

DEFINING 'BENEFIT' WHEN MAKING PRODUCTION INVESTMENTS -AN INQUIRY OF CURRENT STANDARDS

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Abstract: Investments in production equipment are made to generate desired production benefit. This work examines how benefit generally is defined and to what extent the benefit is well defined when equipment investments are made. The study revealed that benefit from investments often is unclearly or inconsistently defined, with a narrow system view and often has a weak correlation with benefit for a production system with broader boundaries. This could hamper the possibility to capitalize on industrial trends that indicate a shift in focus, from products, to the benefit utilization of the products can deliver.

Keywords: Production development, benefit, value, S-D logic

1. INTRODUCTION

The environment for industrial operations is continuously changing. The ability to manage this change is one of the factors that decide long term industrial competitiveness (Kotter, 1995). Factors that define change management ability are; ability to describe clear pictures of where you are, where you are going, and the ability to communicate this to all actors affected by the change (Kotter, 1995). The reigning industrial picture or industrial paradigm could be described as a *product* focused paradigm where work models, definitions and terminology are centered on the products. The industrial terminology and definitions that surround buying and selling of products can be assumed to be well established and accepted among most industrial actors. This paradigm makes it possible for those actors to gather around the “goods and services” concept and communicate and work effectively as products are produced, sold and delivered. The consumer industry, however, has for several years seen a shift in focus, from products, to the assumed or actual *benefit*, utilization of the products can deliver, e.g. manifested by work describing the emerging *Sharing Economy* and the concept of *Collaborative Consumption* e.g. (Andersson, 2013; Belk, 2014; Heinrichs, 2013; Gansky, 2012; Botsman and Rogers, 2010; Buczynski, 2013; Scharmer and Kaufer, 2013). This shift in focus has also begun to affect industrial relations. Cedergren et al. (2012) e.g. talk about an ongoing shift “*from products to experiences, from features to solutions and from supply chains to value creation networks*”. The shift could potentially lead to a new *benefit* focused paradigm with new characteristics where work models, definitions and terminology are centered on the delivered benefit instead of on the products. Given the potentially large industrial impact of this paradigm shift, efficient management of the shift could be of importance for future industrial competitiveness. One prerequisite for efficient management is that the “benefit” concept is well defined and described, with an accepted terminology. The precision of the definitions will determine how well actors can gather around the “benefit” concept and work effectively as benefit is defined, specified, purchased and received. Having this terminology and these definitions is hence important for management of the focus shift. Having methods to adequately defining benefit are important for other reasons as well. Different sources such as *projectplace.se* has for many years reported that the majority of industrial projects in general fail in varying degrees. For large industrial IT projects this figure is even higher and commonly 60-80% fail (<http://www.quadras.se/cio-veteran-sluta-kora-it-projekt>). One important reason for these large figures is inadequate resources spent on thorough definition of desired benefit

from the projects, indicating the importance of studying how “benefit” is defined. The failure rate of IT-projects is an important figure for all industrial departments, production included, as "IT" in the form of control-, planning-, logistics- and other IT-systems that support production, develops rapidly and becomes ever more important for all types of projects. This is particularly true for robotics and automation where the capacity of robots and other advanced automation equipment is intimately correlated to the capacity of the IT that controls the machinery.

If a new benefit focused paradigm is forming, this new paradigm must have definitions and terms that clarify the differences with the older product focused paradigm, enabling different actors to gather around the “benefit” concept and work as efficient as they are able to do under the old paradigm. Benefit providers must be able to explain to would be “benefit buyers” what they have to offer and on what terms. E.g. providers of the benefit *indoor climate* must be able to explain what that means, how it is measured and how much a “unit” indoor climate costs for customers. Likewise, “benefit purchasers” must have the capacity to describe what benefit they are looking for and how they are prepared to pay for this benefit. E.g. if a company realizes that it is not interested in goods such as drills or drill machines, but only in the benefit “holes”, how should “holes” be defined, purchased, maintained and upgraded? Another example could be a company interested in continuously improving its production capability but has taken a strategic decision to only have resources to procure the benefit “production capability”, and not have resources to choose, install, operate and upgrade production equipment. How should that company define, evaluate and purchase “production capability” from a production capability provider, e.g. a robot developer?

The general aim of this work is to shed more light on the benefit concept, from the benefit provider point of view as well as the benefit receiver point of view, in order to identify well researched areas as well as areas where further contributions could be made. This is to be done by presenting a description of current standards concerning the use of terms and definitions surrounding the industrial “benefit” concept, found in the literature and for selected industrial investment projects. The general purpose is to make a contribution to a system of well established definitions and terms that can help industry capitalize on the ongoing shift in focus from products to benefit, to stimulate the development of and trading with “benefit products”. The purpose is also to make a contribution to the work of improvement of industrial procurement and project management skills and to reduce the share of failed industrial projects.

2. METHOD

To answer the question if a “generally agreed upon terminology and set of definitions” exists, it was asked if it is possible, through a broad literature study, to find consistent answers to the following four reference questions:

- Are authors making clear distinctions between *benefit* and the *tools* used to *deliver* a benefit? E.g. is it clear that measurable improvements in *outcomes* such as “quality of produced goods” or lowered “cycle time” are viewed as benefits, while commissioning, installation as well as the operation of the machinery used to deliver the benefits are tasks or characteristics that can be viewed as *tools*. Maintenance can e.g. be viewed as the tool “worked hours”, while the resulting “improved uptime” can be viewed as the benefit.
- Are authors making clear distinctions between the *definition of benefit* and the *valuing* of this benefit? “Savings” and “profit” can be viewed as valuing of “benefit”, e.g. “reduction of needed manual labor hours” can be viewed as a benefit, while “reduction of labor cost” can be viewed as valuing of this benefit.
- Are there clear distinctions between defining benefit on a *conceptual* level and defining benefit on a *measurable* level (which can be arbitrarily refined and valued)? E.g. *lighting* can be viewed as the conceptual benefit that the *tools lights* and *energy* are assumed to deliver. The amount of *lumen* that the lighting is supposed to deliver can be viewed as a crude form of measurable benefit, which can be refined by adding e.g. *lux*, *where* and *when*.
- When authors are concerned with benefit, is it clearly described what benefit level on the value stairs (Pine and Gilmores, 1998) they are discussing? E.g. is it clear if they are talking about benefits as: *functionality*, *physically measurable outcomes* or *experiences*?

The used literature search method can be described as a broad literature study in Scopus, treating “definition of benefit” as definition of a concept, a definition procedure and a terminology. Several key words were used, such as benefit, value, performance, result, effect, Service Dominant logic (S-D logic) industrial product service

systems (IPSS) etc, trying to identify different approaches to the benefit concept and commonly used terms. This broad approach was used to identify how well the studied literature answered the questions posed above.

The literature study was combined with interviews with engineers responsible for production development for ten large and mid-sized Swedish industrial mechanical assembly companies regarding how they define benefit when making production investments. When the terminology and definition of different types of benefit were studied a broad approach was used and it was studied how benefit is defined within general commercial relations. However, when industrial definitions of benefit were studied through interviews a more narrow approach was used and it was analyzed how benefit from mainly industrial automation projects are defined when companies make investments. Other delimitations were that the triggering of production measures or valuing of benefit from production measures were not specifically studied, and benefits connected to ulterior motives of actors responsible for investments were not considered.

3. EMPIRICAL FINDINGS

3.1. Findings from broad literature study

The concept of benefit can be viewed from many possible angles. In this study mainly four different industrial research areas for which benefit is an important concept were identified. Those are areas concerned with the:

- *Industrial transfer from a Goods Dominant logic (G-D logic) to a Service Dominant logic (S-D logic)*
- *Development of Product Service Systems (PSS) or more specific Industrial Product Service Systems (IPSS)*
- *Development of environmentally friendly, low resource consumption companies, through the transfer from selling goods to selling benefit*
- *Development of better work environments by making benefit based IT purchases*

The first three research areas are mainly taking the “provider” point of view concerned with the question how to sell and provide benefit for customers. The last is mainly taking the benefit purchaser point of view, concerned with the question how to purchase and secure benefit from providers. It was found that research taking the benefit provider point of view, generally is more common than research taking the benefit purchaser point of view. It was also found that these four research areas have generated somewhat different methods of defining benefit.

The body of research concerned with the transfer from a G-D logic to an S-D logic within manufacturing firms, and with the development of IPSS, is focused on how manufacturing companies can develop products and solutions that generate more value for customers. There are numerous of tools and methodologies that have been developed for design of product-service offerings e.g. (Brezet, *et al.*, 2001; Engelhardt, *et al.*, 2003; van Halen, *et al.*, 2005; Luiten, *et al.*, 2001; Morelli, 2002, 2003 and Kar, 2010). These aim to describe development processes of the general PSS offering and have comparatively little focus on definition and evaluation of the actual delivered benefit. However, this body of research has developed one set of mainly conceptual definitions of benefit. Tukker (2004) talks about 8 types of PSS business models within three categories, where each type has ever more value in the service content of the solution that is offered to the customer. He places three business models within the “result based” category, where one is named: *pay per service unit*, exemplified with the service unit “copies” instead of “copy machines”. Another is named *functional result* exemplified with companies that offer a “pleasant climate” in offices rather than offering heating or cooling equipment. Tukker uses the term *result* for the general, technology dependent or independent, benefit. A *service unit* is the term for the technology dependent benefit and *functional result* the term for the technology independent benefit. He does not discuss the difference between conceptual benefit and measurable benefit, or between definition and valuing of benefit. Clayton, *et al.* (2012) use the expression “selling the *functionality* of the product” exemplified by “Rolls-Royce’s Power-By-The-Hour® *availability* contracts”. Isaksson, *et al.* (2009) use the word *function*: “Product-Service Systems (PSS) raise interesting opportunities for the manufacturing firm as the *function* is provided to meet customer needs rather than the physical hardware itself.”

Lusch and Vargo (2006) have developed a conceptual lexicon of marketing, describing several concepts important for the transfer from an industrial G-D logic to an industrial S-D logic, the concepts most relevant for this survey are shown in table 1. This lexicon highlights the difference between *service* and *services*. *Services* is produced and sold to customers while *Service* is secured for customers. A company that delivers *services* is hence not necessarily using an S-D logic. One mentioned example was RyanAir which profitably provides *Services*, but not necessarily *Service*, considering the comparatively high number of complaints. Lusch and

Vargo (2006) do not specifically discuss the difference between conceptual benefit and measurable benefit, or between definition and valuing of benefit.

Table 1. Conceptual lexicon of marketing (excerpt), Lusch and Vargo, 2006.

G-D logic concepts	Transitional concepts	S-D logic concepts
Goods	Services	Service
Products	Offerings	Experiences
Feature/attribute	Benefit	Solution
Value-added	Coproduction	Cocreation of value
Price	Value delivery	Value proposition
Supply chain	Value chain	Value-creation network
Product orientation	Market orientation	Service orientation

Improving resource efficiency as a means to reduce industrial environmental impact has been widely recognized as a cost efficient environmental method. A change from selling goods to selling benefit transfers the efficiency incentive from receivers to providers, often generating substantial improvements of resource efficiency. One work describing the large environmental benefits from this business model is *Performance Economy* (Stahel, 2010). Stahel discusses the term *pay per performance*, essentially describing the general procedure of paying per unit benefit. He also mentions the concept *pay per service unit*, exemplified with the number of landings for aircraft tires. He gives numerous examples of companies that sell performance in some way. These companies, however, rarely use the term “performance”, or “benefit” for that matter, when they describe their “performance products”. Instead they often use specific, sometime trademark registered names, which are generally described as “service products” e.g. exemplified by: *PowerByTheHour®*, *Rent-a-molecule*, which is a business concept where magnetic material is offered by Cookson, *On Demand Software*, which are specific software functions offered by SAP, *Negawatt*, offered by Tennessee Valley Authority, defined as indoor climate and lighting, etc. Stahel also differs between the *Service Economy* where people buy services and the *Functional Service Economy* where people buy functioning systems as a permanent service over time. Selling performance instead of products transfers risks to providers and Stahel mentions insurance costs as a way to value performance products. He mentions *value per weight* as an example of metrics for the performance economy.

Competitive purchasing and utilization of IT is competence demanding due to the rapid technological development within the IT industry. Focus on desired benefit instead of products could hence be particularly rewarding when making IT investments and it was not surprising that “benefit work” from the receiver point of view was found within this domain. A book that brings up problems with introduction of new IT systems in the workplace is “*Jävla Skitsystem*” (Söderström, 2010). There Söderström discusses the differences between *function* and *effect* and how those concepts are related to benefit. He illustrates the problems of equating “function” with “benefit” by describing how a company delivered the function; *possibility to charge for a vaccination*. The charging routine, though, required twenty keystrokes, the effect being that the function was basically useless and not beneficial at all. He writes that developers often assume that functions will be used if they exist, which often is not the case due to insufficient training, time pressure and bad interfaces. To secure benefit from IT investments he therefore recommends not to focus on functions, but to follow the procedure:

- *Define the purpose, e.g. “make the order handling more efficient”.*
- *Secure metrics for the purpose.*
- *Identify who needs what to make the new solution more efficient, focus on good enough solutions, instead of optimized solutions.*
- *Secure user targets and metrics for the user targets.*

Söderström does not specifically discuss how “purpose purchasers” should go about to secure metrics for the purpose or how to value fulfillment of the purpose.

Bettencourt and Ulwick, (2008) introduces the concept of *jobs* and *job mapping* which “breaks down the task the customer wants done into a series of discrete process steps”. This is substantively different “from process mapping in that the goal is to identify what customers are trying to get done at every step, not what they are doing currently.” They claim that all jobs have a universal structure with pre-execution steps and post execution steps. Crucial parts of those steps are to “define”, “confirm”, “verify” and “validate” performance and actual outcomes. This could be viewed as a method to identify the “real” benefit that customers are looking for and an example of how the approach has been used is mentioned: “While other MP3 manufacturers were concentrating on helping customers listen to music, for example, Apple reconsidered the entire job of music management, enabling customers to acquire, organize, listen to, and share music.” (Bettencourt and Ulwick, 2008, p. 110).

In addition to the terms mentioned above there are numerous variants of terms used to describe benefit such as *capability* as described in the document *Factories of the Future* (2013) by the Publications Office of the European Union, or *outcome*, *customer satisfaction* and *efficiency*.

Within the research domains above as well as within other research areas, the term *value*, is used in numerous variations within the benefit context. When using this word, authors have a range of meanings though. Ng and Smith (2012) categorize existing value literature into six themes of value understanding: *utility*, *economic worth*, *perceived satisfaction*, *net benefit*, *means end* and *phenomenological experience*. "In addition to those themes, the phrase *value adding* often does not mean benefit, nor value, but is used to describe that "something" is happening to a specific goods (machining, adding another component, etc) during production.

3.2. Findings through interviews

Given the many terms and definitions used in the literature when discussing benefit it was not surprising that the interviews and discussions with companies showed that “benefit” is an elusive concept when making investments, and somewhat difficult to discuss. Several factors contributed to the demanding interviews and to different views among different actors affected by the investments:

- Different actors within the same company had different system views, both in space and in time. There was no common view on how to answer the questions; benefit for *whom?*, *when?* and *during what time period?*
- The companies had no clear routines to make distinct separations between conceptual benefit and the definition of measurable benefit, and between desired benefit and the valuing of this benefit.
- There were also different opinions on what the actual measurable benefit was, e.g. shortened cycle time or reduced manual labor, or both.

Despite the different views from different actors it was clear that automation investments mainly were made with the intention to lower the production cost per produced product. Lower production cost was mainly assumed to come as a result of the benefit; *reduced manual labor time for specific assembly operations*. There was awareness that it is not possible to equate lowered manual labor time with reduced production cost when making investments. However, this awareness did not translate into thorough valuing of the actual impact on production cost for the factory as a whole over time, as a basis for the investment. It was also found that benefit from investments, often was unclearly defined with a narrow system view, e.g. “reduced labor time for a specific assembly operation”, and not well communicated to actors affected by the investment. Local benefit with a narrow system view was prioritized before global benefit for the production system as a whole over time. Actual benefit from earlier investments was rarely evaluated. Instead attempts to maximize value from an investment were made by standardization efforts. That is, by standardizing routines for commissioning, choice of equipment, installations, operation, upgrading, reconfiguration, programming, maintenance, information handling, documentations, etc, it was assumed that the benefit “reduced manual labor time”, would translate into lowered production cost for the larger factory system over time. The procurement methods were investments and purchasing of specific services, paid by the hour. The possibility of using “benefit” focused business models where companies pay per unit delivered benefit instead of making production investments, was generally not evaluated, neither were organizational consequences of such business models.

4. ANALYSIS

Different aspects on how to develop products that deliver benefit and more value to customers are well covered in the literature. However, this survey indicates that most work focus on the *procedure* of developing PSS products and the general components that these products entail. There is comparatively limited focus on how to

define desired, and evaluate actual benefit. The existing research also mainly takes the provider point of view and often has a marketing approach. It tends to focus on describing the conceptual benefit their products is assumed deliver for customers. The differences between conceptual benefit and measurable benefit and between benefit and the valuing of benefit are rarely emphasized. The procedure how to define the measurable benefit is rarely discussed in detail. The findings showed that there are many terms used to define benefit, and that the very term “benefit” is rarely used. *Service* (not to be mixed up with *services*), *service unit*, *functional result*, *function*, *functionality*, *performance*, *effect* and *value* are however some commonly used terms. Generally, the work showed that specifically the terms *service* and *value* are liberally used in the literature, describing concepts with a rather wide range of characteristics and using e.g. the phrase “delivering value added service” within a project group could potentially cause significant misunderstanding.

In contrast to the development of products that provides more value for customers, research on how purchasing departments is defining, or should go about to define benefit, they would like to secure from investments or by using other purchasing business models, seems to be less well covered. Handbooks and recommendations on how to invest in complex equipment, give mainly recommendations on what to think about when investing. They rarely give recommendations on how to define desired benefit with such a quality that a choice can be made between investments in equipment *or* by using other business models such as direct purchasing of the defined benefit.

Several steps have been taken to create a terminology, definitions and a general theoretical framework for a possible future benefit focused paradigm. However, looking across several research domains, the inconsistent use of terms and limited emphasis of differences between benefit and the tools used to deliver the benefit, benefit and the valuing of the benefit, etc, make it difficult to answer yes on any of the chosen reference questions and based on only those questions it could be said that there are several steps left before a general agreed upon benefit paradigm framework is in place. The literature survey also showed that several more questions should be consistently answered over different research domains in order to say that there exists a theoretical benefit paradigm framework. Some examples of further questions:

- Product service systems could be said to simultaneously provide benefit, goods and services for customers. When those systems are discussed, are authors making clear distinctions between the *benefit*, the *goods* and the *services*?
- Business relations based on the transfer of benefit need a process with several steps: preparation for benefit delivery, delivery, measuring of delivered benefit and evaluation of delivered benefit. When authors discuss this, are they making clear distinctions between the *process of benefit delivery* and the *actual delivered benefit*?
- Different types of benefit might need different types of definitions. Do authors highlight this and consistently describe the differences, when needed?

Current trends towards more focus on benefit seem to have had limited impact on the industrial companies interviewed. Their focus is still predominantly on specification of production equipment and how to reduce equipment cost when investments are made. There seem to be an assumption that resources spent on standardizing methods, on thorough technological specifications and on negotiating a low price for equipment, will translate into valuable solutions for the whole production system. There seem to be convictions that there is little value in spending resources on detailed defining of metrics for the factors that mean benefit to the production system, on connecting economical value to all metrics and on analyzing what alternative types of production measures, outside investments, that most cost efficiently could secure desired total benefit for the company production system as a whole over time. There also seem to be a conviction that there is little value in spending resources on thoroughly evaluating experiences and actual delivered value from earlier investments. It could be argued that these company assumptions and convictions are important and should be backed up with evidence based support, as e.g. production technology and markets develop very fast, potentially causing standards as well as production technology to quickly be outdated. This evidence based support for the convictions and assumptions could only be found to a limited extent when the interviews were made.

Even though it cannot be said that a well established theoretical conceptual framework for “benefit trade” exists, companies could take advantage of the theoretical work that has been done to secure maximum value from their investments. However, in this study it has been found that companies use the existing “benefit” work to a very limited extent. The result from the interviews indicated that one possible explanation to this could be that the very process of defining benefit with such a quality that a direct purchase of this benefit would be possible, would also make outsourcing a more accessible option. The likelihood that engineers responsible for specific

assembly operations would initiate measures that can simplify outsourcing of these operations, could be assumed low.

5. CONCLUSIONS AND FUTURE RESEARCH

If industrial providers and receivers of products consider a transfer from trading goods and services to trading benefit and look for support on how to carry out this transfer by making a broad literature study, they will not find a generally agreed upon terminology and set of definitions that can help out with the transfer. However, they will most likely find that the term “benefit” is not used to describe benefit. Commonly used terms, though, such as service and value are not consistently used and can have different meanings.

When companies make automation investments, limited resources are spent on defining desired benefit, on evaluating alternative business models than can secure desired benefit and on evaluating actually delivered value. This indicates a potential for general improvement of the success rate for automation projects. It further indicates that mechanical engineering companies in general are not prepared to capitalize on the current industrial shift in focus from products to benefit. E.g. companies cannot evaluate the choice: *investing in machinery*, and compare this with the choice: *direct purchase of the benefit* that is assumed to come as a result of utilization of the purchased machinery, if the desired benefit is not thoroughly defined and valued.

The findings have raised several more questions that will be investigated in future studies:

- *What term should be used to describe “benefit” in order to make it clear to different actors what is meant?*
- *Which reference questions need to be consistently answered, over several research domains, to say that there exists a general agreed upon theoretical framework for a benefit centered paradigm?*
- *Are the strategic assumptions companies make when they carry out automation investments well founded?*
- *If enough resources are spent so desired benefit of automation could be defined and valued with enough quality to enable a choice between direct purchase of this benefit or an automation investment, what would a cost-benefit analysis reveal?*

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