Effects of ‘Long Tail’ Economies on Operations Management

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Abstract
The primary purpose of this paper is to investigate, if and in how far the ‘Long Tail’ is a relevant concept for operations management. Under the assumption that there is relevance, requirements and effects on operations management in manufacturing firms are discussed. The paper is mainly based on conceptual thinking, embellished by some real world examples. Additionally, some insights are presented that are derived from a conceptual simulation model of production and product diffusion in ‘Long Tail’ economies.

Keywords: Long Tail economy, Internet, simulation model

The Long Tail phenomenon
Products distributed to end users over classical sales channels serve local markets and often have relatively high distribution and storage costs. However, when products are sold over the Internet and distributed directly to the end customer by specialized logistics service providers, the geographical scope of the products (and, thus, the number of potential customers) increases, while at the same time storage and distribution costs decrease (or are even zero, when digital products are considered). In addition with intelligent search and rating mechanisms, customers are able to identify products that fulfill any special needs. Because of their access to highly specialized products through the Internet, the majority of unaware but potentially interested customers will eventually be tapped and quasi all conceivable demand be fulfilled. This phenomenon, called ‘the Long Tail’ by Anderson (2004; see also Brynjolfsson et al., 2003), allows serving a broad range of market niches, when before only products of mass interest were profitable for firms to sell in business to consumer markets.

Figure 1 shows the principle differences between Long Tail economies and the classical “old” economy in a schematic form. On the x-axis, products are ordered according to their sales volume. On the y-axis, sales volume of the products is shown. For the “old” economy, some products are sold massively (so-called “hits”), while many products are hardly sold at all (“non-hits”). This is different for a Long Tail economy: while the sales volume of the hits is lower than in the “old” economy, much more products then before achieve relevant sales volumes at all. On the one hand, the revenues and profits generated by hits might decrease, on the other hand, many more

products then before generate revenues and profits. Thus, the economic relevance of the Long Tail lies in the seemingly small difference between the Long Tail curve and the "old" economy curve in the right part of Figure 1.

The Long Tail effect developed because—due to low storage and transportation costs—it is now possible for firms to offer low-selling products and for customers to find and buy these products at a reasonable price. Note that the concept of hits does not become obsolete within Long Tail economies; they just become less important and non-hits provide an additional or substitutional source for revenues. It has been noted that, therefore, the Long Tail provides a means to overcome the well-known 80/20 rule (that 80% of revenues are created with 20% of the products).

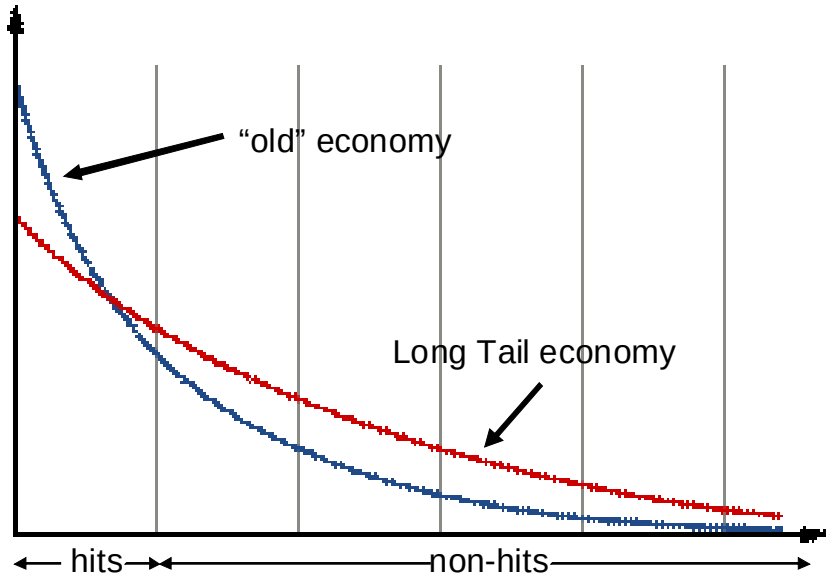

Figure 1: A schematic representation of the Long Tail phenomenon

Examples for the Long Tail phenomenon are usually taken from the software or media industry. For instance, thanks to Amazon and its huge database of books in print and CDs on stock, it is now possible to find and buy obscure literature about Romanian monasteries or music from the Indonesian islands all over the world. Mostly, the Long Tail phenomenon is driven by technological developments, in particular in the IT sector, with the Internet being the most crucial one.

Recently, the idea of the 'Long Tail' has caught some attention in the popular as well as the academic literature (for a criticism see Elberse, 2008). However, mostly the focus of these reports and studies is on the effects the 'Long Tail' has on the marketing, sales, or strategy function. For instance, it has been discussed that technical or organizational mechanisms are needed to restrict users' choice (Schwartz, 2004) and preliminary models of the diffusion of 'Long Tail' products have been proposed (Größler, 2008).

Since the costs relevant in examples of the Long Tail effect are mainly storage and distribution costs, fixed cost for developing the product in the first place are usually regarded as either small compared to these other cost types or not existing, for instance when products are produced by amateurs (e.g. the amateur bird watcher writing a book about the existence of certain species in his or her home region). With having this implicitly underlying assumption, the Long Tail effect relies to a substantial share on ideas of Crowdsourcing (Howe, 2008) and the Wisdom of Crowds (Surowiecki, 2004).

The primary purpose of this paper is to investigate, if and in how far the 'Long Tail' is relevant for operations management, in particular when it comes to physical goods manufacturing firms (as in contrast to media companies or producers of digital or can-be-digital goods, where the concept has its often cited examples). Under the assumption that there is relevance, requirements and effects on operations management in manufacturing firms are discussed. The paper is mainly based on conceptual thinking, embellished by some real-world examples. Additionally, some insights are presented that are derived from a conceptual simulation model of production and product diffusion in 'Long Tail' economies.

The paper is structured as follows. In the next section, examples of potential Long Tail effects along a firm's value chain are presented. The third section summarizes requirements and effects on manufacturing in more general terms. The fourth section discusses a conceptual model of product diffusion in 'the Long Tail' and indicates connection points to operations management. The paper closes with a short discussion and outlook on future research.

Examples of (potential) Long Tail effects along the value chain

The discussion of potential effects of the Long Tail along the value chain of a firm is based on the simple framework as depicted in Figure 2. For each of the central operations activities sourcing, manufacturing, sales/shipment, and new product development, an exemplary effect of the Long Tail is briefly described.

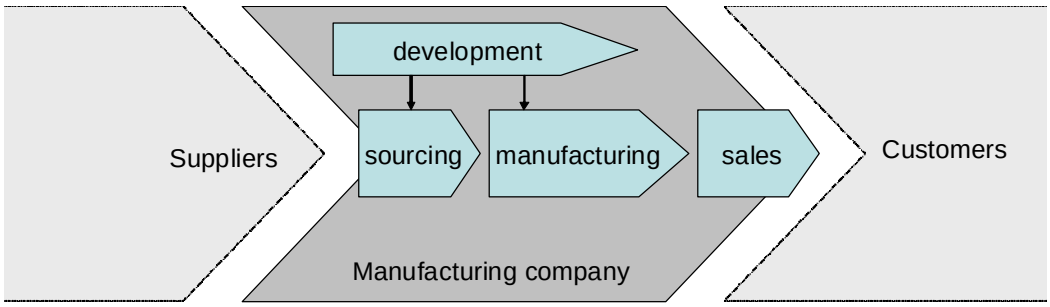

Figure 2: The value chain of a manufacturing firm

At the first glance, the sourcing function of firms might be affected by Long Tail phenomena, since the very idea of the concept is that obscure or specialized goods become available globally at reasonable cost. However, for industrial firms this has always been true: they were always aware where to purchase their raw material, components, and modules, even when these were highly specialized. Otherwise, the firms simply would not have been existent because the availability of the required input factors is a necessity for manufacturing firms to exist. Thus, the Long Tail effect addresses consumer goods, not investment goods.

Much more than for sourcing, the Long Tail has an effect on the core manufacturing function because here customer demand for very specific needs must be fulfilled. Manufacturing has to be capable of producing small batches of products with specific design, which might have been developed many years ago. Thus, flexibility becomes the prime strategic capability in manufacturing. An emphasis might lie on the employment of skilled personnel and flexible manufacturing technology.

When it comes to sales and shipment of finished goods, going for Long Tail effects changes the procedures of manufacturing companies. As we have seen above, the Long Tail mainly addresses end-customers. Thus, manufacturing firms need to be able to deal

with large numbers of end-customers that buy only small numbers of the product each. This implies many potential issues like shipping in small quantities, factoring many invoices, and tracking the receipt of money, etc.

For the development of new products and processes one has to keep in mind that designs probably are offered much longer than in "old" economies. For the development of really new products, Crowdsourcing seems to be a natural complement to Long Tail strategies, when many potential customers design the functionality and appearance of a product.

Characteristics of a Long Tail manufacturing function

As the cursory discussion of Long Tail effects on a manufacturing firm in the subsequent section has shown, being a producer in a 'Long Tail' economy brings along special requirements for operations management. Even more than in conventional settings, operations should be able to

- produce using a low fixed cost structure because only then customers can benefit from the substantial decrease in storage and distribution costs,
- design products for easy storage and distribution because only then low costs in these areas can be achieved,
- be flexible when it comes to producing small batches fast since customers will ask for specific products in small numbers only, which the company must be able to produce at reasonable cost,
- working with low set-up costs to allow for small batches,
- produce durable goods because they might be stored in finished product inventory for a long time until—very infrequently—there is demand for a special product,
- design products that are useful in a wide range of geographical surroundings because only then a substantial number of potential customers can be addressed,
- being able to procure original materials, parts, and components over many years since there might be a demand for a special product long after its initial introduction to the market,
- offer products that will confirm to safety and quality standards in the foreseeable future even when they are demanded many years after their market entry,
- keeping manufacturing processes and knowledge available and up-to-date even for products that are only infrequently produced and which development dates back a long time.

Production and product diffusion in the Long Tail

One critical aspect for the manufacturing function is the estimation of diffusion patterns of products, in order to adjust capacity to demand. Since the Long Tail economy is built on the idea that even small volume products generate profits (i) when storage and distribution costs are low and (ii) when a great share of all interested customers eventually buy the product, the diffusion of Long Tail products might differ from "old" economy products, where firms concentrated on high production volumes. Based on a dynamic simulation model, this section explores the diffusion in the Long Tail as compared to conventional product diffusion.

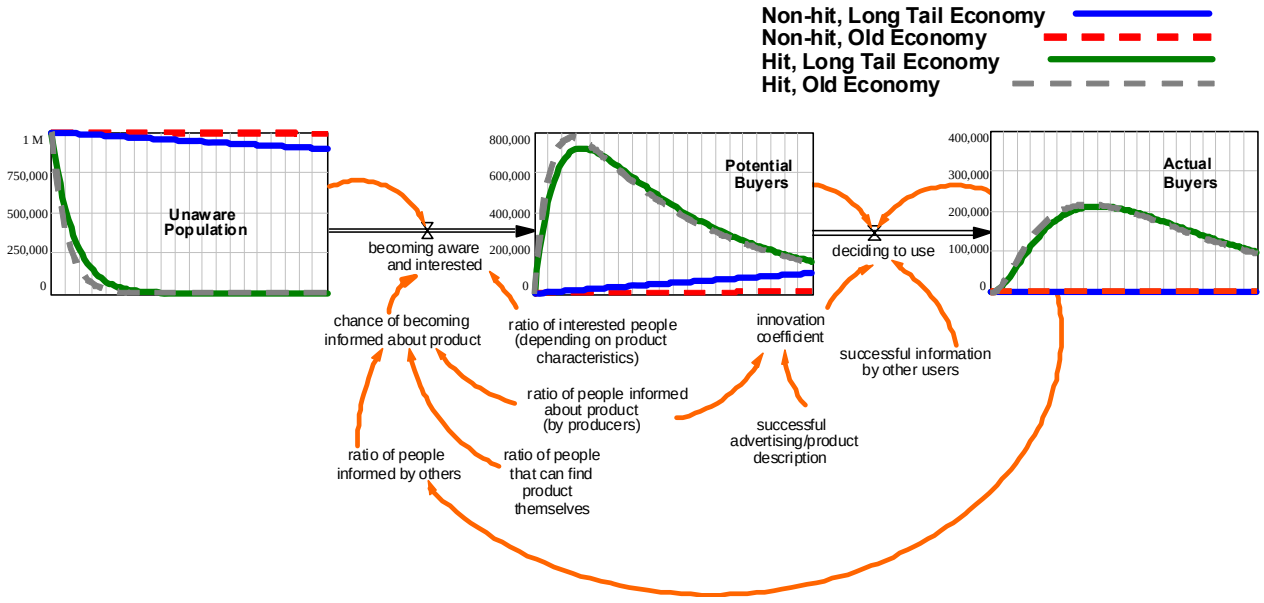

Figure 3: A dynamic model of product diffusion in the Long Tail

Figure 3 depicts the structure and behaviour of the simulation model, which was built following the system dynamics method (Forrester, 1961; Sterman, 2000; Größler et al., 2008). The central chain of the model shows the flow of buyers from being unaware, to potentially interested, to actual buying (Warren, 2007). The right half of this chain represents a diffusion model as described by Bass (1969). Diffusion is an effect of communication acts: innovators and imitators can be distinguished according to their sensitivity for different kinds of communication (external = advertizing versus internal = word-of-mouth).

From a Long Tail perspective more important is the left part of the model, which represents the fact that potential customers need to be informed about the availability of a product. Making unaware customers into potential (i.e. aware) customers depends on product features, information measures of the firms, possibilities for people to inform themselves, and on the communication of actual users about the product.

The insights from the modelling of the diffusion process can be summarized as follows:

- Becoming a potential user depends on technology-supported communication mechanisms:
  - Information by producers (web sites, push email, rank tuning,…),
  - Information by other users (fora, blogs, chats,…),
  - Self-guided information (recommendation sites, searches,…).
- Potential users will eventually become actual users (no time or effort restrictions apply in the Long Tail economy) due to the desire to innovate or to imitate.
- Measures to guide choice are necessary (see Schwartz, 2004): in situations of too much choice, people will avoid, delay or regret decisions; so, paradoxically, more freedom to choose is not beneficial without being prepared for making a guided choice.

Of course, informing unaware customers by firms exists for a long time. However, technological developments allow for new forms of (potential) customer communication. In addition, the social and cultural effect of customers communicating

easily with each other (even across continents and time zones) cannot be underestimated. Thus, the Long Tail effect is heavily based on what has been called Web 2.0 technologies.

Long Tail phenomena are dynamic since they reduce acceleration effects in business: products do not need to amortize their development costs soon because they will be offered over a longer time span with a higher chance to address all relevant customers. Similarly, marketing costs can be reduced since for non-hits little or only "Guerilla" marketing will be conducted.

For a prototypical parameterization, a reasonable outcome results (see Figure 4): non-hits are hardly sold at all; hits, however, diffuse more or less totally, but doing a bit worse in the Long Tail economy.

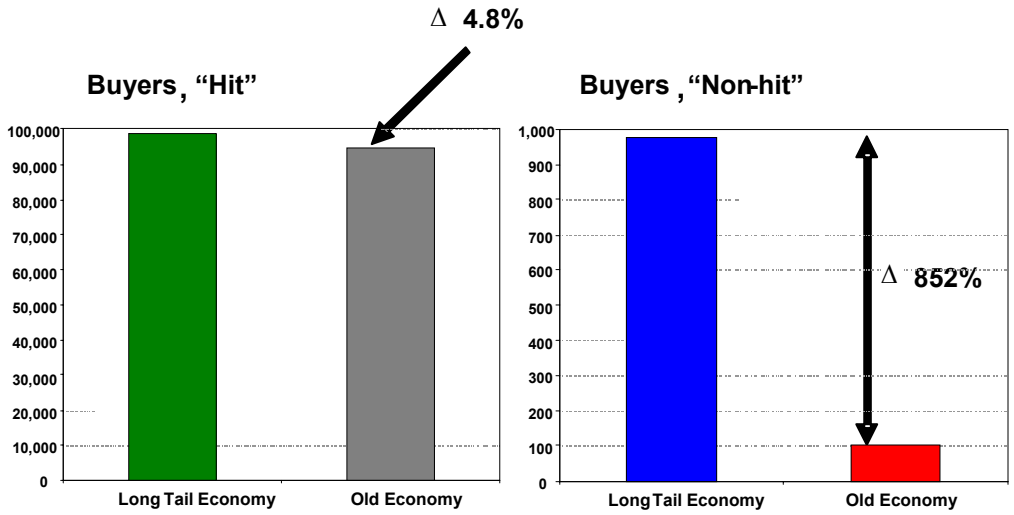

Figure 4: Comparison of model results: number of buyers at the end of the simulation

However, note the different scales being used in Figure 4. So, actually, for hits the diffusion is not much different whether we investigate a Long Tail or an "old" economy situation. Hits were and still are useful and beneficial. The difference lies in the non-hits. Here we observe a difference of nearly ten times as much products being sold in the Long Tail economy as compared to the "old" economy. Non-hits become profitable. In addition, we have to assume that non-hits will be produced and stored for a very long time, allowing even the remotest demand to be fulfilled.

Discussion and further research

The Long Tail seems to be a valuable concept in end consumer markets of digital or may-be-digital goods (for instance, books). Doubts remain, however, if the concept can beneficially be transferred to the production of physical goods and if manufacturers can benefit from concentrating on the Long Tail. There are two types of issues concerning the transfer of the Long Tail concept to the physical production: economic and psychological.

The economic issues comprise, for instance, the question whether fixed costs for developing the product in the first place can be neglected. In the original ideas of the Long Tail it is implicitly assumed that the development often is done by enthusiastic amateurs or as a Crowdsourcing project. In both cases the assumption is that developers are not or only insignificantly paid for their work. With physical goods it seems

doubtful if there are people willing and capable of developing them without being paid for it. A related question addresses the fact that people that develop Long Tail products for free need to have another job to make a living; what if these jobs become obsolete? Another economic requirement—which again seems to be critical in particular when it comes to developing physical goods—for the Long Tail to work is the (quasi) free availability of production tools for digital goods (for instance, writing, painting, and recording software). This obviously is not the case for manufacturing processes of physical goods: production machinery is not commonly available; possessing such machinery (or at least having access to it) requires substantial financial investments.

The more psychological issues of the Long Tail phenomenon are the same for both, the production of digital as well as of physical goods. One criticism addresses the fact that Crowdsourcing can also lead to mediocrity, when real experts (paid or not) are missing. Another issue concerns the phenomenon that sometimes people just want to possess things: having access to digital goods is not always enough. Thus, not everything that can be digitalized will meet substantial demand (at the time of this writing, it is still a question whether electronic books will prevail). However, as we have seen, often for physical goods Long Tail effects are not so easily to achieve as for digital goods.

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