ASQ EVIDENCE PRESENTATION PDW:
HOW TO VISUALIZE YOUR DATA AND WHY IT IS IMPORTANT

TECHNOLOGY REEMERGENCE:
Creating New Markets for Old Technologies, Swiss Mechanical Watchmaking 1970–2008

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Click link below for open access to the ASQ article:
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Background:
Research Question and Contribution

How and why does demand for a legacy technology rematerialize to achieve substantive and sustained market growth?

Contribution:

"This study uncovers the **process and mechanisms associated with technology reemergence**: the resurgence of substantive and sustained demand for a legacy technology following the introduction of a new dominant design."

The Challenge

Publishing an…

- inductive,
- theory-building,
- industry/field level study

That draws on…

- qualitative and quantitative data,
- and longitudinal analysis

With the goal of introducing a new theoretical construct

- (i.e., “technology reemergence”).

Questions I faced during the review process

- How to present qualitative and quantitative data in an inductive (theory-building) paper?

- Which data to include as evidence to adequately illustrate the (38-year) longitudinal evolution a field/industry?

- How to illustrate the impact of multiple actors across multiple levels-of-analysis?

(in ~45 pages)

Questions:

Presentation of Evidence

- How to present qualitative and quantitative data in an inductive (theory-building) paper?

- Which data to include as evidence to adequately illustrate the (38-year) longitudinal evolution a field/industry?

- How to depict the impact of multiple actors across multiple levels-of-analysis?

(in ~45 pages)

Using data to illustrate the initial hook/puzzle

Using archival data to introduce the theoretical and phenomenological puzzle

State of the Swiss Watchmaking Industry: 1983

"Now we bid farewell to the master craftsmen who have brought us these wonders of the mechanical arts… ***Their time has come and probably gone.***"

(Landes, 1983:359)

State of the Swiss Watchmaking Industry: 2008

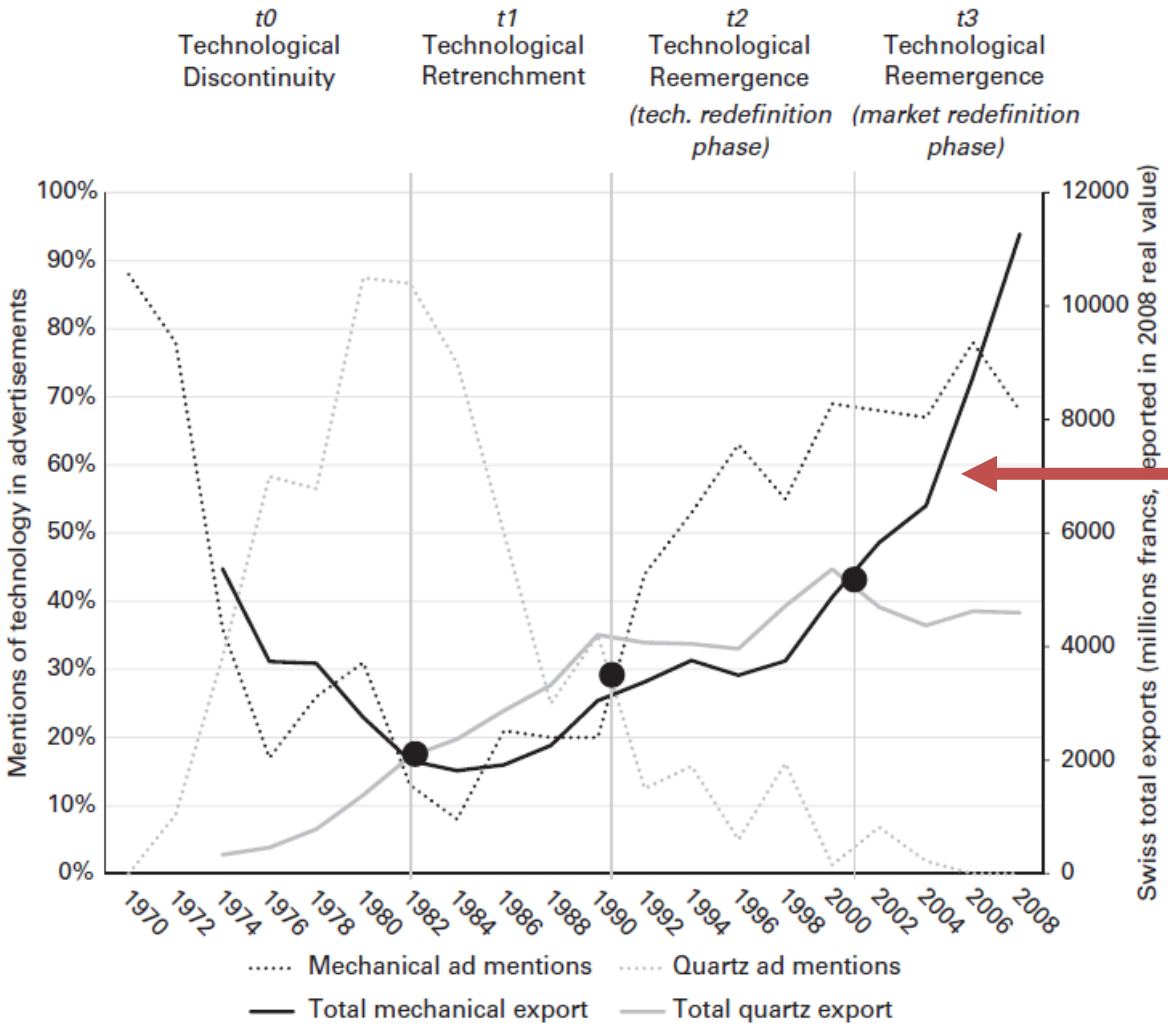
"The watch industry is today, as it was yesterday, ***one of the brightest stars in the Swiss economic firmament.*** Better still, during the last five or six years, it has taken the leading position amongst the country's most successful industries."

(Federation of the Swiss Watch Industry, 2008)

Using archival data to introduce the theoretical and phenomenological puzzle

Using a graph to help visualize the hook:

Figure 1. Trajectory of the Swiss mechanical watch.*



How did this unexpected reemergence happen?

Presenting qualitative and quantitative data in an inductive (theory-building) paper

Presenting qualitative and quantitative data in an inductive (theory-building) paper

Primary data

- Trade journal print advertisements (n=845)
- Field Interviews (n=136)

Secondary data

- Archival CEO interviews (n=27) and industry data
- Focus Groups (n=42 people)
- Field Observation (attended a watchmaking course)
- Non-participant observation

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Presenting qualitative and quantitative evidence

Qualitative Data	Quantitative Data
• Induce mechanisms • Identify descriptive, axial, and theoretical codes. • Create initial codebook • Reinforce patterns found in quantitative data.	• Illustrate high-level trends • Distinguish longitudinal shifts between periods • Triangulate trends induced in interviews • Develop a longitudinal process model

Using codebooks to build reviewers' confidence in your analysis

Table B1. Codebook

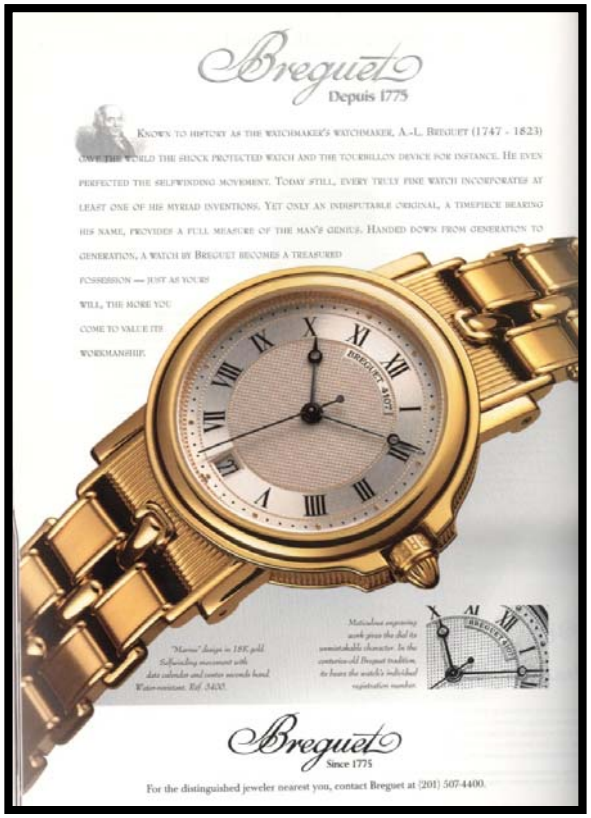
Article Identifier	Code ID	Textual Coding: Common words/phrases	Textual Coding: Examples of coding of text	Visual Coding: Visual cues	Visual Coding: Example of coding of visual cue
Mentions of technology	Mechanical	"mechanical" "mechanical movement" "self-winding" "hand-winding" "winding stem" "automatic" "balance spring" "mainspring" "escapement" "rotor"	 *Text in ad to left:* "The watch is water resistant, has a sapphire crystal and an **automatic** Ulysse Nardin **movement.** The San Marco is a rare masterpiece, assembled entirely by hand and destined for both enthusiasts and collectors of fine **mechanical watches.**" *Other example*: "Kelek **automatic mechanical** diving watch intended for professionals."	Ads that expose the internal mechanism of the watch (balance wheel, gear train, mainspring, etc.) Ads that show side-by-side displays of the watch—one showing the face of the watch and the other exposing the internal mechanisms of the watch	 This ad shows both the face of the watch and the internal mechanisms.
	Quartz	"quartz" "quartz movement" "electronic" "electronic timekeeping" "battery operated" "integrated circuit" "stepping motor" "digital" "digital display"	 *Text in ad to left:* "Longines, leaders in **electronic timekeeping**" *Other example*: "The spell of a new concept Hublot, the perfection of Swiss technology with an exclusive natural rubber strap. **Quartz movement,** waterproof 5 ATM."	Ads that show a quartz digital time display, or internal mechanisms of a quartz watch, like the integrated circuit or the quartz crystal	 This ad shows the quartz digital time display.
Recombining values	Precision: Focus on exactitude of the watch as an instrument for accurate timekeeping	"precise instrument" "made/manufactured to the highest level of precision" "love of precision detail" "accurate" "never loses a second" "never loses a beat" "never fails" "durability under duress" "keeps perfect time underwater" "on time" "chronometer"	 *Text in ad to left:* "High precision attested by official rating-certificates..." *Other example*: "Ernst Benz: Precision instruments for timekeeping."	Ads that show watchmakers or individuals testing the watch's ability to keep time Ads that show close-ups of the movement of the watch's timing function, sometimes under duress because of weather, atmospheric pressure, water, or heavy use	 This ad explains the watch is accurate enough to serve as a timekeeper for Olympic athletes.

To view the entire codebook and online appendix:
https://journals.sagepub.com/doi/suppl/10.1177/0001839218778505/suppl_file/DS_10.1177_0001839218778505.pdf

Presenting archival and interview data to induce a set of novel mechanisms.

Mechanism: Temporal Distancing

Illustrative advertisements:



"Breguet. Since 1775. Known to history as the watchmaker's watchmaker."

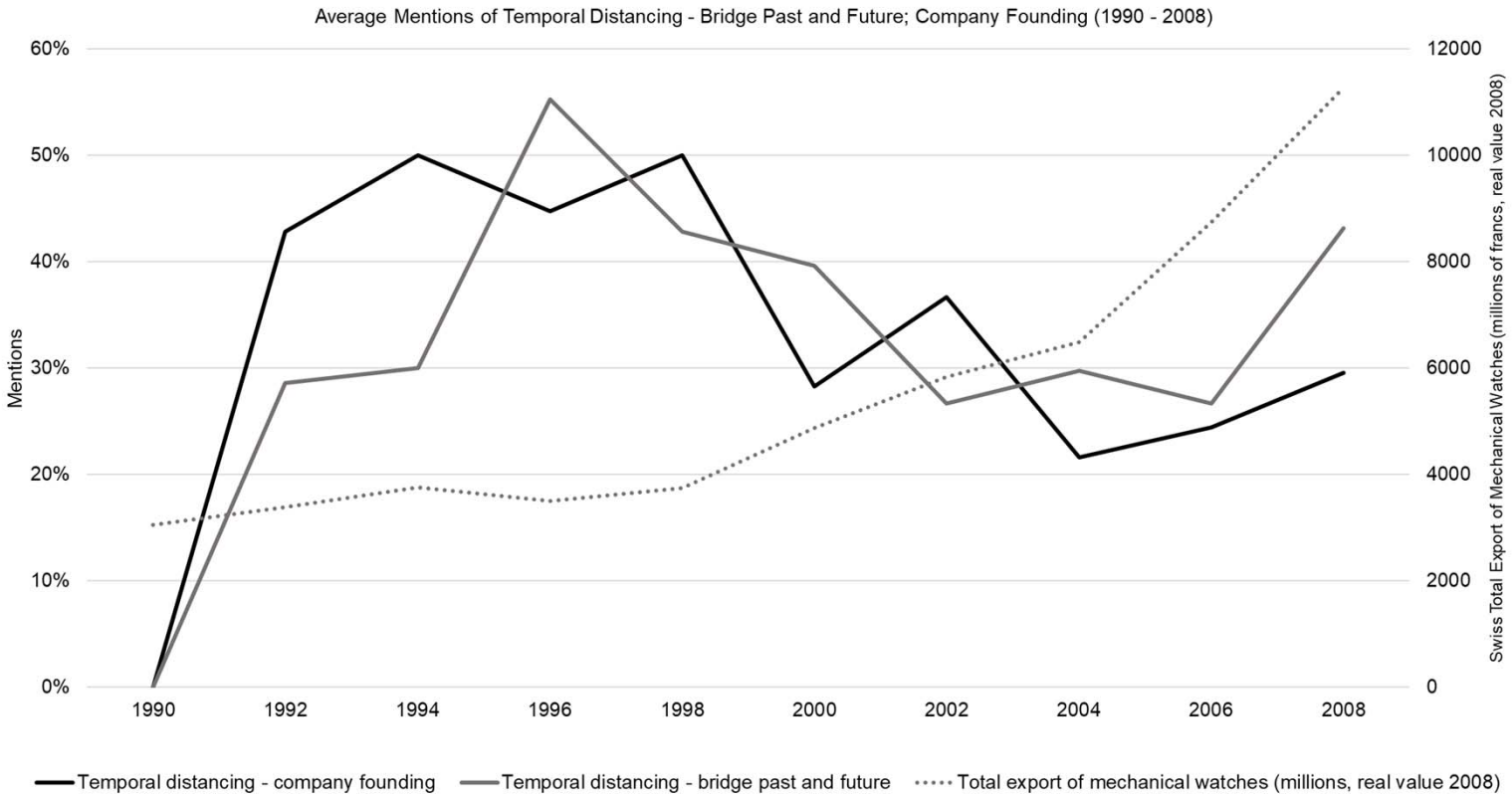
"Vacheron Constantin. The world's oldest watch manufacturer. Geneva 1755"

Illustrative interview quotes:

As one company historian explained, "We take care to distance ourselves from the [quartz] crisis. We prefer to go back to the founding of our business when we mention mechanical watches."

Mechanism: Temporal Distancing

Illustrative graphs:



Mechanism: Recombining Values

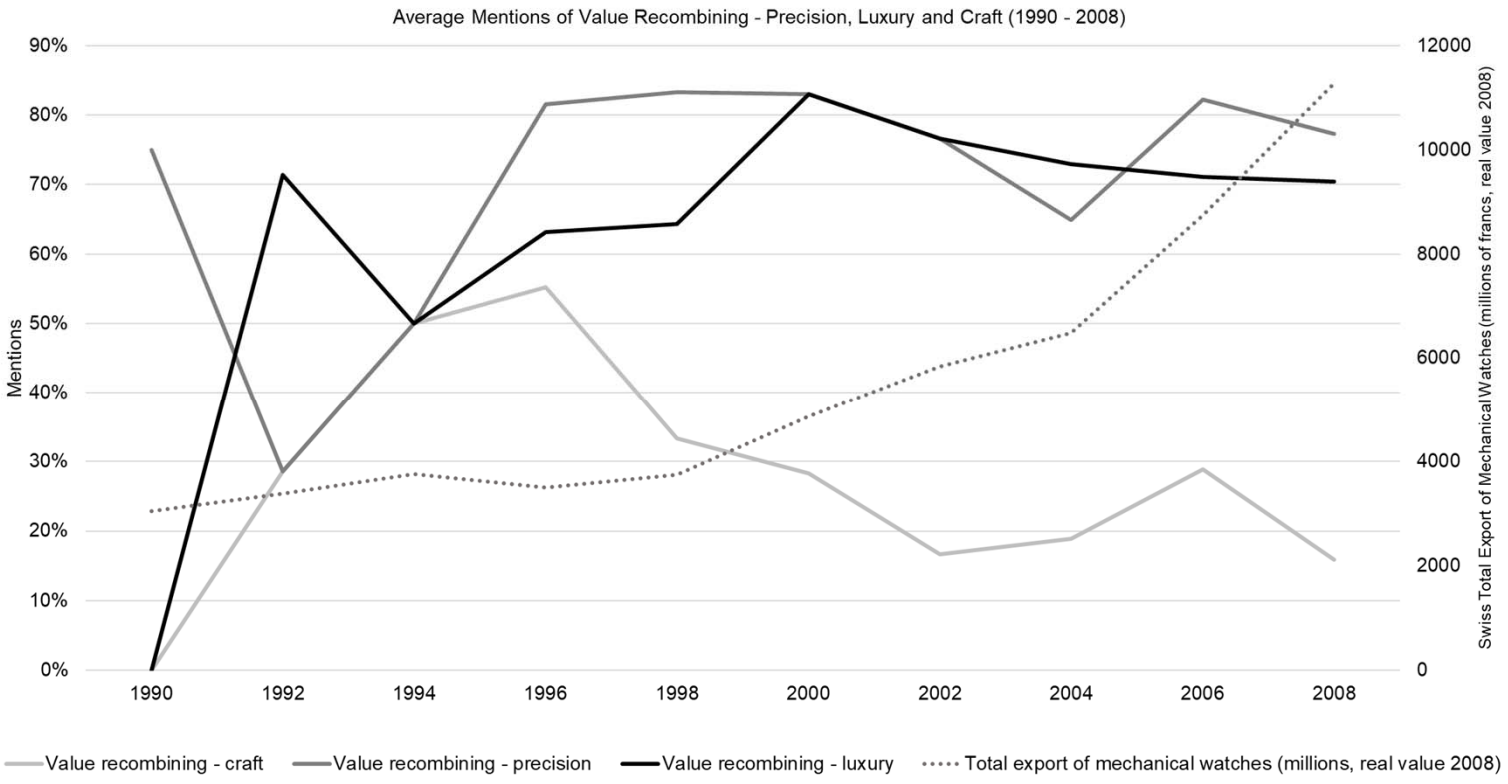
Illustrative advertisements:

Illustrative interview quotes:

"An industry veteran I interviewed noted that most firms began to combine these two elements: 'Your mechanical Rolex or your Patek is a portable status symbol. It shows your status, your bank account, your power.'"

Mechanism: Value Recombining

Illustrative graphs:



Triangulating common patterns over a 38-year period

Figure 2. Average mentions of value recombination—precision, luxury, and craft—in ads during technological reemergence (1990–2008).

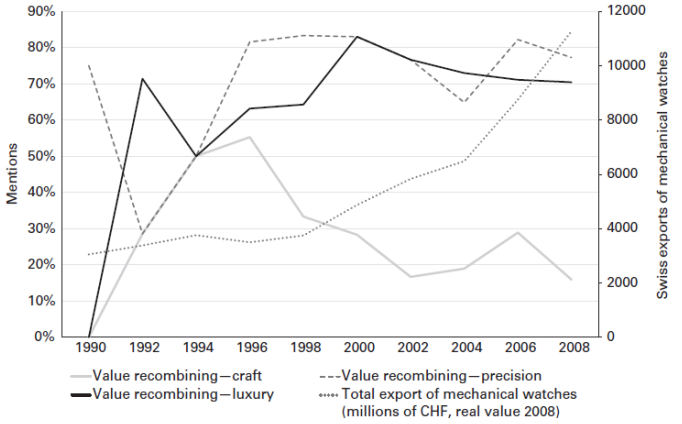


Figure 3. Average mentions of temporal distancing in ads during technological reemergence (1990–2008).

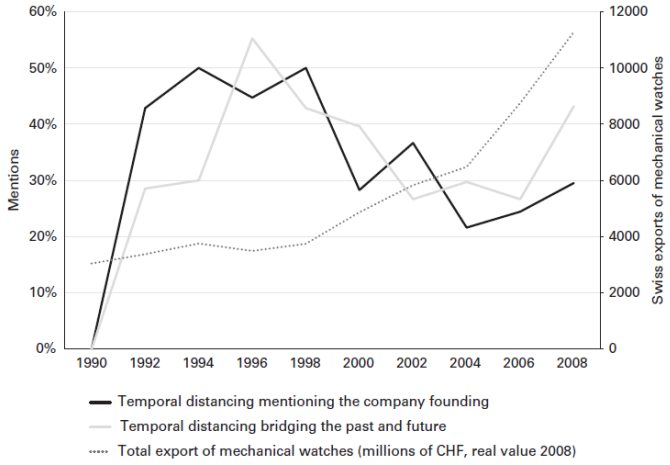


Figure 4. Average use of conceptual bridging—metaphors and similes— in ads during technological reemergence (1990–2008).

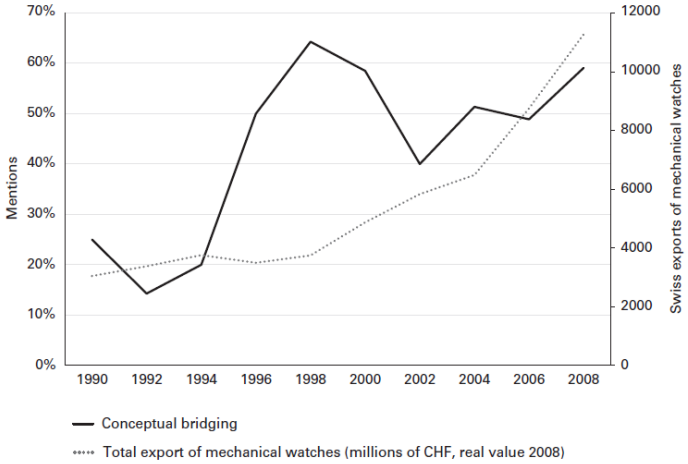
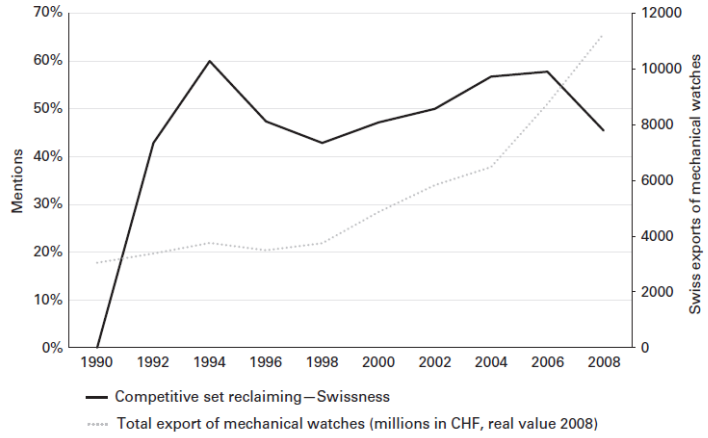


Figure 5. Reclaiming the competitive set: Mentions of "Swissness" in ads (1990–2008).



Triangulating common patterns over a 38-year period

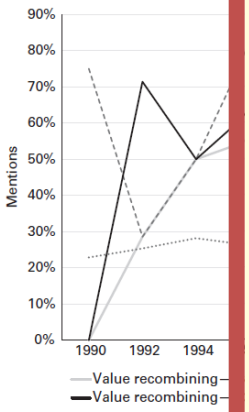
Table 1. Results of Analysis of Variance of Advertisement Features*

Ad feature		*t0*: Tech. discontinuity N = 133	*t1*: Tech. retrenchment N = 103	Technological Reemergence *t2*: Tech. redefinition N = 246	*t3*: Market redefinition N = 218	All periods N = 700	Tukey T-tests *t0* vs. *t1*	*t1* vs. *t2*	*t1* vs. *t3*
Mentions of technology (% of ads depicting feature)									
Mechanical	Mean	.47	.17	.61	.70	.55	–5.04***	8.04***	9.62***
	S.D.	.50	.37	.48	.46	.50			
Quartz	Mean	.32	.53	.07	.01	.17	4.91***	–12.01***	–13.31***
	S.D.	.47	.50	.26	.11	.38			
Mechanisms of technology reemergence (only mechanical ads, adjusted sample)		N = 62	N = 60	N = 150	N = 156	N = 428			
Recombining values:									
Precision	Mean	.79	.85	.78	.76	.78	.80	–1.11	–1.49
	S.D.	.41	.36	.42	.43	.41			
Luxury	Mean	.13	.20	.70	.72	.56	.91	7.57***	7.99***
	S.D.	.34	.40	.46	.45	.50			
Craftsmanship	Mean	.06	.07	.38	.21	.23	.03	5.11***	2.27+
	S.D.	.25	.25	.49	.41	.42			
Identity marking:									
Identity markers	Mean	.10	.40	.53	.62	.48	3.56**	1.76	3.10**
	S.D.	.30	.49	.50	.49	.50			
Temporal distancing:									
Bridge past & future	Mean	.06	.13	.43	.32	.30	.87	4.48***	2.81*
	S.D.	.25	.34	.50	.47	.46			
Company founding	Mean	.06	.12	.41	.28	.27	.67	4.45***	2.45+
	S.D.	.25	.32	.49	.45	.44			
Conceptual bridging:									
Metaphors & analogies	Mean	.21	.33	.53	.51	.45	1.41	2.70*	2.35+
	S.D.	.41	.48	.50	.50	.50			
Reclaiming the competitive set:									
Swissness	Mean	.31	.08	.47	.53	.41	–2.62*	5.33***	6.18***
	S.D.	.46	.28	.50	.50	.49			
Reinvesting in innovation & R&D:									
Complications	Mean	.21	.12	.17	.28	.21	–1.28	0.81	2.60*
	S.D.	.41	.32	.37	.45	.40			

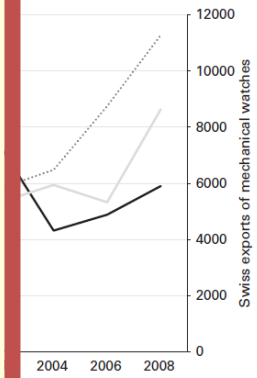
+ $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

* Tukey HSD post hoc t-tests reported; *q*-values and adjusted *p*-values are available from the author upon request.

Figure 2. Average mentions of valu… during technological reemergence (…

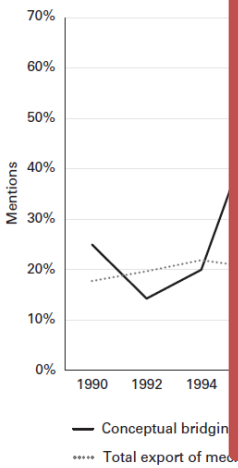


…during technological reemergence

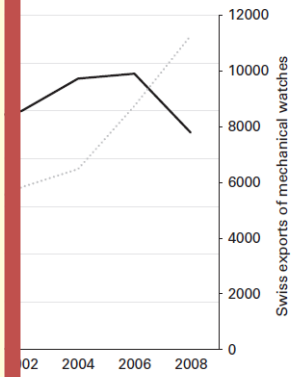


…ounding
…re
… CHF, real value 2008)

Figure 4. Average use of conceptu… technological reemergence (1990–…



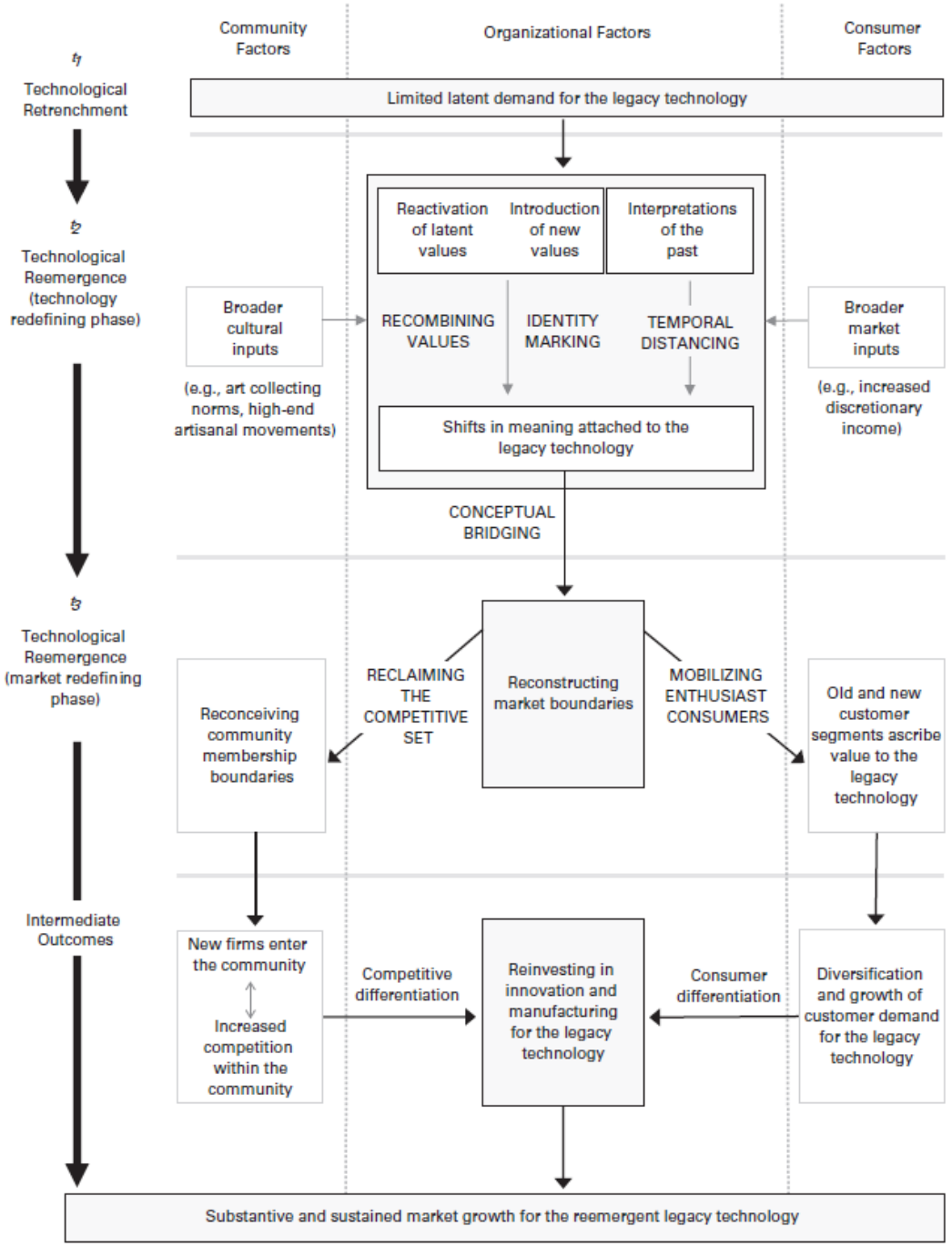
…Swissness" in ads (1990–2008).



…in CHF, real value 2008)

Presenting a longitudinal field/industry-level process model

Figure 7. Process and mechanisms of technology reemergence.*



Longitudinal analysis

Figure 7. Process and mechanisms of technology reemergence.*

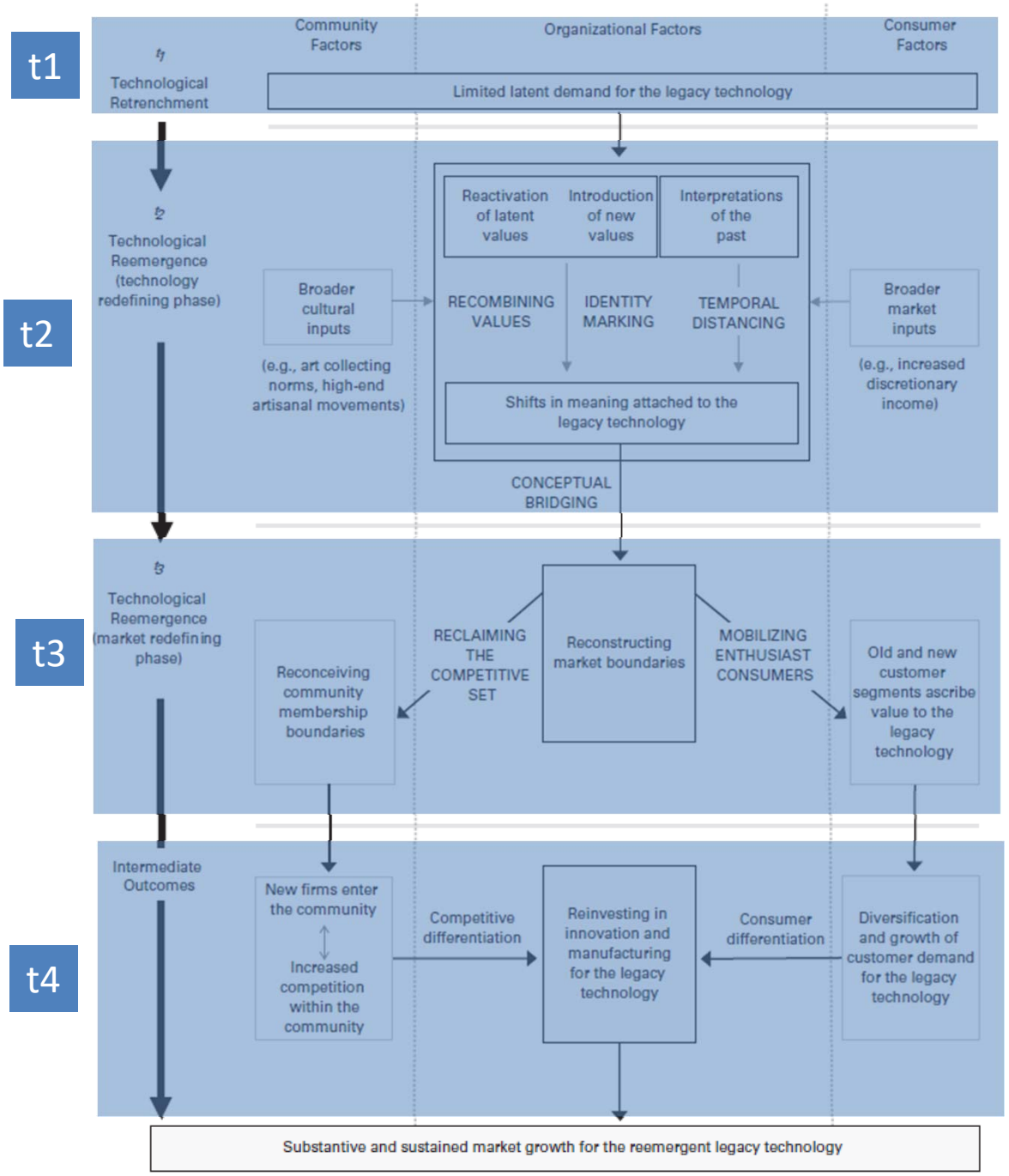
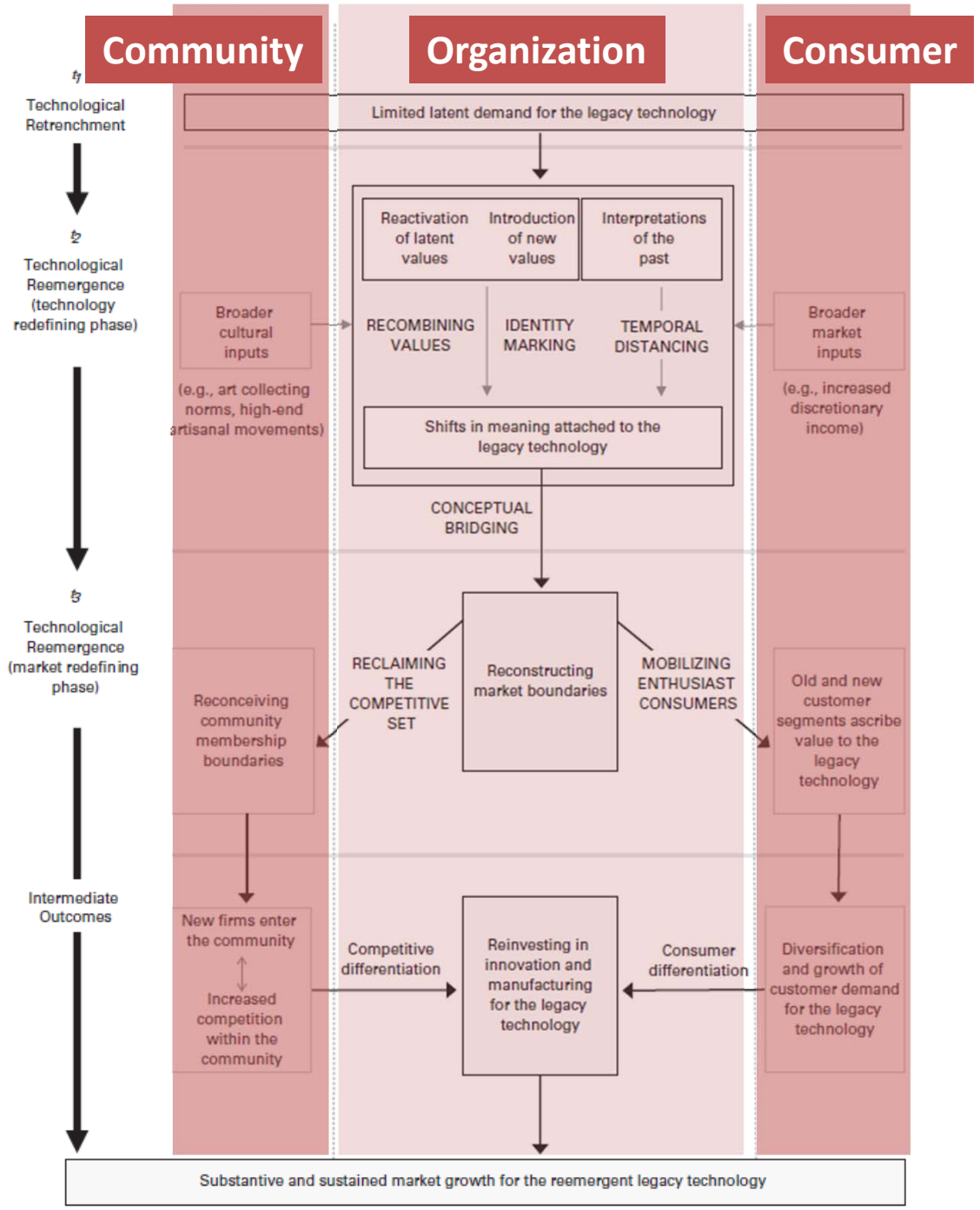


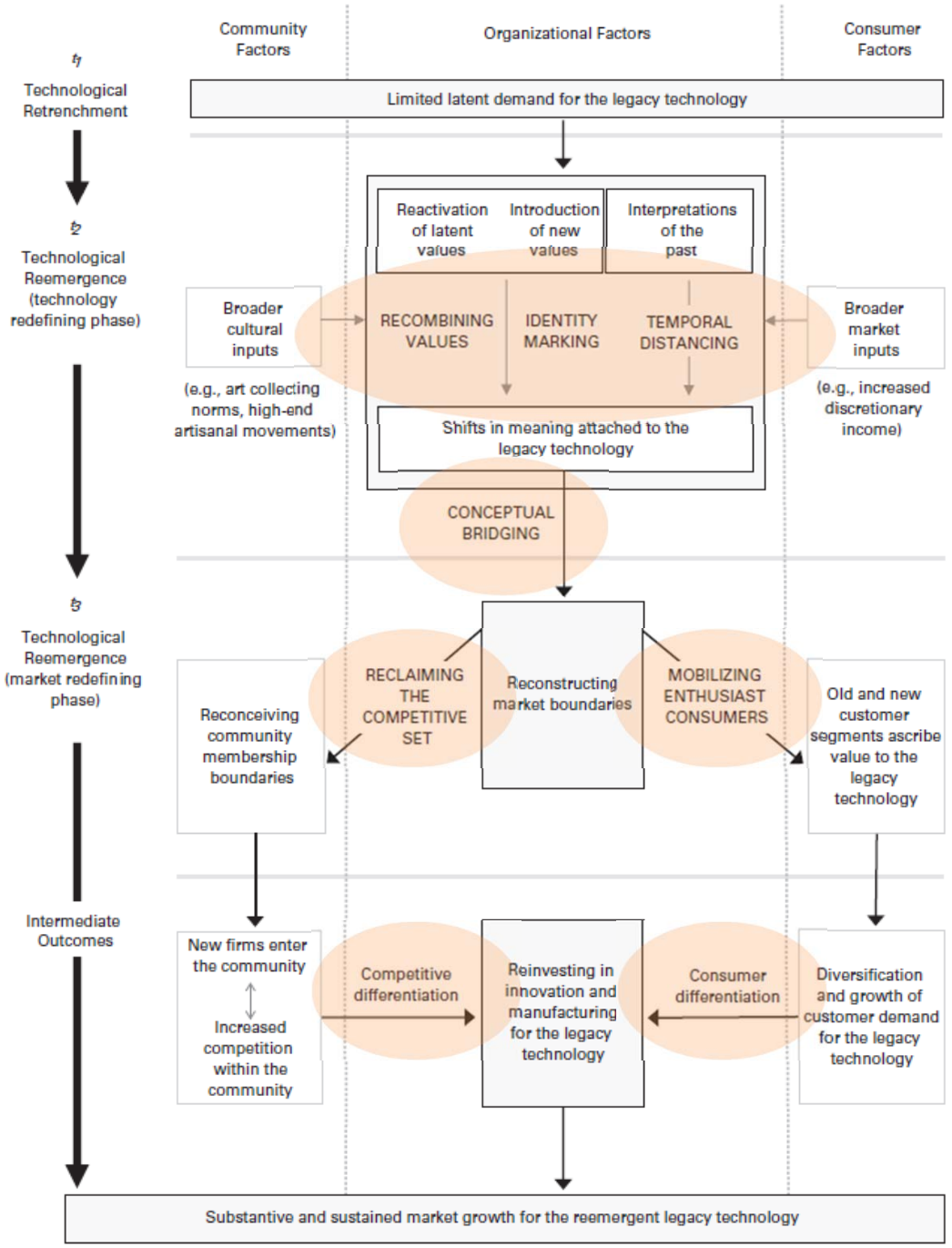
Figure 7. Process and mechanisms of technology reemergence.*



Multiple levels-of-analysis

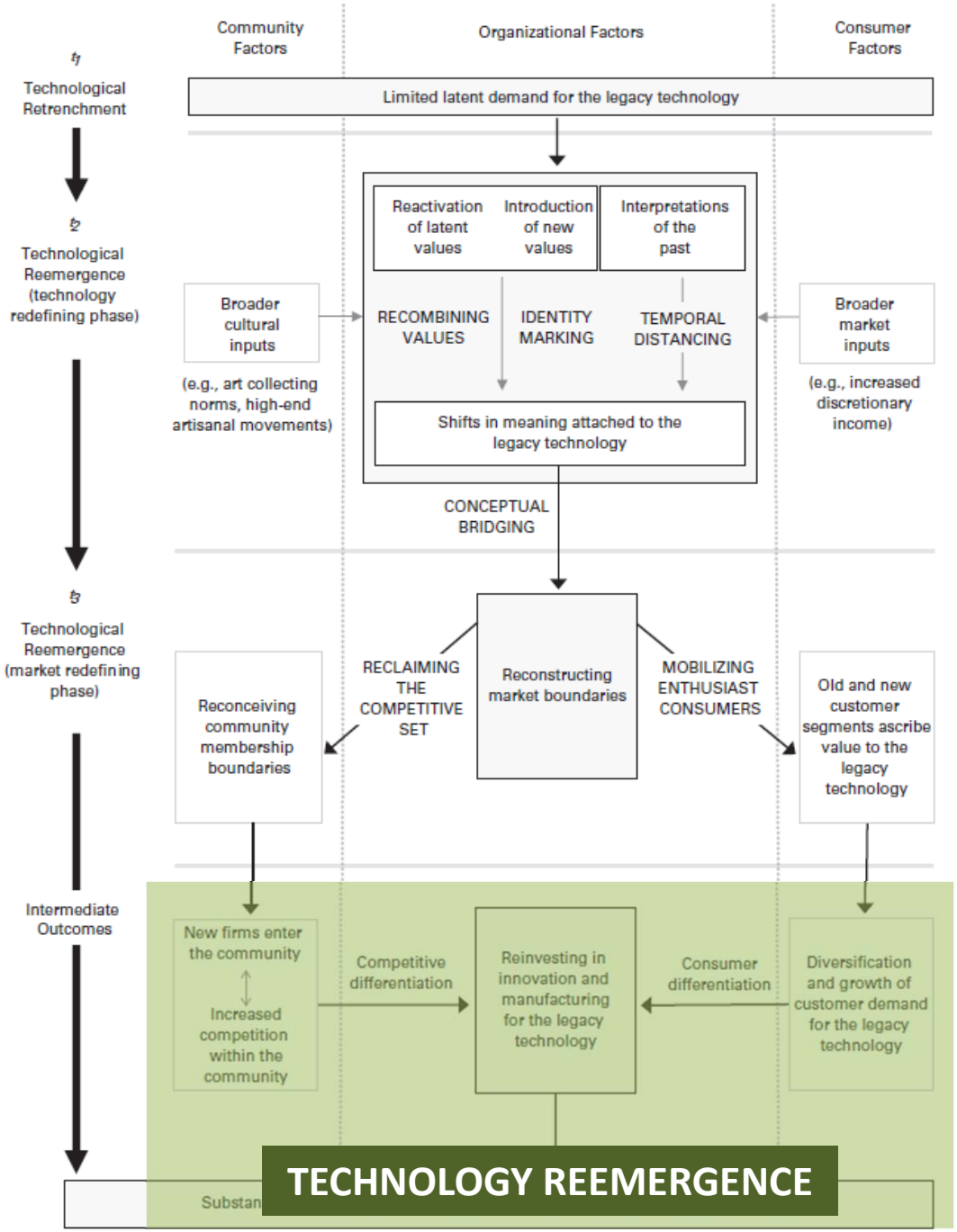
Induction of mechanisms to build a process model

Figure 7. Process and mechanisms of technology reemergence.*



Evidence of outcomes to support a new construct

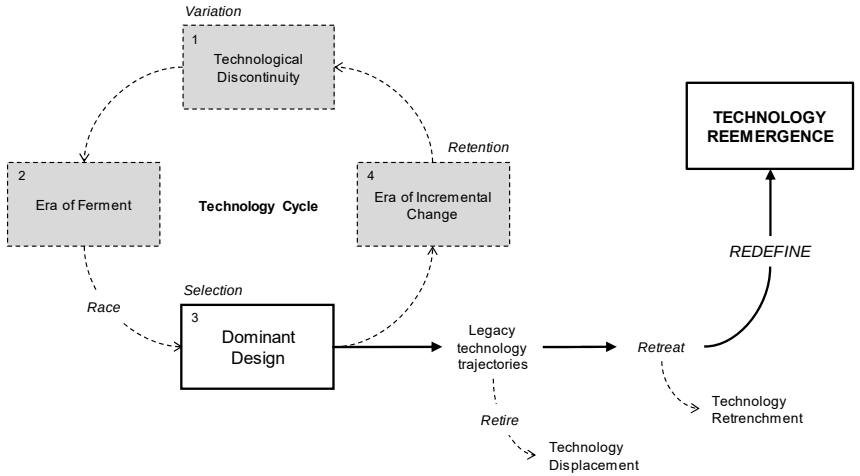
Figure 7. Process and mechanisms of technology reemergence.*



Summarizing the theoretical contribution with simplified visual models

Summarizing the theoretical contribution in the Discussion section

A simplified model



A short summary to distinguish the new construct from prior work

Possible legacy technology trajectories following the selection of a new dominant design:

	Technology DISPLACEMENT	**Technology RETRENCHMENT**	**Technology REEMERGENCE**
Outcomes	**Retire**	**Retreat**	**Redefine**
Examples	telegraphs, dial-up modems, audio cassettes, VHS tapes bias tires	vacuum tubes, medical use pagers, CTR monitors	mechanical watches
Theorized responses			
Industry revenue growth	no industry growth	decreased and marginalized industry growth	***increased*** industry-wide growth after an initial period of decline
Firm entrants	no new entrants	only a limited group of firms remain, typically in small niche	***new entrants*** emerge from in and outside preexisting field
Customer base	prior customers switch to dominant design	maintenance of a limited and/or shrinking customer base	***expansion*** of old *and* new customer segments
Innovation and R&D investment in the legacy technology	no further innovation, cease R&D	very limited incremental innovation and R&D	***significant innovation*** and R&D efforts
Production facilities investment	cease use of facilities	attempt to maintain some existing facilities	***reinvestment*** in old and new facilities
Theorized demand function(s) for the legacy technology	Demand Substitution: switching cost tradeoffs; liquidation of remaining supply	Latent Demand Heterogeneity: small pockets of remaining demand; niche specialization	Demand Creation and Growth: ***substantive & sustained*** market expansion; underlying mechanisms unknown
Representative Sources	Tushman & Rosenkopf, 1992; Utterback, 1994; Sull, 1999	Adner & Snow, 2010; Furr & Snow, 2014, 2015; Porter, 1980, 1996	-----

Some lessons this paper taught me about evidence presentation…

- Be willing to present and use different forms of data to triangulate your analyses and findings.

- Show evidence of broad trends, but also include data and appendices that offer the reader specific details.

- Seek input and guidance from your reviewers and editor.

THANK YOU

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