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Fifty Years of the Strategic Trade-Offs Model: In Memory and Honor of Wickham Skinner

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Abstract—In 1969, Professor Wickham Skinner, whom many consider as “the father of manufacturing strategy,” published a seminal paper entitled “Manufacturing—Missing Link in Corporate Strategy.” Among the many interesting insights outlined in that article, Skinner is particularly careful to explain the importance of acknowledging the existence of specific tradeoffs in the design of production systems. For example, he warns that a failure on the part of executives to recognize the limitations and compromises that are inherent to all technology and human based systems will inevitably result in a diminished ability of firms to compete successfully in the marketplace. Fifty years after the publication of that influential paper, we reassess some of Professor Skinner’s contributions to the theory and practice of strategic operations management. In particular, we put forth the argument that strategic tradeoffs in the operations of firms is a concept that is still—and will continue to be—important and relevant to practitioners worldwide.

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Key words: Wickham Skinner, strategic trade-offs, manufacturing strategy, business strategy, corporate strategy, competitive capabilities

1 INTRODUCTION

WHILE working on previous drafts of this article, we, as members of the operations management (OM) community, received the sad news that Professor Wickham Skinner had passed away on January of this year. Having completed research based on some of his ideas, we are especially appreciative of his invaluable insights and contributions to the theory and practice of operations management. Therefore, this article will serve both as a small and humble celebration of his life and legacy, and, also as a repositioning of his “strategic trade-offs” model. Our previous investigations on this particular topic allow us to articulate the argument that when viewed in its proper context, strategic trade-offs is a concept that -contrary to what has been argued by some researchers- has key implications vis-à-vis the adequate design and management of manufacturing and service firms.

The rest of the paper follows this structure. Section 2 offers a brief biographical note on Professor Wickham Skinner. Section 3 presents some clarifications of the “strategic trade-offs” concept. Major implications for practitioners are then outlined in Section 4, before Section 5 discusses future research opportunities. Finally, conclusions are summarized in Section 6.

2 PROFESSOR WICKHAM SKINNER: A BIOGRAPHICAL NOTE

Upon graduating from Yale University with a degree in Chemical Engineering, Professor Skinner was “immediately inducted into the Army”, and afterwards, he was assigned to work on the Manhattan Project at Los Alamos, getting involved in the manufacturing and engineering tasks necessary to build the first bombs [Hayes, 2002]. After earning an MBA from Harvard Business School and

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83 working for several years in the private
84 sector, Professor Skinner decided to
85 return to Harvard to pursue doctoral
86 studies, receiving his PhD in 1961.¹

87 At Harvard, Professor Skinner went
88 on to have a distinguished career as
89 a teacher, researcher, mentor and
90 administrator. Amongst his various
91 distinctions and honors, he was
92 elected a Fellow of the Academy of
93 Management in 1976. He received
94 the same honor from the Production
95 and Operations Management Society
96 (POMS), when he was elected a
97 Fellow in 2004. Furthermore, this
98 same society named an award after
99 him in order to “encourage POM
100 scholarship and publication, to
101 promote significant research in the
102 field, to reward academics who have
103 achieved unusually high
104 accomplishment early in their
105 careers, and to facilitate the sharing
106 of innovative new ideas about
107 teaching POM”. Additionally, he
108 received an honorary doctorate
109 from the University of Ghent in 2002.

110 Commenting on the extent to which
111 Professor Skinner has influenced the
112 teaching, theory and practice of
113 strategic operations management,
114 [Hayes, 2002] notes that at Harvard,
115 Professor Skinner successfully taught
116 several courses, and one in particular
117 (“Advanced Production Problems”)
118 became “extraordinarily popular”,
119 always receiving high ratings from
120 students when led by him. The
121 relevance and importance of his
122 research, including the “Missing
123 Link”² article [Skinner 1969] were
124 quickly acknowledged in industry,
125 which made Professor Skinner a
126 sought after consultant and speaker.

¹ The sources of the biographical material used in this section were: (both links accessed on 13 March 2019): <https://www.hbs.edu/news/releases/Pages/c-wickham-skinner-obituary.aspx> <http://poms.org/skinnerawardsintroduction.pdf> Hayes (2002), see references section. Sprague (2007) see references section.

² As of 14 March 2019, this paper has 3015 citations in Google Scholar.

He was the author or co-author of over 75 articles and book chapters, published 10 books, and his Harvard Business Review articles have sold more than half a million reprints.

Professor Wickham Skinner's teachings, research and insights will continue to influence and inspire future generations of OM students, scholars and practitioners. He will be greatly missed.

3 STRATEGIC TRADE-OFFS IN THE OPERATIONS OF FIRMS: SOME CLARIFICATIONS

It is our position that Professor Skinner's strategic trade-offs model has been a much-misunderstood concept.³ With this in mind, this section briefly explains the nature and consequences of this theory.

In his 1969 paper, Skinner puts forth the argument that “a production system inevitably involves trade-offs and compromises and so must be designed to perform a limited task well, with that task defined by corporate strategic objectives” (p. 138). To understand the full implications of Skinner's model, it is essential to note that in that seminal article, he clearly makes the argument that the existence of trade-offs in the design of products or services necessarily imply the existence of trade-offs in the design and operations of manufacturing or service firms (p. 140):

Yet most managers will readily admit that there are compromises or trade-offs to be made in designing an airplane or a truck. In the case of an airplane, trade-offs would involve such matters as cruising speed, takeoff and

landing distances, initial cost, maintenance, fuel consumption, passenger comfort, and cargo or passenger capacity. 171
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Much the same thing is true of manufacturing. The variables of cost, time, quality, technological constraints, and customer satisfaction place limits on what management can do, force compromises, and demand an explicit recognition of a multitude of trade-offs and choices. 175
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In his studies, Skinner found that a lack of acknowledgement of these trade-off relationships would result in inefficiencies that could hamper the ability of firms to compete in the marketplace (p. 140): 184
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Yet everywhere I find plants which have inadvertently emphasized one yardstick at the expense of another, more important one. 190
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...[consequently] customers were more dissatisfied than ever. Product managers hotly complained that delivery promises were regularly missed—and in almost every case they first heard about failures from their customers. 194
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It appears as if Skinner's ideas regarding the existence of strategic trade-offs went unchallenged for a number of years. However, this started to change in the 1980s and 1990s, when researchers began to question the validity of the trade-offs model,⁴ arguing for example that there are synergy effects that allow firms to obtain an advantage across a number of competitive capabilities. In response to those arguments, 202
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⁴ This questioning has continued to more recent times, when some researchers have even argued that “in practice, the trade-offs model is not used” [Singh et al., 2015, p. 4001]. See Sarmiento, Whelan and Thurer (2018) for a detailed analysis of this particular claim against Skinner's proposal of strategic trade-offs.

214 [Skinner 1992, 1996] offered a more
 215 detailed explanation of his theory. In
 216 particular, he advanced the following
 217 proposition (1996, p. 6):

218 Choices must be made; tradeoffs
 219 are inevitable; one system
 220 cannot be outstanding enough at
 221 meeting all criteria to create
 222 competitive advantage.

223 We refer the reader to [Sarmiento
 224 Thurer and Whelan, 2016] for a
 225 technical analysis of Skinner’s
 226 proposition. Here we only discuss a
 227 few important consequences of his
 228 statement. The nature of Skinner’s
 229 hypothesis is universal in its scope.
 230 This means that, according to him, it is
 231 impossible for a technology and
 232 human based system to operate
 233 without trade-offs. Put differently,
 234 Skinner affirms that there is no
 235 manufacturing or service system in
 236 which some form of trade-off between
 237 at least one pair of competitive
 238 capabilities (e.g., quality, cost) does
 239 not exist. Also, we posit that the
 240 expression “one system cannot be
 241 outstanding enough at meeting all
 242 criteria to create competitive
 243 advantage” can be fairly characterized
 244 as: “No manufacturing or service firm
 245 can be the best at everything (e.g.,
 246 delivery, cost, quality, environmental
 247 competitiveness)”.

248 The assertion that no manufacturing or
 249 service firm can be the best at
 250 everything has important implications
 251 for research (and practice). In our
 252 investigations on this topic, we have
 253 observed that, almost without
 254 exception, all previous studies have
 255 collected information from
 256 manufacturing or service firms in order
 257 to investigate whether trade-offs exist.

This information is often provided by
 executives, who are asked, for
 example, to make assessments of
 their firms’ performance across various
 competitive capabilities. While this way
 of doing research on strategic trade-
 offs has its advantages, we think that
 there is another, more adequate form
 in which this topic can be investigated.

Referring back to Skinner’s [1969]
 explanation about the existence of
 trade-offs, it is important to underline
 that he interlinks the existence of
 compromises in the design and
 performance of products with trade-offs
 in the design and operations of
 systems (140):

... there are compromises or
 trade-offs to be made in
 designing an airplane or a truck.

Much the same thing is true of
 manufacturing.

In our view, it is clear that Skinner
 emphasizes the idea that just as there
 are trade-offs in the design and
 performance of individual products or
 services, there also must be,
 necessarily, compromises in the
 design and operations of the
 (manufacturing or service) systems
 that produce them. Once this
 interrelationship has been established,
 one of its logical consequences can
 also be clarified. We argue that a
 statement such as “no manufacturing
 or service firm can be the best at
 everything”, by necessity, entails a
 similar universal proposition along the
 lines of “no product or service can be
 the best at everything”.

Viewed in this way, it becomes less
 difficult to understand and corroborate

if Skinner’s proposal of strategic trade-
 offs in the design and operations of
 firms is consistent with everyday
 evidence. We suggest that
 researchers interested in this topic can
 analyze, for example, pairs of
 competing products or services in
 order to determine whether it is
 possible for individual goods to be the
 best at everything (e.g., price,
 availability of products/services,
 quality features, environmental
 performance, etc.). We further discuss
 these ideas in the next sections.

4 DISCUSSION OF PRACTICAL IMPLICATIONS

In the previous sections, we clarified
 the underlying concept behind
 Skinner’s proposal for the existence of
 strategic trade-offs in the operations of
 firms. We suggested that, to
 understand Skinner’s model more
 comprehensively, it is recommended to
 analyze carefully the characteristics of
 individual goods and/or services, and
 the potential consequences on the
 overall policies that govern the design
 and operations of manufacturing and/
 or service systems. Skinner basically
 argues that just as there are
 compromises in the design and
 performance of individual products or
 services, there also must be,
 necessarily, trade-offs in the design
 and operation of the entire systems
 that produce them. This allows us to
 suggest that while the product
 characteristics **define** the required
 production system characteristics, the
 production system characteristics
constrain the product characteristics
 (see Figure 1). In other words, the
 actual trade-off occurs at the
 production system level while it is more
 visible at the product level.

The implications of this core premise,
 we opine, should be of guidance to
 practitioners and researchers
 worldwide. Would it be realistic to run a
 business with a strategy that aims at
 designing and offering to customers
 products and/or services that can be

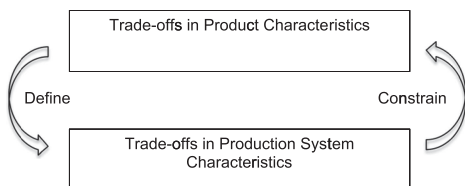


Figure 1. Interlinked relationship between an output and its respective production system.

352 “the best at everything”? To crystalize
353 this question further, we invite the
354 reader to think of the potential answers
355 to the following two questions:

- 356 1. Will it ever be possible to build a
357 BMW using the same entire
358 supply chain system that
359 produces a Skoda at the same
360 (low) production cost?
- 361 2. Will it ever be possible to build a
362 (high quality) Macbook laptop
363 using the same entire supply
364 chain system that produces a
365 Dell laptop at the same (low)
366 production cost?

367 Similar questions can be asked vis-
368 à-vis pairs of competing products or
369 services across all economic sectors
370 and activities. It should be clarified that
371 we are not closed to the idea of new
372 technological breakthroughs that
373 would make it possible to build
374 products or services that could be the
375 “best at everything”. But even if this
376 could be accomplished,⁵ we also think
377 that Professor Skinner’s proposal of
378 strategic trade-offs is consistent with
379 evidence that consumers of everyday
380 goods and services can corroborate.
381 We opine that insomuch as the
382 production of goods and services that
383 we all consume remains dependent on
384 systems that are technology and
385 human based, there will always be
386 some form of trade-off that will need to
387 be accounted for.

388 One of the most important and
389 practical implications of Professor
390 Skinner’s works is the idea that
391 factories adopting a “focused”⁶
392 approach would become more

⁵ In a personal communication with the first author of this article, Professor Roger Schmenner affirmed that a product outperforming its competitors across all measures of performance was already built: the transistor radio. The implication of this is that, at least in some contexts, it is possible to build products or services that could be the best at everything.

⁶ A “focused factory” (as in Skinner 1974) is one whose “entire apparatus is focused to accomplish the particular manufacturing task demanded by [its specific] strategy . . .” [Hayes, 2002, p. 5].

competitive. Is there empirical
evidence that corroborates this
assertion? [Hayes, 2002] writes about
the case of the Copeland
Corporation, whose CEO “decided to
“bet the company” by investing all its
available capital into building a new,
focused factory for the company’s
major product line” (p. 5). The results
of this decision, according to [Hayes
2002, p. 5], were remarkable: “Within
5 years the competitive advantages
provided by this set of focused
factories had forced two big
competitors to drop out of the
business, and Copeland’s worldwide
market share rose from 15% to 60%”.

Critics could reasonably say that the
above is just an anecdotal example.
While this may be a valid point, it can
also be said that, once specific trade-
offs in the design of goods and/or
services have been identified,
executives and managers would do
well to design and operate entire
supply chains taking into consideration
those compromises. In other words, we
think that it would be unwise on the part
of, for example, Apple executives, to
attempt to produce Macbook Pro
laptops with the same supply chain
system that builds Dell laptops. Doing
so, we think, would result in
inefficiencies that would hinder Apple’s
ability to compete successfully in the
marketplace.

It is important to note that in Skinner’s
view, the term “focused factory” does
not mean that a manufacturing
operation should focus on one
specific product. Rather it means
focused on core capabilities. For
example, Henry Ford focused on its
Model T which resulted in efficiencies
including high production volumes at
a low cost per unit. Subsequently,
however, it took him several months
to introduce a new model (during
these months nothing was produced
since the whole production system
had to be set up anew). This meant
that the focus on a specific product
led to production shortfalls which
allowed a competitive advantage to
rivals such as GM. In this context, the

focus should have been on the
capability to produce large volumes
(and thus low unit cost) independent
of the product manufactured.

Summarizing the main implications of
Professor Skinner’s works for
practitioners, we can say that the
available evidence tells us that there
are trade-offs in the design of individual
products and/or services. According to
this theory, these compromises are
due to the limitations that are inherent
to all technology and human based
systems. Consequently, executives
and managers should design and
operate entire supply chains taking into
consideration these trade-offs. A failure
to do so, Professor Skinner warns,
would limit a firm’s ability to compete.

5 FUTURE RESEARCH

In terms of scientific research, there are
a few areas that need further
investigation. For example, Professor
Schmenner’s idea (see footnote 5) that
it is possible to build products and/or
services that could be the best at
everything needs to be explored in
more detail. Let us concede for a
moment that technological
breakthroughs could make it possible
to build goods and services that would
outperform all established competitors
across all measures of performance.
This scenario notwithstanding, it also
appears as if there is a point in the
development/maturing of technologies
and/or market conditions where firms
have to make decisions vis-à-vis the
design and operations of systems that
are consistent with the dictates of
Professor Skinner’s trade-offs model.
What we are saying here is that even if
Schmenner were correct in his
comments, this situation would not
refute at all the practical implications
and empirical “validity” of Professor
Skinner’s model.⁷ Perhaps there is a

⁷ This would be akin to the empirical “validity” of Newton’s laws. Although Newtonian physics are generally considered to be false [Dienes, 2008], there is no denying their practical applications and utility.

495 scientific theory waiting to be advanced
 496 (and tested) that would encompass
 497 both Schmenner's proposal and
 498 Professor Skinner's ideas.

499 There are also opportunities to
 500 explore the potential trade-offs
 501 involved in the implementation of
 502 green initiatives. [Sarmiento and
 503 Vargas-Berrones, 2018] and [Bai and
 504 Sarkis, 2018] have already proposed
 505 frameworks and methodologies that
 506 are useful to understand the conflicts
 507 that may exist amongst different
 508 environmental, societal and business

targets. While their works are a
 welcome start, more investigations
 addressing the different compromises
 that firms might face when
 implementing environmentally
 friendly programs are needed.

6 CONCLUSIONS

This paper sought to clarify the trade-
 offs law and reemphasizes its
 importance in management practice.
 Taking a look back at the last
 50 years, we can see that there

521 have been fundamental and massive
 522 changes in the technologies that
 523 enable the manufacture and delivery
 524 of products and services.

525 Notwithstanding these technological
 526 developments, the trade-offs model
 527 continues to be of relevance for both
 528 practitioners and researchers
 529 involved in operations management.
 530 We hope that the ideas outlined in
 531 this paper will help to further unravel
 532 the important implications contained
 533 in the writings of Professor Wickham
 534 Skinner.

535 REFERENCES

- 536 Bai, C. and Sarkis, J. (2018). Honoring complexity in sustainable supply chain
 537 research: A rough set theoretic approach (SI: ResMeth). *Production Planning &*
 538 *Control*, 29(16), 1367–1384.
- 539 Dienes, Z. (2008). Understanding psychology as a science. *An Introduction to*
 540 *Scientific and Statistical Inference*. Basingstoke, U.K.: Palgrave-Macmillan.
- 541 Hayes, R. H. (2002). Wick Skinner: A life sailing against the wind. *Production and*
 542 *Operations Management*, 11(1), 1–8.
- 543 Sarmiento, R., Thurer, M., and Whelan, G. (2016). Rethinking Skinner's model:
 544 Strategic trade-offs in products and services. *Management Research Review*,
 545 39 (10), 1199–1213.
- 546 Sarmiento, R., Whelan, G., and Thürer, M. (2018). A note on "beyond the trade-off
 547 and cumulative capabilities models: Alternative models of operations strategy."
 548 *International Journal of Production Research*, 56(12), 4368–4375.
- 549 Sarmiento, R. and Vargas-Berrones, K. X. (2018). Modeling the implementation of
 550 green initiatives: An AHP-BOCR approach. *Cogent Engineering*, 5(1), 1432120.
- 551 Singh, P. J., Wiengarten, F., Nand, A. A., and Betts, T. (2015). Beyond the trade-off
 552 and cumulative capabilities models: Alternative models of operations strategy.
 553 *International Journal of Production Research*, 53(13), 4001–4020.
- 554 Skinner, W. (1969). Manufacturing-missing link in corporate strategy. *Harvard*
 555 *Business Review*, 47(3), 136–145.
- 556 Skinner, W. (1974). The focused factory. *Harvard Business Review*, 52(3),
 557 113–121.
- 558 Skinner, W. (1992). Missing the links in manufacturing strategy. in *Manufacturing*
 559 *Strategy: Process and Content*, C. A. Voss, Eds. London, U.K.: Chapman and
 560 Hall, 13–25.
- 561 Skinner, W. (1996). Manufacturing strategy on the "S" curve. *Production and*
 562 *Operations Management*, 5(1), 3–14.
- 563 Sprague, L. G. (2007). Evolution of the field of operations management. *Journal of*
 564 *Operations Management*, 25(2), 219–238.