Reengineering Business Process Reengineering with System Dynamics

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Abstract. The breakthrough by Shingo to depict production as a net of processes and operations is a rather brilliant visualization with practical implications for business process reengineering (BPR). Shingo's framework not only helps unearth and negate the dysfunctional effects of Anthony's paradigm on management systems but also constitutes a powerful conceptual front end for system dynamics interventions.

At present, "reengineering" is best known in business as another name for *downsizing* or *restructuring*. Even Hammer & Champy (1994) worry about the misuse and abuse of *reengineering*—a term which not only has permeated the vernacular of the business media but it is also used in marketing goods and services to confused executives. And for those confused about reengineering, its proponents have some special treatment in store. With these two paperback editions, both academics and practitioners will now have an opportunity to reacquaint ourselves with Michael Hammer's non-conjoint notions of business process reengineering (BPR).

On the one hand, Hammer & Champy have embellished their book in order to clarify the thinking that had originally appeared between hard covers and to amplify "what reengineering isn't" (pp. 47-49). They have even added a new chapter after their epilogue in order to answer the questions that concerned readers ask. In so doing, Hammer & Champy finally admit that in BPR the term process is "the most important concept to grasp" (p. 219), a point most welcome because

> the only absolutely essential element in every reengineering project is that it be directed at a process... that commandment honored, practically everything else in reengineering comes down to technique (p. 159).

Except for a rough-cut influence diagram, however, which they call "the business system diamond" (p. 80), some market segmentation scenarios *rhetorically conjured up*—as opposed to *computed*—about hypothetical insurance services (p. 140), and the *Texas Instruments Semiconductor Business Process Map* (p. 119), Hammer & Champy shy away from anything related to method or technique, leaving BPR's substance to Johansson et al. (1994) and to other researchers (Davenport, 1993; Tobias, 1991).

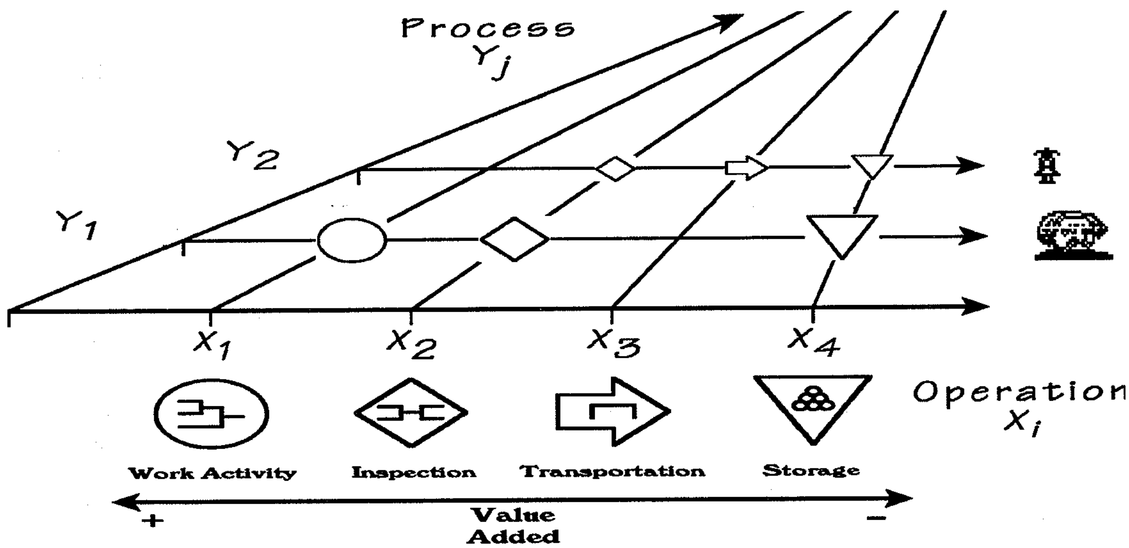
Johansson et al. (1994) view BPR as a natural extension of the improvement family of management technologies—such as JIT and TQM (or CWQC)—which *traditionally* (sic!) aimed at the continuous, incremental improvement of internal production operations. Its business process focus, however, as opposed to internal production and external market operations focus, is what makes BreakPoint BPR radically different from JIT and TQM. Does it?

Although managers may welcome this position as a prudent one, its unidimensional—or linear, as Hammer & Champy might say—extension from internal production operations and processes to external market operations and processes implies that a firm's production and market performance might improve if its production and market operations—the small units of analysis—improve. Yet, like Hammer & Champy, Johansson et al. seem to share the even more obscure notion that, if a firm's production and market operations improved, then its production and market processes—the large units of analysis—would also improve. According to Shingo, this is wrong (Shingo & Robinson, 1990).

To overcome the dysfunctional effects of Anthony's (1965) paradigm on management systems, Georgantzas (1995) enacted Shingo's conceptual breakthrough that depicts production as a well-specified net of processes and operations (Shingo & Robinson, 1990). A unique visualization with practical implications for production, Shingo's framework not only helps unearth and negate the dysfunctional effects of Anthony's paradigm on management systems but also leads to an isomorphic representation—a new framework—of strategic management as a well-specified net of strategies and tactics. Paralleling the new framework, the widely publicized moves at Daimler-Benz illustrate how firms design effective goal-seeking strategies efficiently through the flexible coalignment of tactics (Georgantzas, 1995).

Every business includes activity tasks or bundles leading from raw material to finished goods and services. When a firm wants to satisfy the specific need of a specific customer within a specific market segment, then the firm can (re)design and manage a process by selecting and sequencing (in a serial or parallel configuration) the

Fig. 1
The net view of business processes and operations adapted from Shingo & Robinson (1990)



necessary operations in order to make it so. The process designers can pick and choose among four principal business operations, namely value added *work activity* (or machining or computing), *inspection* (or decision making), *transportation* (of people, material, or electronic signals), and *storage* (or inventory or delay). Figure 1 shows the four business operations and the activity bundles they contain—sometimes called *therbligs* (from Gilbreth spelled backward).

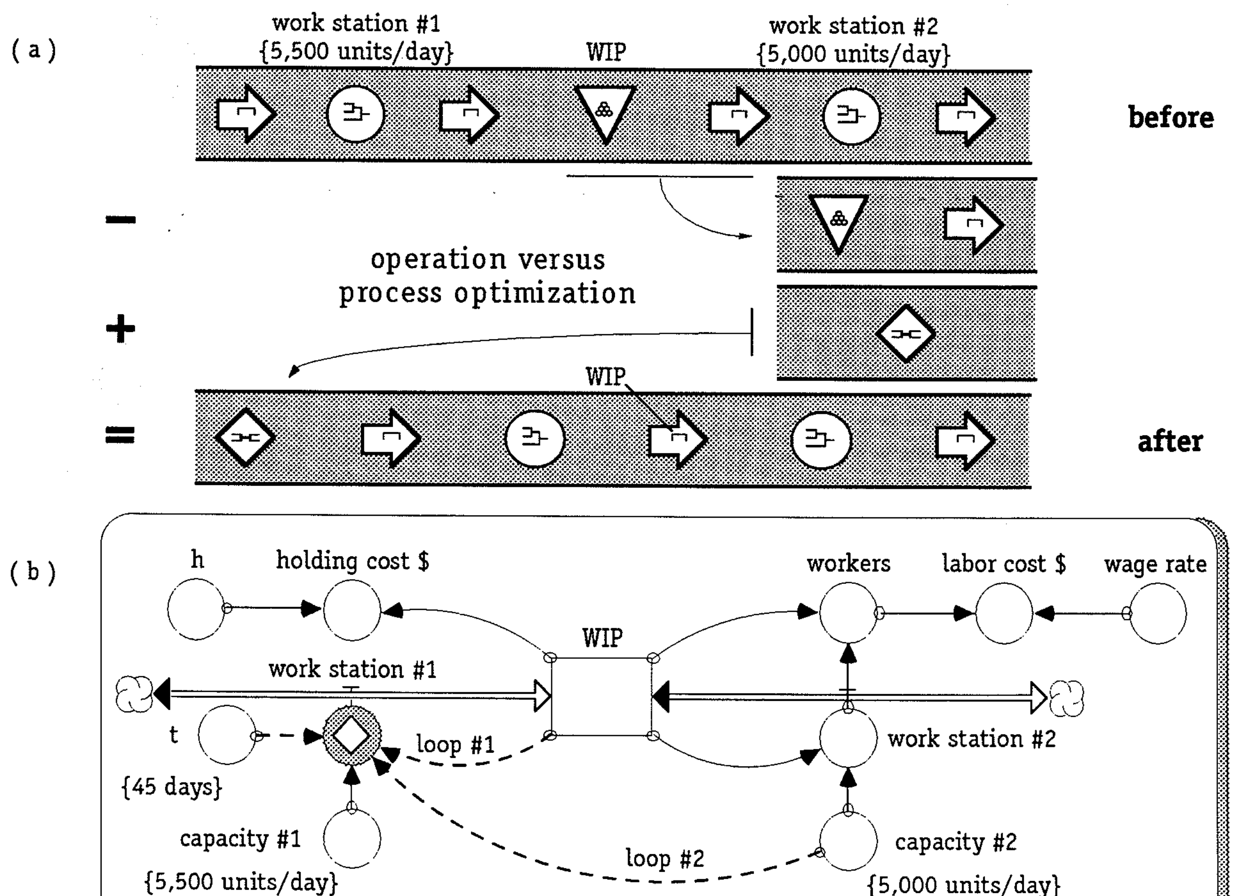
Given that the conventional view of a business discounts the difference between *operations* and *processes*—Hammer & Champy treat them as synonyms—it is perfectly natural for the directly-observable motion of operational activities to capture the attention of business researchers, managers and journalists, particularly those who are not sensitized to this difference. Some may even conclude that a business consists exclusively of operations. However, every business involves two distinct streams of activity: along the X_i axis of Fig. 1, operations depict the activity of workers and machines (and customers in a service business); along the Y_j axis, the interspace between business operations are the processes that invisibly link operations from raw material to finished goods and services. The intersecting X_is and Y_js of Fig. 1 depict a business as a well-specified net (or network) of operations and processes. To Shingo, this is self evident but many business researchers, managers, and journalists call for improvements in operations as the means to improving production and market efficiency and quality; only a few emphasize process improvements (Shingo & Robinson, 1990). The idea that process redesign can greatly improve business performance, and to a much higher level than secondary operational improvements can, is far from being well understood.

The Appendix of the C&L team on process mapping and modeling attests to the lack of a clear understanding among BPR proponents of what the difference between processes and operations really is. Johansson et al. define a process as "a set of linked activities that take an input and transform it to create an output" (p. 209). It sounds like an operation; doesn't it? They also define an operation as "the main steps in a process method or procedure" (p. 213). This is where their sequence of definitions breaks off. How can possibly firms buy into and advance BPR to its full potential when its very proponents use something as complex as a *process method*—whatever that means—to define something as simple as an operation? This definition problematic may be a juicy assignment for an academic to trifle with but does explain why in practice, as Hammer & Champy argue, processes

> are often fragmented and obscured by organizational structures... are invisible and unnamed, [and] also tend to be unmanaged in that people are put in charge of departments or work units, but no one is given the responsibility for getting the whole job—the process—done (p. 118).

Extant formal definitions not withstanding, Fig. 1 shows that firms meet customer-driven production

Fig. 2
The IBM Credit reengineering example adapted from Hammer & Champy (1994)

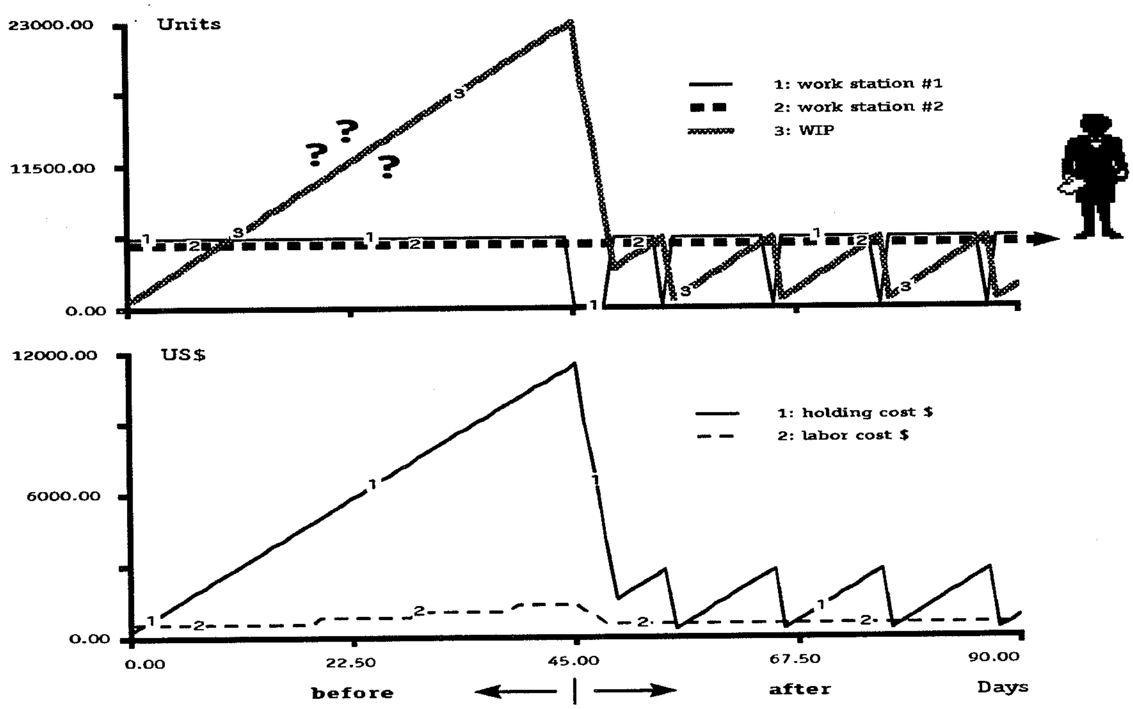


Stock:
WIP(t) = WIP(t − dt) + (work station #1 − work station #2) * dt
INIT WIP = capacity #1 − capacity #2 {units}
Flows:
work station #1 = If Time < t Then capacity #1 Else If WIP ≤ capacity #2 Then capacity #1 Else 0
work station #2 = If WIP ≤ 0 Then 0 Else capacity #2
Auxiliaries:
holding cost $ = WIP * h / 2
labor cost $ = workers * wage rate
workers = If WIP > work station #2 Then INT(2 + ((WIP − work station #2)/work station #2)) Else 2
Constants:
capacity #1 = 5500 {units/day}
capacity #2 = 5000 {units/day}
h = 1 {$/unit/day}
wage rate = 250 {US$/worker/day}
t = 45 {days}

and market goals through process improvements; operations play a supplementary role. For example, a conveyor improves a transportation operation rather than transportation. Similarly, a fully-automated warehouse—a multimillion-dollar investment—improves an inventory operation rather than inventory.

In summary, the directly observable motion of operational activity makes business operations visible and thereby simple enough to talk about and to manage. Yet operational control and improvement is not what business process reengineering (or redesign—for a better term) deals with. The purpose of BPR is *first* to identify the invisible, unnamed, and fragmented processes that exist in a business and then, *if necessary*, to redesign these processes so that business managers can manage them to their customers' delight. W. Edwards Deming declared: "Until you draw a flow diagram, you do not understand your business" (Schultz, 1994, p. 21). Because they occupy the invisible interspace between operations, business processes cannot be managed effectively, let alone reengineered, unless mapping or modeling bring them out on paper or on the glass of a computer screen.

Fig. 3
Simulation results



Using the symbols of Fig. 1, BPR can be reduced into an algebraic manipulation of operations. The simplified version of the IBM Credit BPR example illustrates this (Fig. 2.a). In turn, Fig. 2.b shows how to translate BPR into a full-fledged system dynamics model. The benefits from making it so are twofold. First, the modeling process helps to identify the information leverage points that BPR requires, i.e., the broken-line arrows (loops #1 and #2) of Fig. 2.b . Second, the output from system dynamics simulation allows assessing the potential impact of BPR in the form of computed scenarios (Fig. 3).

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