Buffers in Capacity Management: A multiple case study

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Abstract
A competitive delivery capability is dependent on a balance between supply and demand, a challenge that increase due to variations. This inevitably leads to a need for proper management of buffers. The purpose of this research is to investigate buffers utilized in practice in relation to a framework of buffers for capacity management. Twelve different kinds of buffers from the conceptual framework are identified in the multiple case study. The experiences from eleven respondents highlights the purposes and procedures of buffer capacity management (BCM).

Keywords: Buffers, Capacity Management, Case Study

Introduction
A competitive delivery capability is dependent on striking a balance between efficiency and responsiveness (Chopra and Meindl, 2016). At the core of this challenge is supply in response to demand, where the requirements for supply resources are defined by demand that needs to be balanced with the availability of these resources. There is a mutual relationship between availability of resources and order fulfilment lead-time when supply is responding to demand. The lead-time is affected by queue time, which in turn is influenced by the resource utilization rate. A high utilization rate is often seen as a key performance indicator related to efficiency and thus something that many managers strive for. However, queuing theory shows that if arrival rates approach the service rate for highly utilized resources the queue time, and as a consequence the lead-time, will tend to be very long (Atwater and Chakravorty, 2002). Inevitably this creates issues on how to sustain a competitive delivery capability. These issues exist as required supply is exposed to uncertainties and variations in future demand. For the example of utilization rate, it is required to plan for extra capacity in order to successfully provide what is needed when needed (Bish *et al.*, 2005). This extra capacity indicates what is here also referred to as a buffer, in general terms interpreted as an addition of resources in form of material, capacity and/or time to cope with variations in supply and demand. Due to costs, buffers are always limited which means that the costs need to be weighed against the protection the buffers provide. Consequently, the management of buffers regarding the kind of buffer, location and size is an important capability. This management of buffers in the context of capacity related issues (including materials and lead-time to protect and/or compensate for capacity) is here referred to as Buffer Capacity Management (BCM).

The purpose of this research is to investigate buffers utilized in practice in relation to a framework of buffers for capacity management presented in Hedvall and Mattsson (2018). An important aspect of the purpose is to investigate how buffers are used for different situations and types of variation in demand. To support the fulfilment of this purpose, three research questions are formulated: (i) "Which are the main buffers utilized in BCM in practice?"; (ii) "What is the purpose of utilizing these buffers in BCM in practice?"; (iii) "How are these buffers configured in BCM in practice?"

Next, the employed conceptual framework for buffers in capacity management is outlined. The outline is followed by a description of the research methodology employed for this study. Thereafter, the case study findings and the analysis are presented and finally some concluding remarks are made.

Theoretical framework

Variations

Businesses are to some extent exposed to uncertainty and variations in demand. These variations can be referred to as systematic or stochastic variations depending on their character. Systematic variations in demand tend to follow a pattern that is most often long-term such as trend or seasonality, where the demand variations are most often forecasted as expected average volumes per period across the horizon (Wikner and Mattsson, 2018). According to Wikner and Mattsson (2018), stochastic variations in demand represent short-term random variations over-layered the regular demand in the periods. Both these types of variations in demand cause variations in requirements of materials and capacity that needs to be handled to enable a competitive delivery capability.

Buffers in capacity management – a conceptual framework

Variations in demand can be handled by having sufficient buffers. In general, there are three different types (characteristics) of buffers; in form of materials, lead-time and capacity (Caridi and Cigolini, 2002). A framework of buffers in capacity management, including the three types of buffers, is proposed by Hedvall and Mattsson (2018). The framework consists of buffers related to systematic and stochastic variations, where the buffers related to stochastic variations are divided into process buffers, inbound buffers and outbound buffers. In total, 12 buffers are included in the framework. In Table 1 the framework is conferred with the categories, buffers, buffer types (material, lead-time or capacity), purposes and descriptions. The categories are described below, together with examples of buffers that are included in the framework.

The first category, *Buffers related to systematic variations*, refers to buffers that can be utilized to handle long-term demand patterns. To exemplify, a lead strategy in capacity investments represents capacity changes prior to expected demand changes (Hill and Hill, 2012). For an expected increase in demand, the lead strategy implies an increase of capacity in advance of demand that result in slack capacity, at least for some time. This additional capacity is here seen as an anticipation buffer that provides opportunities to gain market shares and securing the delivery capability. The following three categories are buffers related to stochastic variations that are intended to cope with short-term random variations in demand.

The second category, *Process buffers*, represent buffers that protect the customer of the process from late delivery due to unexpected fluctuations and disruptions. It is common to insert queue times in the processes (Vollmann *et al.*, 2005), that smooths the capacity requirements and makes the delivery lead-time more predictable. This queue time is here regarded as a process buffer where a wider time span is provided to manage the work and unexpected events. Another hedge against uncertainties in the manufacturing system is to utilize various types of flexibility, seen as operational hedging by Van Mieghem (2003) that is needed to achieve high service levels and efficiency (Betts *et al.*, 2000). This flexibility represents a buffer that can be used to temporarily increase the capacity, such as utilizing overtime or subcontracting.

Table 1. Framework for buffers in CM (Hedvall and Mattsson, 2018)

Category	Buffer	Type	Purpose	Description
Buffers related to systematic variations	Anticipation buffer	Capacity	Secure future delivery capabilities when anticipating increasing demand	An anticipation capacity buffer is a higher capacity level in advance of demand based on expected future requirements, providing opportunities to gain market shares by securing the delivery capability.
	Delivery lead-time protection buffer	Capacity	Secure stable and short delivery lead-times	A delivery lead-time protection buffer is an added amount of capacity added to the net capacity requirements, to secure stable and short delivery lead-times.
	Backlog buffer	Lead-time	Smooth capacity requirements by allowing backlog of orders	A backlog buffer is a queue of customer orders waiting to be released or being processed, that compensates constrained capacity by allowing a more levelled capacity utilization in addition to more stable and reliable delivery lead-times.
	Seasonal inventory buffer	Material	Compensate for capacity shortages	A seasonal inventory buffer can be built up when demand is lower than the available capacity, to be used during periods of higher demand than the available capacity. The seasonal inventory buffer compensates for capacity shortages and allows a more levelled capacity utilization.
Buffers related to stochastic variations (Process buffers)	Queue time buffer	Lead-time	Protecting delivery lead-time	A queue time buffer is the amount of time a job waits at a work centre before setup or work is performed on the job, smoothing the capacity requirements as there is a wider time span to manage the work.
	Safety capacity buffer	Capacity	Allowing more stable, short and reliable delivery lead-times	A safety capacity buffer is an amount of capacity added to the capacity requirements to allow stable, short and reliable delivery lead-times.
	Internal capacity flexibility buffer	Capacity	Sort-term opportunities to increase capacity when needed	An internal capacity flexibility buffer consists of internal short-term opportunities to increase capacity when needed, e.g. utilize overtime. Note that internal opportunities are here referring to capacity opportunities within a base element.
	External capacity flexibility buffer	Capacity	Sort-term opportunities to increase capacity when needed	An external capacity flexibility buffer is external capacity possible to utilize when the capacity requirements are higher than the available capacity internally. It consists of external (within or outside the company) short-term opportunities to increase capacity when needed, e.g. utilize external multiskilled workers or subcontracting.
Buffers related to stochastic variations (Inbound buffers)	Inbound safety lead-time buffer	Lead-time	Protecting capacity losses	An inbound safety lead-time buffer is an added amount of time in front of a constrained base element to protect the resource capacity from not being fully utilized.
	Inbound safety stock buffer	Material	Protecting process capacity against material shortages	An inbound safety stock buffer is an extra amount of materials placed in front of a constrained base element to protect a process from material shortages, providing a protection of the resource capacity from not being fully utilized.
Buffers related to stochastic variations (Outbound buffers)	Outbound safety lead-time buffer	Lead-time	Compensating process capacity losses and lead-time variation (in addition to safety time for demand variation)	An outbound safety lead-time buffer compensates capacity losses in constrained resources, placed after the base element to allow more stable and reliable delivery lead-times.
	Outbound safety stock buffer	Material	Compensating process capacity losses and lead-time variation (in addition to safety stock for demand variations)	An outbound safety stock buffer compensates capacity losses in constrained resources, placed after the base element to allow high service levels.

The third category in the framework is *Inbound buffers*. Inbound buffers protect the manufacturing system from unexpected disruptions in delivery of input materials. Disruptions in deliveries may cause capacity losses due to starvation of input materials. Inbound buffers in form of additional lead-time or material can therefore protect the manufacturing system and enable high capacity utilization for constrained resources.

The fourth and final category in the framework is called *Outbound buffers,* representing buffers that compensates for capacity shortages to protect the delivery capability. These outbound buffers can be in form of materials to allow high service levels or lead-time to allow more stable and reliable delivery lead-times.

Several of the descriptions in Table 1 include what is called a base element, which refers to a generic model of some part of a business independent on the level of abstraction. This means that the base element can represent a whole company as it can represent a part of the transformation, such as a single transformation resource (Wikner and Mattsson, 2018). The base element explicitly illustrates that it is the combination of available materials and capacity that determines the ability to satisfy demand.

Research methodology

This research originates from empirical observations of capacity management in an ongoing research project. These empirical observations constitute a baseline for analysis have primarily been conducted during 2017 and the beginning of 2018, through workshops and interviews with respondents from the participating case companies in the research project. The focus of this study is to investigate buffers utilized in a manufacturing context to make a first evaluation of the framework by Hedvall and Mattsson (2018). The unit of analysis is limited to BCM and is investigated based on the experiences from four manufacturing companies and in total 11 respondents. A qualitative direction is considered an expedient choice for this study as it enables the possibility to explore and generate in-depth knowledge about the phenomenon of interest. The possibility to explore a phenomenon (such as BCM) from different perspectives for a deeper understanding is considered as one of the main strengths of qualitative research (Yin, 2014).

Data collection

According to Voss *et al.* (2002), the most common sources of information in qualitative research are interviews and documents. The data collection in this study include both these sources but with a primary source in form of interactive workshops including all case companies. The case companies have received an assignment with questions to discuss internally before the workshops. During the workshops the case companies presented their answers and work connected to the questions, where the compounded presentations constitute important documentation. Before the interviews, recordings from the workshops and the documents have been scrutinized to summarize remaining questions into an interview guide. The case companies' representatives were interviewed early 2018 through semi-structured open-ended interviews with the intension to identify buffers and the work with these buffers in practice. The reliability (as described by Lincoln and Guba (1985)) is sought to be enhanced by audio-recorded interviews, where relevant information has been extracted and transcribed. The overall intension of the research project has resulted in a selection of cases from different industries, which enables a broadened understanding of BCM in this study. In Table 2 the data collection in terms of face-to-face meetings are summarized, where the company names are exchanged with Company A, Company B and so forth for anonymity purposes. R is hereafter used to designate the respondent together with the respondent number as indicated in the table. The duration refers to the duration of the complete workshop.

Table 2. Data collection

Company	Respondent	Position	Method	Duration
Company A	R1	Manager Sales and Operations	Workshop 1	10 h
			Workshop 2	10 h
			Semi-structured interview	2 h 10 min
	R2	Procurement Director	Workshop 2	10 h
	R3	Leader Logistics Development	Workshop 1	10 h
			Workshop 2	10 h
	R4	Capacity Planner	Workshop 1	10 h
			Workshop 2	10 h
Company B	R5	Team leader Planning	Workshop 1	10 h
			Workshop 2	10 h
			Semi-structured group interview	2 h 30 min
	R6	Production Planner	Workshop 2	10 h
			Semi-structured group interview	2 h 30 min
	R7	Logistics developer	Workshop 1	10 h
Company C	R8	Supply Chain Manager	Workshop 1	10 h
			Workshop 2	10 h
			Semi-structured interview	2h 45 min
	R9	Production Planner	Workshop 1	10 h
Company D	R10	Senior Specialist Logistics	Workshop 1	10 h
			Workshop 2	10 h
			Semi-structured group interview	3h 10 min
	R11	Process developer	Workshop 1	10 h
			Workshop 2	10 h
			Semi-structured group interview	3h 10 min

Additional questions arising after the interviews have been handled by further contact with the respondents. The interviews were performed in the native language of both the researcher and the respondents to avoid language barriers, encourage discussion and reduce the risk of misunderstandings.

Data analysis

An interview review framework has been established by extracting relevant information from workshops, interviews and additional documents. This interview review framework consists of the identified buffers, the main descriptions and purposes for each buffer based on explanations from respondents, that together with quotes from respondents exemplifies connections. The data analysis has included a categorization in relation to the conceptual framework by Hedvall and Mattsson (2018), where case explanations are related to different types of variations and kinds of buffers. The conceptual framework has been refined based on input from the workshops.

Research quality

Eisenhardt (1989) emphasize the importance of a synergetic view of evidence to increase the evidence in the findings. The synergetic view of evidence is sought to be strengthened by multiple data collection methods, which also enable a deeper understanding of the phenomenon of interest. Audio-recorded workshops and interviews provide an accurate rendition of what has been said, that together with documentation of the research has been used to enhance the research reliability, as described by Lincoln and Guba (1985).

Case study findings and analysis

In this section, the case study findings and analysis are presented with regard to the purpose of this research, which was initially stated as: "to investigate buffers utilized in practice in relation to a framework of buffers for capacity management in Hedvall and Mattsson (2018)". The purpose was then divided into three research questions.

RQ (i) "Which are the main buffers utilized in BCM in practice?"

The empirically utilized buffers in the four case companies have been categorized according to the conceptual framework by Hedvall and Mattsson (2018). The categorization is conferred in Table 3 with case companies that mention the buffer as described in the conceptual framework and an exemplifying quote from one of the respondents. Note that the purpose with each buffer for the case companies comes forward in several of the quotes. B is hereafter used to designate the buffer together with a number to be used as a reference for the type of buffer.

Table 3. Buffers utilized in practice

#	Buffer	Source	Supporting quote
B1	Anticipation buffer	Company A, Company B	Company B, R5: "…when I first started we went up in takt time to 20 000 units per week...we built a factory for 30 000 units per week to prepare, then came a [technology] shift...now we run at 15 000 units per week…Making more money but still have capacity for much more."
B2	Delivery lead-time protection buffer	Company A, Company B	Company B, R6: "We have a machine capacity for a higher takt time, and it concerns the whole production as it is presently… we don´t fill our [machine] capacity...although to utilize the slack we need additional labour."
B3	Backlog buffer	Company A, Company B, Company D	Company A, R1: "In final assembly…there are opportunities to smooth…everything is MTO...it happens that we utilize it [backlog]."
B4	Seasonal inventory buffer	Company B, Company D	Company D, R11: "...where we run orders in advance before vacation…to protect against seasonal variations and enable to smooth the utilization."
B5	Queue time buffer	Company A, Company B, Company C, Company D	Company A, R1: "…have some form of lead-time buffer, note queue time for operations...with the main reason to protect the flow [absorb disturbances]."
B6	Safety capacity buffer	Company B, Company D	Company D, R10: "It [slack capacity] is a way to ensure that we get a reasonable lead-time…"
B7	Internal capacity flexibility buffer	Company A, Company B, Company C, Company D	Company C, R8: "We have labour exactly to reach the agreed service level agreement with sales...overtime is the option, it is our buffer in this."
B8	External capacity flexibility buffer	Company A, Company B, Company C, Company D	Company A, R3: "Flexibility buffer…we count on that we can outsource if needed."
B9	Inbound safety lead-time buffer	Company A, Company C, Company D	Company D, R11: "to order [from suppliers] in advance is also a buffer…earlier ordering protects against the transport/delivery variations that are present."
B10	Inbound safety stock buffer	Company A, Company B, Company C	Company B, R5: "The safety stock in procurement is individual...the level varies depending on person, it can vary extensively."
B11	Outbound safety lead-time buffer	Company A, Company B, Company C, Company D	Company B, R5: "…[lead-time buffer] to absorb all problems…protects delivery with one day."
B12	Outbound safety stock buffer	Company B, Company D	Company D, R11: "A stock that protects against variations in supply and demand."

The selection of buffers varies between the case companies. Some companies utilize almost all kinds of buffers while others, for different reasons, only go for a few different buffers. Company C exemplify the difference in strategy for procurement depending on how critical the incoming material is and how close the supplier is in terms of geographical distance. For a closely located supplier, an inbound safety lead-time buffer (B9) of 1,5 days is the only protection, while a safety stock (B10) covering 8 weeks of demand is utilized for materials supplied across the world even though weekly deliveries are present.

Four of the buffers are mentioned in all case companies; queue time buffer (B5), internal capacity flexibility buffer (B7), external capacity flexibility buffer (B8) and outbound safety lead-time buffer (B11). That all the case companies utilize queue time buffers and capacity flexibility buffers is not a surprising result, as it is common to count on queue time in capacity management (Vollmann *et al.*, 2005) and that various types of flexibility (e.g. overtime and temporary employment) are frequently utilized in practice for short-term requirements (Hedvall *et al.*, 2017). The relation between a selection of buffers and a manufacturing strategy (e.g. make-to-order and make-to-stock) has not been clear in this research as the manufacturing strategy varies between the case companies. Hence, additional cases are required to investigate these potential connections.

Company D stresses that it is hard to know where to draw the line for what is a buffer and not. R11 exemplifies this when discussing what a safety capacity buffer (B6) implies for maintenance engineers, since they do not have somebody just sitting inactive and waiting to be needed. Rather, available time is used for other relevant tasks as process development and preventive maintenance. Since not all time should be devoted to the main task, the remaining time may be considered as a safety capacity buffer (B6) or a delivery lead-time protection buffer (B2). However, all parts are important for the long-term success and a question of prioritizing in the short-term. This matter of prioritizing work tasks is closely connected to an aspect discussed during one of the workshops, namely the impact of motivation, suggesting that more output can be achieved during short periods when in a rush. This raised questions about if this possibility can be seen as a buffer. After consideration it might be an aspect of internal flexibility (B7) but not a buffer per se. This with regards to that a buffer is here defined as an addition of resources, that should be intentionally developed. Capacity utilization has also been discussed as a potential buffer, that after discussions tend towards that it might not be a buffer but an important issue to consider in BCM since 100% utilization cannot be expected, and therefore needs to be taken into account in capacity dimensioning.

RQ (ii) "What is the purpose of utilizing these buffers in BCM in practice?"

It is possible to extract several reoccurring nuances of purposes for the utilized buffers in practice. In Table 3 this takes form by statements as "to prepare [for expected future demand]", "opportunities to smooth", "protect against variations", "to protect the flow", "get a reasonable lead-time", "protect against the transport/delivery variations", "absorb all problems", "protects delivery" and "protects against variations in supply and demand". In general, protection appears to be a main purpose for utilizing buffers. R5 argues that the overarching purpose, independent of the specific kind of buffer, is to protect customer orders. When asked further about this, R5 explained that the protection of customer orders is the main concern but if the materials, process capacity and lead-time are protected the customer orders will be protected as well. Thus, that the purpose can be defined in different ways depending on the point of view. R11 sees the overall purpose with buffers as protecting processes and activities against variations, placed in front of or in the process or activity. R10 adds to this by stating that the purpose is to enable a reasonable delivery lead-time to customers, hence that protection of delivery should also be considered by outbound buffers. R1 discuss that a buffer is something that is possible to use when needed and that it should be sustainable to use.

In general, material buffers before the processes (B10) are considered to enable a high capacity utilization by protecting the resources from capacity losses. Company D adds that

B10 is a protection for quality shortages. Material buffers after the processes (B12) are considered to secure a high service level, according to Company B. Company D also mention the advantage of utilizing material buffers for systematic variations in demand, that is protects against seasonal variations (B4) and enable a levelled capacity utilization.

Company B explain that an anticipation buffer (B1) aims to secure future delivery capability, while Company A describe that B2 increase the ability to absorb disturbances for long-term demand patterns. Process buffers are seen as protecting against capacity losses, together with smoothing the capacity requirements. Company D mentions that the purpose is to protect against variations in the processes such as quality issues, capacity variations or demand variations. Company C argues that capacity flexibility buffers (B7 and B8) reduce the need of buffers in form of material and/or lead-time as they enable short-term opportunities to increase the capacity level when needed. An important notion is that the selection of buffers is affected by several issues. R1 raises the issue of operations complexity, where it might not be possible to utilize external resources (B8) when there is a need of a certain resource or competence. R8 adds that this issue remains even within Company C´s manufacturing, where some processes might have extra capacity, but the personnel cannot contribute in other processes due to limited physical abilities in relation to the heavy work required.

Lead-time buffers are regarded as protecting following processes, both processes in manufacturing by B9 (to handle variations in delivery from suppliers) and the process of delivery by B5 and B11 (to handle variations in the manufacturing process). B3 is partly of a different character, as it is used for systematic variations to smooth the capacity utilization. Both the outbound buffers, B11 and B12, are considered to be buffers that compensate capacity losses in the processes to protect delivery. This is in line with the proposed purpose in the framework by Hedvall and Mattsson (2018). Except for compensating capacity losses, R1 mention that the outbound safety lead-time buffer (B11) is present due to practical planning purposes in the same time as it is a hedge against late deliveries that lead to fines.

The total selection of buffers is an important aspect to consider in the capacity strategy (Slack and Lewis, 2001). Company D emphasizes the challenge of managing the buffers in a proper way and to maintain it for what it is intended for, to handle variations and not utilize it for other things. This is especially common for lead-time buffers, according to R11. R11 also mentioned that the queue time buffer (B5) is a general time to protect themselves from most uncertainties or variations that arises.

RQ (iii) "How are these buffers configured in BCM in practice?"

A lack of support for capacity management decisions, and buffer management, is expressed as a common challenge across all cases. Company A emphasize that their buffer management consists of active choices but from different parties within the company. According to R1, the efforts of mapping the existing buffers internally led to new insights of additional buffers utilized than what was known before. Company D mentions a similar situation but also raises concerns that the management of buffers tend to become sub-optimized, where people do it their own way locally without understanding the bigger picture.

The actual configuration in terms of deciding on an appropriate buffer level is to a large extent based on experience and intuition; as an intuitively appropriate level, a fraction of expected variations or based on statistics for the requirements historically. According to Krajewski *et al.* (2010), the intuitive approach is common when there is a lack of theoretical knowledge of how to evaluate the impact of different capacity strategies. Company A has decided to have high levels of all buffers in a transition period to takt-based production. R1 explain that the transition is a strategy to increase productivity and reduce lead-times, where several buffers are built into the system to stabilize the flow before starting to adjust the buffer levels. The plan is to continuously track when/if the buffers are needed and to what extent. Then the strategy is to decrease these levels step by step until appropriate levels are reached. This iterative process is seen as an adaptive way of working where changes are made followed by scrutinizing the outcome, trying to see potential relations between cause and effect.

Company C raises what they consider as one main challenge for going forward; "how do we select an appropriate mix of capacity and buffer alternatives? Nevertheless, how do we determine the level of these?" – R8. Company D discusses similar challenges but connected to a specific resource, the maintenance engineers; "What capacity level should the buffer capacity have? What is an acceptable lead-time for solving the problems that arise? What level of capacity is required in order to manage the other work tasks as well, the preventive maintenance and process development?" – R11. These statements illustrate the challenges of capacity decisions. Slack and Lewis (2001) argue that the issue over time is to determine when to make changes in the buffer levels, how big the changes should be and how fast the changes should be performed. Although, this research indicates that there are also challenges in deciding the overall selection of buffers and in knowing the combinatorial effects of a certain selection of buffers, when to use which buffer and how to dimension the buffer levels. This research is considered a part of studying the content of BCM and the process of BCM in manufacturing companies. Thus, this research is considered an important part in order to study how the process should be designed for increased decision-support in BCM.

Conclusions

The participating companies regard BCM as an important challenge for the future competitiveness of the business. The respondents do however consider the decision support for BCM to be insufficient. In addition, a literature review by Hedvall and Mattsson (2018) indicates that BCM has not been explicitly reflected in the frameworks traditionally employed. This have contributed to that decision-making in relation to BCM is mainly based on experience and/or intuition instead on relying on formal procedures and techniques. As a first step towards developing decision support for BCM, this research contributes to answering parts of the questions what, why and how regarding buffers in BCM. "What?" refers to identifying the buffers utilized in practice, "Why?" refers to the purpose for each of these buffers and "How?" refers to the practical procedures in the configuration of these buffers. Empirical data indicate that there are twelve different kinds of buffers in BCM (the same as in the conceptual framework) for three main types of buffers (materials, capacity, and lead time). The utilization of one kind of buffer decrease the need of another since the different kinds of buffers are mutually dependent.

Contributions and implications

The theoretical contribution of this study is the investigation of buffers and their purposes in BCM for a manufacturing context, put in relation to an existing framework. The intention is to increase the understanding of BCM as a critical capability by a deeper understanding of how BCM is handled by practitioners. The main practical contribution is an overview of possible buffers and their purposes, that can contribute to more rational decision-making and therefore improved BCM for practitioners. In fact, this recognition and awareness can contribute to decision-making for increased responsiveness, which in turn contribute to sustaining future competitiveness of the business.

Further research

The validity of the findings can be reinforced by gathering empirical data from similar and other research settings. Hence, further investigations are considered required to increase the confidence in the findings. This initial exploration of buffers in BCM and practice provide an overview of buffers and their purposes as well as an explanation about the configuration of buffer size. Further research could be done to investigate how the selection of buffers (that have been described in this study) depends on the business order winner or overall capacity or manufacturing strategies. The overall combination of buffers determines the business ability to handle systematic and stochastic variations. Further research is therefore needed to explore the consequences of utilizing certain buffers in combination and how the configuration should be done when considering these relations.

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