterprise holds meeting in which all workers participate.
The proprietor knows how long each production process takes.

Management Score (Knitwear|Steel)
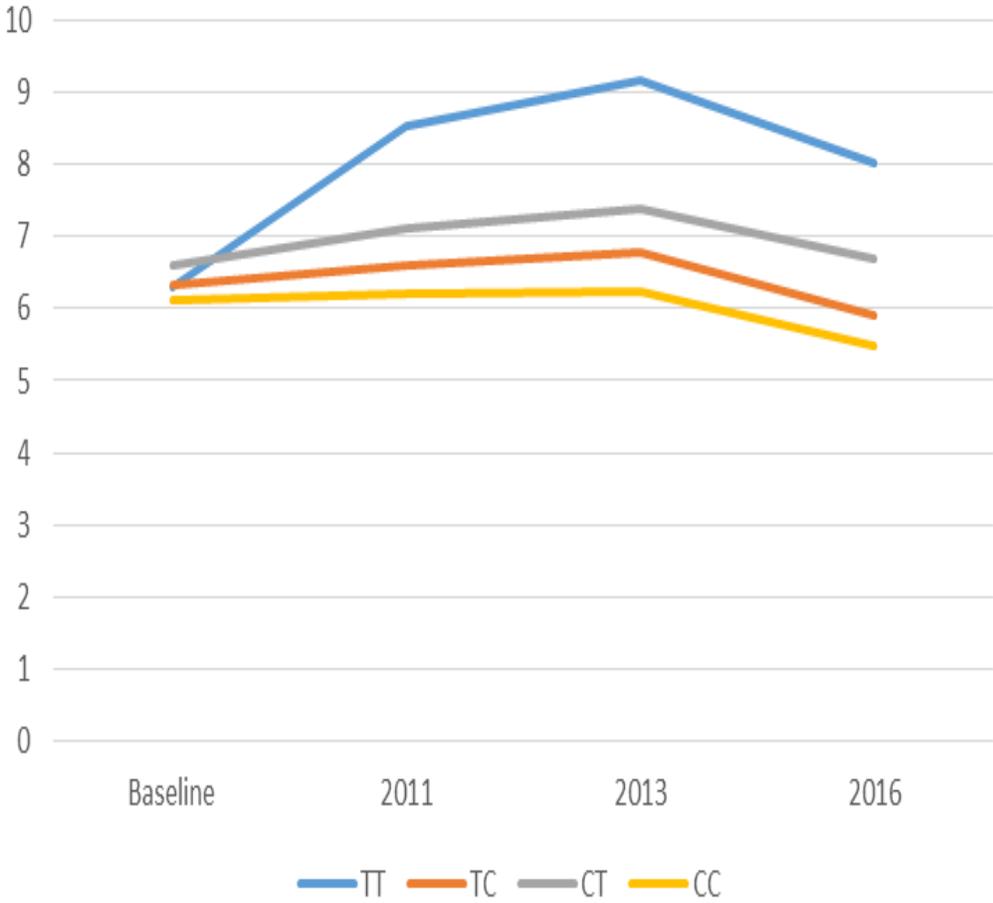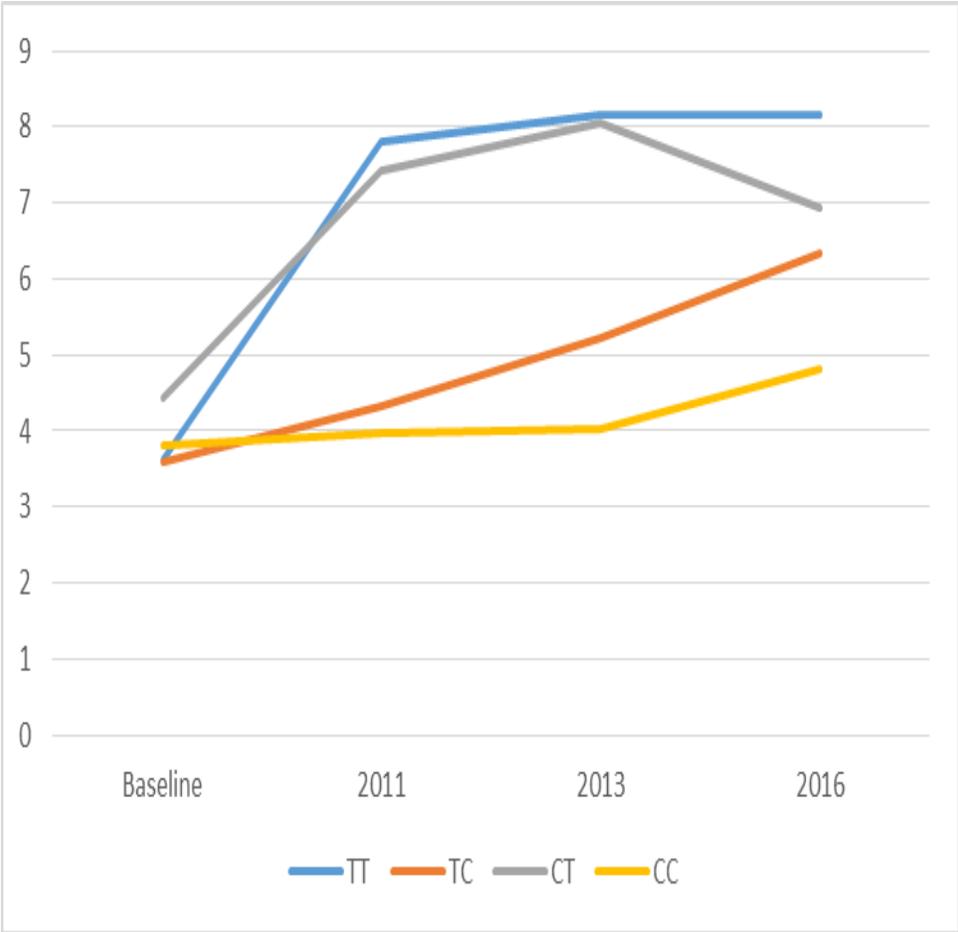
MW Score (only in 2016)

Group	Knitwear (mean)	Knitwear [median]	Steel (mean)	Steel [median]
Class + Onsite	12.4	[12.5]	8.0	[6.5]
Class-only	8.3	[9.0]	7.1	[6.0]
Onsite-only	11.0	[7.5]	7.3	[6.5]
Control	5.7	[6.0]	7.4	[6.0]
Total	9.0	[7.5]	7.4	[6]

Continued Learning and Innovation

	=1 if definitely willing to learn mgmt	=1 if participated in training (2011-2015)	=1 if invited external consultant (2015)	= 1 if introduced an upgraded product	=1 if have a concrete plan to introduce new product	= 1 if confident in producing new product
Class+Onsite	0.76***	0.089	0.67***	0.28***	0.17***	0.38***
	(10.58)	(1.26)	(11.26)	(3.29)	(3.14)	(5.54)
Class-only	0.33***	0.034	0.14***	0.11	0.12***	0.18***
	(4.45)	(0.66)	(2.94)	(1.59)	(2.73)	(3.45)
Onsite-only	0.41***	0.22*	0.73***	0.15	0.10	0.20**
	(3.74)	(1.90)	(8.87)	(1.29)	(1.45)	(2.08)
Training (any)	0.49***	0.11**	0.40***	0.16**	0.13***	0.24***
	(7.63)	(2.40)	(7.29)	(2.57)	(3.42)	(5.09)
Control mean	0.156	0.039	0.022	0.186	0.081	0.116

Innovation (product upgrading)
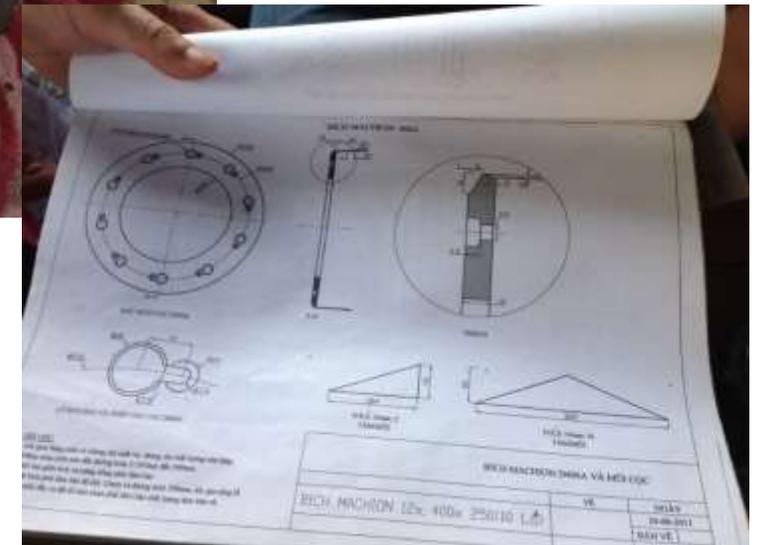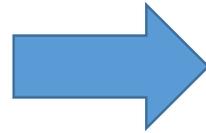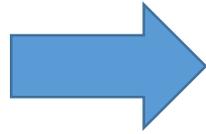
Results (mechanism)

	Sample size	1st follow-up	2nd follow-up	3rd follow-up	P-value equality	P-value all zero
Panel D: Kaizen Score (0-11)						
Class+Onsite	780	3.238	3.639	2.523	0.00	0.00
		(0.245)	(0.212)	(0.360)		
Class-only		0.643	0.992	0.811	0.04	0.00
		(0.221)	(0.221)	(0.339)		
Onsite-only		2.407	2.990	1.449	0.00	0.00
		(0.265)	(0.257)	(0.381)		
Control mean		4.85	4.87	5.18		
Panel F: Entrepreneurial Spirit (0-7)						
Class+Onsite	504	0.534		2.027	0.00	0.00
		(0.070)		(0.212)		
Class-only		0.250		0.720	0.01	0.00
		(0.058)		(0.188)		
Onsite-only		0.272		1.447	0.00	0.00
		(0.098)		(0.272)		
Control mean		0.10		0.89		

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Summary

- Training has impacts on management capability, continued learning, and innovative activity
- Training can be a trigger for long-term firm dynamics
- The combination of classroom and on-site training worked best
  - ✓ Quantity of training matters
  - ✓ Production management (*Kaizen*) component is most likely useful

-> More research is warranted for policy making

Next Step (Vietnam)

- Issue of scalability
  - ✓ Training by local trainers had weaker impacts than training under close supervision of international researchers [Berge et al., 2012 J Af E]
  - ✓ Fischer and Karlan [2015 AER PP]
- Training by local consultants in a cluster producing bedding items
- Focus only on *Kaizen* to analyze its pure impact
  - ✓ Anderson et al. [2016 mimeo]

Next Step (Argentina)

- Intensive training to vendors of Japanese transportation and/or electronic equipment manufacturers
- We will evaluate
  - ✓ training impact on business/management
  - ✓ training impact on workers (including stress measure using biomarker)
  - ✓ spillover effect on upstream firms

Supply Chain Network