Conception of an effective Six Sigma belt deployment structure for manufacturing small and medium-sized enterprises

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Doctoral Thesis Summary

Tomas Bata University in Zlín

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Faculty of Management and Economics

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Koncepce efektivního rozvoje struktury Six Sigma belt v malých a středních výrobních podnicích

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ABSTRACT

The Six Sigma methodology creates many possibilities for radically improving process and product quality resulting in enhanced financial performances, customer satisfaction and bottom-line results. While Six Sigma was initially applied within large organizations, the interest of small and medium-sized enterprises in using this continuous improvement initiative is increasing. Due to the fact that a wide variety of small and medium-sized enterprises act as suppliers to larger enterprises and therefore taking over a substantial part in global supply chains, small and medium-sized enterprises are demanded to have robust quality processes in place as well as offer products and services of the highest quality.

One of the most important critical success factors for the implementation of Six Sigma is the strong organizational infrastructure of process improvement specialists, also known as “Belt Hierarchy” or “Belt System” which originally consists of four core types of Six Sigma professionals: Master Black Belt, Black Belt, Green Belt and Yellow Belt. Since the traditional Six Sigma belt approach is not applicable in small and medium-sized enterprises due to a lack of human and financial resources as well as other organizational differences to larger enterprises, amendments are required when it is applied in small and medium-sized enterprises.

For this reason, the research focus of this dissertation is to investigate on an empirical basis how the Six Sigma belt deployment structure in manufacturing small and medium-sized enterprises differs from the traditional SS belt deployment structure used in large manufacturing enterprises. This research question will be supported by six research goals. In particular, the research shall identify the key Six Sigma belts for manufacturing small and medium-sized enterprises, their roles, responsibilities and required skills, their proportion in relation to the total workforce and invested working time towards Six Sigma, their possible number of Six Sigma projects that can be executed and the related cost savings compared to large manufacturing organizations as well as the differences between the current and target state of the Six Sigma belts deployment in manufacturing small and medium-sized enterprises.

The research work is established as combination of a descriptive and explanatory quantitative-based research design. Based on the findings and conclusions derived from the theoretical fundamentals and systematic literature review, research hypotheses are developed that are linked to several statistical hypotheses for their evaluation. As research instrument for testing the statistical hypotheses a questionnaire was developed and an internet survey conducted to collect primary data directly from Six Sigma experts.

The results show that Six Sigma is only implemented in a small portion of those small and medium-sized enterprises that employ the survey respondents but the Six Sigma belt deployment status in these small and medium-sized

enterprises is in accordance with the developed guidelines of the study. It can be concluded that an extensive organizational infrastructure with Master Black Belts and full-time Black Belts as applied in large manufacturing enterprises is not needed in manufacturing small and medium-sized enterprises. In comparison, Green Belts should be the driving force of the Six Sigma initiative and Black Belts shall take on the coaching and trainer role in manufacturing small and medium-sized enterprises. Master Black Belts are not required in small and medium-sized enterprises. As a result of this research a conception of an effective Six Sigma belt deployment structure for manufacturing small and medium-sized enterprises is put together as best practice model which should aid manufacturing small and medium-sized enterprises in establishing an effective and robust Six Sigma belt deployment structure in their organization.

ABSTRAKT

Metodika Six Sigma nabízí mnoho možností k radikálnímu zlepšení kvality procesů a produktů, což vede k lepší finanční výkonnosti, spokojenosti zákazníků a výsledkům. Zatímco se Six Sigma původně používala ve velkých organizacích, zvyšuje se zájem malých a středních podniků o využití této iniciativy neustálého zlepšování. Vzhledem k tomu, že široká škála malých a středních podniků působí jako dodavatel pro větší podniky, a proto přebírá podstatnou část globálních dodavatelských řetězců, je od malých a středních podniků vyžadováno, aby také měly zavedeny robustní procesy kvality a nabízeli produkty a služby nejvyšší kvality.

Jedním z nejdůležitějších faktorů kritického úspěchu při implementaci Six Sigma je silná organizační infrastruktura specialistů na zlepšování procesů, známá také jako „Belt hierarchie“ nebo „Belt systém“, která původně sestával ze čtyř základních typů profesionálů Six Sigma: Master Black, Black Belt, Green Belt a Yellow Belt. Vzhledem k tomu, že tradiční přístup založený Beltech Six Sigma není použitelný v malých a středních podnicích kvůli nedostatku lidských a finančních zdrojů a kvůli jiným organizačním rozdílům ve větších podnicích, je nutné provést změny, pokud se použije v malých a středních podnicích.

Z uvedeného důvodu je cílem disertační práce na empirickém základě zkoumat, jak se struktura nasazení Six Sigma ve výrobě malých a středních podniků liší od tradiční struktury nasazení Six Sigma používané ve velkých výrobních podnicích. Tuto výzkumnou otázku podpoří šest výzkumných cílů. Výzkum zejména identifikuje klíčové Belty Six Sigma pro výrobu malých a středních podniků, jejich role, odpovědnosti a požadované dovednosti, jejich poměr ve vztahu k celkové pracovní síle a požadovanou pracovní dobu k Six Sigma, jejich možný počet Six Sigma projektů, které lze provést a související úspory nákladů ve srovnání s velkými výrobními organizacemi, jakož i rozdíly mezi současným a cílovým stavem nasazení Beltů Six Sigma ve výrobě malých a středních podniků.

Výzkumná práce je založena na kombinaci popisného a vysvětlujícího kvantitativního výzkumu. Na základě zjištění a závěrů odvozených z teoretických základů a systematického přehledu literatury jsou vypracovány výzkumné hypotézy, které jsou spojeny s několika statistickými hypotézami pro jejich vyhodnocení. Jako výzkumný nástroj pro testování statistických hypotéz byl vyvinut dotazník a proveden internetový průzkum s cílem sbírat primární data přímo od odborníků Six Sigma.

Výsledky ukazují, že Six Sigma je implementovatelná pouze u malé části těch malých a středních podniků, které zaměstnávají respondenty průzkumu, ale stav nasazení Beltů Six Sigma v těchto malých a středních podnicích je v souladu s vyvinutými pokyny studie. Lze vyvodit závěr, že rozsáhlá organizační infrastruktura s Master Black Belty a Black Belty na plný úvazek, jak se používají ve velkých výrobních podnicích, není při výrobě malých a středních

podniků potřeba. Ve srovnání s tím by Green Belti měly být hybnou silou iniciativy Six Sigma a Black Belti by měly převzít roli koučování a školitele při výrobě malých a středních podniků. Master Black Belti nejsou v malých a středních podnicích požadovány. Výsledkem tohoto výzkumu je koncepce efektivní struktury nasazení Beltů Six Sigma pro výrobu malých a středních podniků jako modelu nejlepší praxe, který by měl pomoci výrobě malých a středních podniků při vytváření efektivní a robustní Six Sigma struktury Beltů a jejich nasazení ve společnosti.

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Research background and research problem

The growing importance of supply chain management issues in a global market environment make large firms heavily dependent on small and medium-sized enterprises (SMEs) when it comes to the provision of high-quality products or services at low costs. To ensure cost effectiveness, robust quality processes and the fulfilment of customer requirements, SMEs cannot avoid to consider the introduction of quality strategies like Six Sigma (SS) or Lean Six Sigma (LSS) (Antony et al. 2005 and 2008; Deshmukh and Chavan, 2012; Patel and Desai, 2018; Soundararajan and Janardhan, 2019).

The traditional SS approach with a hierarchy of improvement specialists for instance, also known as “Belt System”, which clearly defines and aligns the organizational roles and responsibilities that lead, deploy and implement SS or LSS to produce the expected results in larger companies (Schroeder et al. 2008; Zu et al. 2008; Arumugam et al. 2013) is not desirable in the case of SMEs according to the following researchers: Davis (2003), Rowlands (2004), Kumar et al. (2006 and 2008), Antony et al. (2008), Deshmukh and Chavan (2012), Ben Romdhane et al. (2017), Antony et al. (2019), Alexander et al. (2019). They advised amendments to the SS belt approach when applied in SMEs, as it cannot be used like in large organizations due to various differences in the characteristics of SMEs and large organizations. For these reasons, it is vital to know the SME characteristics and to take the key differences between SMEs and large enterprises into account to ensure the successful deployment of the SS belts in SMEs.

In their literature reviews, Antony et al. (2019) and Alexander et al. (2019) pointed out that LSS in SMEs is an as of yet unexplored area of research that ought to be subject to detailed investigations in the future and identified the following research gaps:

- Lacking knowledge about the required personal traits, necessary skills, responsibilities and roles of the various SS belts
- Lacking knowledge about the required number of SS belts
- Lacking knowledge about the need of Master Black Belts and full-time Black Belts

1.2 Research question and research goals

While taking the aforementioned research problem with the traditional SS belt approach into consideration, which is an essential success factor for the implementation of SS but cannot be fully adopted in SMEs, the objective of the thesis is to answer the following research question and meet the related research goals (see table 1.1).

Table 1.1. Research question and the related research goals. Source: Author.

Research question	
How does the Six Sigma belt deployment structure in manufacturing SMEs differ from the traditional Six Sigma belt deployment structure used in large manufacturing enterprises?	
Research goal 1	*To identify the key Six Sigma belts, their roles, responsibilities and their required skills in manufacturing SMEs compared to large manufacturing enterprises*
Research goal 2	*To identify the Six Sigma belt proportions in relation to the total workforce in manufacturing SMEs compared to large manufacturing enterprises*
Research goal 3	*To identify the required invested working time of the individual Six Sigma belts towards Six Sigma projects in manufacturing SMEs compared to large manufacturing enterprises*
Research goal 4	*To identify the possible number of projects that can be executed by the various Six Sigma belts in manufacturing SMEs compared to large manufacturing enterprises*
Research goal 5	*To identify the possible cost savings by the various Six Sigma belts in manufacturing SMEs compared to large manufacturing enterprises*
Research goal 6	*To identify the differences between the current and target status of the deployment of Six Sigma belts in manufacturing SMEs*

The outcome of this research should serve as input for the conception of guidelines for an effective SS belt deployment structure in manufacturing SMEs.

2. THEORETICAL FUNDAMENTALS

2.1 The Six Sigma belt system

In the 1980s, Bill Smith from Motorola developed SS which is a disciplined and data-driven business improvement methodology that was developed to enhance the quality of processes with the objective of establishing a zero-defect quality strategy, thereby increasing customer satisfaction as well as improving financial results (Arnheiter and Maleyeff, 2005; Schroeder et al. 2008; Montgomery and Woodall, 2008; Desai et al. 2012; Gitlow et al. 2015).

Various authors have criticized SS as "nothing but an old wine in a new bottle" since its method originality seems to be under the umbrella of Total Quality Management (TQM) (Kumar et al. 2008; Schroeder et al. 2008; Antony and Karaminas, 2016). However, there are some key aspects differentiating SS significantly from TQM and other quality initiatives (Snee, 2004; Schroeder et al. 2008; Zu et al. 2008). One of these key aspects is the creation of an infrastructure of process improvement specialists within the organization that lead the way in the data-driven quality improvement efforts. This is also known as "Belt Hierarchy" or "Belt System" (Antony et al. 2005; Arumugam et al. 2013; Antony and Karaminas, 2016).

To define the hierarchy and career paths of these improvement specialists, SS borrows its belt terminology from the world of martial arts which means that professionals trained in SS are distinguished by the colour of their belts. Within this belt system, ranks are determined based on their level of skills and responsibilities similar to karate students (Snee, 2004; Richardson, 2007). The requirements increase with each level. Each level has specifically designed intensive and differentiated trainings that impart knowledge and skills in statistical methods, project management, process design, problem-solving techniques, leadership skills and other managerial skills (Linderman et al. 2003).

The core of the SS organizational infrastructure consists of four trained and certified SS professionals: Master Black Belt, Black Belt, Green Belt and Yellow Belt (Linderman et al. 2003; Haikonen et al. 2004; Jesus et al. 2016).

Black Belts (BBs) fall in the middle of the "Belt Hierarchy" and are the linkage between Green Belts and Master Black Belts. Consequently, BBs are the driving force of the program and play a critical operational role within their organization (Black and McGlashan, 2006; Feng and Manuel, 2008). They typically work on implementing and leading large, high-impact process improvement projects, usually focused on cost saving or quality, by using the DMAIC methodology and a specific set of statistical tools to drive up the customer satisfaction level and business productivity (Hoerl, 2001; Coronado and Antony, 2002; Antony, 2007). Candidates for BBs typically undergo 160 to 200 hours of classroom instruction (for instance, one week per month over a four-month period of time) in combination with the completion of a project that is aligned with strategic objectives of the business (Pyzdek, 2000; Montgomery and Woodall, 2008; Laureani and Antony, 2011; Pyzdek and Kellner, 2014).

Compared to BBs, Green Belts (GBs) are not required to have the same level of experience and knowledge in the use of statistics and leadership skills since they either assist BBs on major projects or lead teams engaged in smaller projects (Ingle and Roe, 2001; Montgomery and Woodall, 2008; McCarty et al. 2004). For this reason, they undergo one or two weeks of training in addition to their project to understand the philosophy and quality tools (Haikonen et al. 2004; Snee, 2004; Laureani and Antony, 2011).

Individuals of the highest expertise level carry the title "Master Black Belt" (MBB). They have completed a number of SS projects and are working full-time in the SS program as strategic leaders. They drive the companies' performance and bring the broad organization up to the required SS competency level. Furthermore, they define and select suitable projects and develop training material. Coaching, teaching as well as mentoring the lower-level SS belts is also part of their responsibilities (Ingle and Roe, 2001; Haikonen et al. 2004; Snee, 2004; Nakhai and Neves, 2009). This requires excellent communication and teaching skills for which MBB candidates receive specialised courses in additional to their BB education. These courses focus, for instance, on topics such as communication and teaching skills, training delivery, advanced statistics, and team building (McCarty et al. 2004; Pyzdek and Keller, 2014).

The SS specialists that acquire this basic training level are named "Yellow Belts" (YBs) (Marzagao and Carvalho, 2016). They work as team members within the SS culture and help the SS project teams with tasks such as collecting data (Breyfogle et al. 2000; Laureani and Antony, 2011). Hoerl (1998) argued that a YB should attend a four-day SS course while, according to the British Standards Institute (BSI) (2011), even as little as a one-day training session would be sufficient.

2.2 Small and medium-sized enterprises

During the past three decades, SMEs played a vital role all over the globe and are considered the backbone and lifeblood of the world economy by various researchers (Müller et al. 2007; Antony et al. 2008; Ayyagari et al. 2011; Antony et al. 2016; Paul et al. 2017; Patel and Desai, 2018; Muñoz-Pascual et al. 2019; Soundararajan and Janardhan, 2019).

They are defined by certain limits regarding the employment size, annual turnover as well as balance sheet total which must not be exceeded. In Europe, a company with less than 250 employees, an annual turnover of up to 50 million € or an annual balance sheet that does not exceed 43 million € is considered a SME (European Commission, 2005). In Germany, however, an enterprise is considered a SME, if the workforce does not exceed 499 employees. Besides the quantitative criteria, the “Institut für Mittelstandsforschung Bonn” (IfM Bonn) also considers qualitative characteristics in their definition of SMEs. A company in which up to two natural persons or their family members hold at least 50% of the company shares and are members of the management of the enterprise is also recognised as SME (IfM Bonn, 2016). Thus, enterprises with 500 employees, or more, or an annual turnover of 50 million €, or more, can also be considered SMEs.

SMEs represent 95% or more of the total number of company’s worldwide, account for more than 50% of jobs and contribute with more than 35% to the Gross Domestic Product (GDP) (Ayyagari et al. 2011; WTO, 2016; Alibhai et al. 2017; Muñoz-Pascual et al. 2019).

Since SMEs achieved a remarkable impact on larger enterprises as suppliers of specialized products (Kumar et al. 2014; Deshmukh and Chavan, 2012), any weaknesses in quality by SMEs could endanger the whole supply chain which would result in rising costs. Robust quality management processes have therefore become a major role in SMEs (Aoki, 2008; Dora et al. 2013).

However, various authors mentioned that SMEs might easily run into problems by replicating the strategy of large enterprises with regard to implementing continuous improvement initiatives without realizing that following the same strategy might not be the best approach. Making this mistake might lead to difficulties when implementing a continuous improvement program and as a result, the idea of implementing such system is often abandoned (Alavi, 2003; Ross and Francis, 2003; Rymaszewska, 2014). To establish an effective SS belt deployment structure in SMEs, it is therefore vital to know the characteristics and environment of SMEs.

Typical strengths of SMEs are the smaller management, the flat management hierarchy with fewer layers and departmental interfaces, the limited number of business locations, the faster and effective internal communication as well as the stronger and more intimate relationships with customers (Antony et al. 2005 and 2008; Deshmukh and Chavan, 2012; Rymaszewska, 2014). Antony et al. (2005) argued that it will be much easier to buy-in management support and commitment as it is the case in large enterprises. Moreover, the flat management hierarchy with fewer layers and departmental interfaces ensures a quick decision-making process and also higher visibility of the top management (Antony et al. 2005 and 2008; Rymaszewska, 2014).

However, Kumar et al. (2006) emphasized potential existing resistance from employees and the management when new business strategies are discussed. If the owner of the small firm is convinced of the benefits that come with such a continuous improvement initiative, its implementation will be greatly facilitated (Antony et al. 2005 and 2008; Kumar et al. 2009).

Furthermore, the education and training component is considerably more challenging for SMEs, because they do not have the capacity to provide trainings or free up employees to engage in trainings and SS projects (Antony et al. 2005 and 2008; Snider et al. 2009; Deshmukh and Chavan, 2012). In SMEs, employees are crucial to the day-to-day operations and solving issues within the company (Antony et al. 2005). Others argued that every employee has usually several other roles on top of their key roles which means that they have overall fewer spare resources available (Isenberg, 2000; McAdam, 2000). Ates and Bititci (2011) stated that such a firefighting approach has a negative effect on SMEs because it can definitely create risks to implement any continuous improvement initiative.

Beside limited human resources, SMEs also face financial constraints (Antony et al. 2005; Snider et al. 2009; Deshmukh and Chavan, 2012; Timans, 2014) which make it difficult to offer training opportunities, educate in-house specialists or engage external agents (Rymaszewska, 2014).

Another serious weakness is that the SME staff may not have the same overall educational level, especially when it comes to knowledge related to statistics (Thomas and Webb, 2003; Deleryd et al. 1999; Deshmukh and Chavan, 2012; Rymaszewska, 2014). This may lead to a lower application of statistical tools for problem-solving activities. Isenberg (2000) also spoke of a limited talent pool in smaller companies. For this reason, it can be a bit problematic to find and select sufficient suitable employees with good leadership skills for the SS initiative of a company as mentioned in the Kumar et al. (2011) article.

3. SYSTEMATIC LITERATURE REVIEW

According to Okoli and Schabram (2010), it is necessary to become aware about the breadth and depth of the current research to understand the level of research and identify areas that need more research in the specific field. Therefore, a systematic literature review was conducted. As a result of the conducted search, 76 sources that were published between the year 1998 and the year 2019 were selected for the comparison analysis of the SS belt deployment structure between manufacturing SMEs and large manufacturing enterprises. 27 sources cover findings about SS belts in manufacturing SMEs that can be used to outline the current state of the SS belt research in SMEs with focus on the manufacturing industry. Based on the conclusions and findings derived from the systematic literature review, seven research hypotheses are formulated that will be investigated in the course of this research study.

4. EMPRIRICAL STUDY

4.1 Methodological approach

To evaluate the formulated research hypotheses, numerous statistical hypotheses will be derived from the research hypotheses as proposed by Cho and Abe (2005) and appropriate statistical tests will be defined for it. In total, 24 statistical hypotheses are formulated for the evaluation of the research hypotheses. For the statistical hypotheses *SH1* to *SH5* two-sample proportion tests will be applied. *SH1.6*, *SH2.3* and *SH3* shall be verified by one-sample proportion tests. The one-sample t-test will be used for the following statistical hypotheses: *SH2.1*, *SH2.2*, *SH4.1*, *SH4.2*, *SH5.1*, *SH5.2*, *SH6.1*, *SH6.2*, *SH7.1*, *SH7.3*, *SH7.5* and *SH7.7*. The Welch´s two-sample t-test is used to test the statistical hypotheses *SH7.2*, *SH7.4*, *SH7.6* and *SH7.8*. The statistical analysis will be done with the free statistical computing software *R* which is widely used for testing hypotheses and data analysis.

However, prior to testing the statistical hypotheses, the required sample sizes (*N*) have to be defined for it. For this, the power analysis approach provides an effective method. It will be applied to calculate the sample sizes (*N*) needed in order to conduct representative statistical hypotheses tests by using the G*Power software tool.

Primary data will be used that is directly collected over a sustained period of time in order to test these statistical hypotheses. As research instrument a survey questionnaire is selected. The target group is comprised of employees working in manufacturing SMEs. These SMEs are mainly located in Germany and the selected informant profiles should be MBBs, BBs, GBs, YBs, CEOs, Directors, General Managers, Middle Managers, Quality and Production Professionals as this group is best suited to provide information with regard to the SS belt system in manufacturing SMEs. Due to the fact that the survey participants shall mainly be SS experts of German SMEs, the definition of the IfM Bonn, which classify SMEs as companies with less than 500 employees, is established as limit value for the selection of the SMEs participating in the survey.

Finally, 39 questions were developed. The survey questionnaire is prepared in English and includes close-ended questions, open-ended questions as well as a Likert scale.

It was transferred into an online version created by the free of charge and user friendly survey tool Google Docs (see https://docs.google.com/forms). This way, survey participants can gain access via internet link which will be sent to them per mail or via XING. XING is a social network for business and career where people can register and create their own business page (see https://www.xing.com). In order to find and contact suitable SS experts, SMEs with focus on the manufacturing sector will be searched at first. For this, the database from the homepage https://www.berufsstart.de/ was selected. It provides a comprehensive list of manufacturing SMEs from all 16 German federal states. After suitable manufacturing SMEs were found, terms such as [*name of the company*] and [*Six Sigma*] or [*Bel*t] will be entered as search strings into the XING search machine. These wordings shall ensure that highly qualified experts in the SS belt field with focus on manufacturing SMEs are found.

The planned timeline for data gathering is set for about eight months. The questionnaire distribution started in January 2019 and lasted until August 2019.

In total, 363 SS experts working in manufacturing SMEs could be found in XING and are asked via private message or mail to participate in this internet survey. To protect the privacy of the survey participants, the questionnaire is anonymous and the results will only be used for the purpose of this scientific research. Individual names and contact information of the participants will therefore not be mentioned in the dissertation thesis.

After distributing the survey to SS experts, the respondent's data will be collected. In total, 108 out of the contacted 363 SS experts working in manufacturing SMEs participated in the internet survey and completed the questionnaire. This represents a response rate of 29.75%.

However, not all 108 respondents who answered the survey can be considered for the various statistical hypotheses tests. Since only 23 of those SMEs that employ the respondents of this survey have implemented SS, only this number will be used for the examination of the statistical hypotheses with focus on the actual state of the SS belts deployment in manufacturing SMEs. By contrast, for the statistical hypotheses tests concerning the target state of the SS belt deployment structure in manufacturing SMEs, 75 respondents can be taken into consideration.

4.2 Evaluation of the research hypotheses

The results of five (*SH1.1* to *SH1.5*) of the six statistical hypotheses tests set to evaluate *RH1*, which states that the BB role in manufacturing SMEs is identical with the typical role of the MBB, are statistically significant. In contrast, only the one-sample proportion test of *SH1.6* shows no effect but at least 60% of the 75 respondent SS experts of the survey confirmed that MBBs are not needed in manufacturing SMEs. On the basis of this information, it can be concluded that BBs should take on the role of the MBB in manufacturing SMEs. Therefore, *RH1* is accepted in the course of this study.

Three statistical hypotheses tests were carried out to draw conclusions for *RH2* which relates to a greater GB and minor BB presence in manufacturing SMEs than in large manufacturing enterprises. While the one-sample t-test of *SH2.1,* which states that a smaller BB proportion is required in manufacturing SMEs than in large manufacturing enterprises, results in a high effect size, there is no effect in the one-sample t-test of *SH2.2* found that is pointing towards a greater GB proportion in manufacturing SMEs than in large manufacturing enterprises. However, a mean value of 6% GBs in relation to the total workforce was suggested by the 73 respondent SS experts of the survey. Moreover, the positive result in the one-sample proportion test of *SH2.3* shows that the SS implementation strategy in manufacturing SMEs should be rather focused on implementing and training GBs instead of BBs. Although one of the three statistical hypotheses tests shows no effect, the identified supporting facts are strong enough to indicate an acceptance towards *RH2*.

The result in the one-sample proportion test of *SH3* that was defined to support the evaluation of *RH3,* which states that the role of the WB is identical to the role of the YB, is not statistically significant. However, since the probability to not reject *H0*, given that it is false, is around 90% in that statistical hypothesis test, the result is not reflecting a proper basis to evaluate *RH3*. At least 60% of the 32 respondent SS experts of the survey agreed with the notion that the WB training is a waste of time since the YB training already provides a basic SS overview. Moreover, nearly 15 years after the proposal of the WB category by Harry and Crawford (2004 and 2005), only 33 out of the 108 respondents from this survey know about the roles and responsibilities of the WB and only three SMEs from all those companies that employ these 108 respondents have implemented this WB type in their own organization. This proves that there is a high degree of unawareness surrounding this SS belt category to the present day and indicates that the YB category is sufficient. For these reasons, an acceptance of *RH3* is favoured despite the negative test result of *SH3*.

The evaluation of *RH4*, which presumes a lower working time towards SS of the SS belts in manufacturing SMEs than in large manufacturing enterprises, is based on *SH4.1* and *SH4.2*. While the one-sample t-test of *SH4.1* that focuses on a lower BB working time towards SS in manufacturing SMEs compared to large manufacturing enterprises results in a high effect size, the one-sample t-test of *SH4.2* that focuses on a lower GB working time towards SS in manufacturing SMEs compared to large manufacturing enterprises shows no effect. However, since the mean value is calculated at about 30% which is just about the proposed minimum GB working time towards SS in large manufacturing enterprises as suggested by Aboelmaged (2010), a decision in favour of accepting *RH4* is quite realistic.

A similar result presented itself upon examining *RH5* which looks at the number of SS projects executed and presumes that a SS belt completes a smaller number in manufacturing SMEs than in large manufacturing enterprises. Here as well, only one of the two statistical hypotheses test results is statistically significant. While the result in the one-sample t-test of *SH5.1* clearly shows that BBs in manufacturing SMEs are not able to execute the same number of SS projects per year as in large manufacturing enterprises, it does not affect the number of SS projects executed by GBs per year according to the result of the one-sample t-test of *SH5.2*. Same as in large manufacturing enterprises, GBs in manufacturing SMEs shall be able to execute an average of three to four SS projects per year. From this result the rejection of *RH5* can be derived.

By comparison, the results of the one-sample t-tests of *SH6.1* and *SH6.2* can be described as statistically significant. For this reason, *RH6*, which assumes lower cost savings per SS project by SS belts in manufacturing SMEs than in large manufacturing enterprises, can be accepted.

The last formulated research hypothesis *RH7* supposes that the deployment of the SS belts in manufacturing SMEs is not implemented as required and its evaluation was supported by eight statistical hypotheses tests. Out of these eight statistical hypotheses tests only the result from the Welch two-sample t-test of *SH7.8* can be described statistically significant. Besides the GB's working time towards SS in those 23 manufacturing SMEs that is in accordance with the recommendations given by Antony et al. (2005 and 2008) but not according the suggestions of the surveyed SS experts, it also cannot be confirmed that the BB and GB proportion in relation to the total workforce as well as the BB working time towards SS suggested by researchers in the current literature and the surveyed SS experts are not followed in practice. Since the required power of the test ($1-\beta$) of 80% according to Cohen (1988) was just scarcely missed in the statistical tests of *SH7.1* to *SH7.7*, *RH7* will be rejected in the context of this study.

The evaluations of the individual research hypotheses are summarized in table 4.1.

Table 4.1. Evaluation of research hypotheses. Source: Author.

Research hypotheses	**Supporting statistical hypotheses**	**Statistical hypotheses results**[1]	**Research hypotheses evaluation**
RH1: *The role of the Black Belt in manufacturing SMEs is synonymous with the role of the Master Black Belt*	*SH1.1* to *SH1.5*	+	***Accepted***
	SH1.6	-	
RH2: *There shall be a greater presence of Green Belts and a minor presence of Black Belts in relation to the total workforce in manufacturing SMEs than in large manufacturing enterprises*	*SH2.1*	+	***Accepted***
	SH2.2	-	
	SH2.3	+	
RH3: *The role of the White Belt is synonymous with the role of the Yellow Belt*	*SH3*	-	***Accepted***
RH4: *The working time of the Six Sigma belts towards Six Sigma projects in manufacturing SMEs shall be lower than in large manufacturing enterprises*	*SH4.1*	+	***Accepted***
	SH4.2	-	
RH5: *The possible number of projects that can be executed by Six Sigma belts in manufacturing SMEs shall be lower than in large manufacturing enterprises*	*SH5.1*	+	***Rejected***
	SH5.2	-	
RH6: *The possible cost savings by Six Sigma belts in manufacturing SMEs shall be lower than in large manufacturing enterprises*	*SH6.1 and SH6.2*	+	***Accepted***
RH7: *The deployment of the Six Sigma belts in manufacturing SMEs is not implemented as required*	*SH7.1* to *SH7.7*	-	***Rejected***
	SH7.8	+	

[1] (+) = *H0 is rejected in favour of HA*
(-) = *H0 is failed to be rejected*

5. RESEARCH RESULTS

5.1 Discussion of the research results

RESEARCH GOAL 1: To identify the key Six Sigma belts, their roles, responsibilities and their required skills in manufacturing SMEs compared to large manufacturing enterprises

Besides the case studies conducted by Green et al. (2006), Nonthaleerak and Hendry (2008) and Timans et al. (2012) as well as the empirical evidences provided by Antony et al. (2008) and Douglas et al. (2015), the results of this survey and the statistical hypotheses tests strengthen the idea of Kumar et al. (2011) that BBs in manufacturing SMEs shall take on the coaching and trainer role in manufacturing SMEs. This, in turn, also indicates that MBBs are not required in manufacturing SMEs. Compared to the survey of Antony and Karaminas (2016) which focused on large enterprises, the BB roles “Coach”, “Mentor” and “Leader of strategic projects” as well as their “Coaching/training skills” and “Leadership skills” have a higher prioritization in manufacturing SMEs according the surveyed SS experts.

However, a greater focus on GBs instead of BBs was proposed for manufacturing SMEs in various older research contributions (see Davis, 2003; Gnibus and Krull, 2003; Burton, 2004; Green et al. 2006 and Pyzdek and Harrison, cited in Antony, 2008). The validity of the greater GB approach was so far only partially empirically proven by the studies of Timans et al. (2012) and Antony et al. (2008) but they could not be considered hard evidences for a topic of this nature. However, the results of the conducted survey and statistical hypotheses tests validate this approach. It can be argued that GBs are the key SS belts in manufacturing SMEs who should be the driving force behind improvement initiatives and drive up customer satisfaction as well as business productivity.

As far as the idea of Harry and Crawford (2004 and 2005) about the introduction of WBs in SMEs is concerned, it can be stated that Setters (2010) doubts that the WB training is a waste of time since the YB training already represents a basic SS overview are valid. Therefore, the YB category currently ought to be rather recognized as a SS basic education level until more positive findings about the advantages and successes of the WB type will be become known and published.

RESEARCH GOAL 2: To identify the Six Sigma belt proportions in relation to the total workforce in manufacturing SMEs compared to large manufacturing enterprises

Regarding the investigation whether or not BBs and GBs are needed in manufacturing SMEs in the same capacity as in large manufacturing organizations the situation is similar. As there are only personal views from a few researchers regarding a greater focus on GBs as already mentioned above, the suggestion of Kumar et al. (2011) to deploy less than 1% BBs, the results of the case study conducted by Timans et al. (2012) and against the background that these sources are quite a few years old, it is hardly possible to draw meaningful conclusions about this topic.

However, the conducted investigations in the course of this study show that the vast majority of the surveyed SS experts had a similar opinion as Kumar et al. (2011) and agreed that a smaller proportion of BBs is sufficient in manufacturing SMEs compared to large manufacturing enterprises, where a BB proportion of around 2%[2] in relation to the total workforce is assumed. At the same time, it could not be confirmed statistically that a higher GB proportion in relation to the total workforce is required in manufacturing SMEs than the proposed 5% for larger enterprises as suggested by Miguel and Andrietta (2009) and Jesus et al. (2016). 30% of 73 surveyed SS experts proposed a GB proportion of 5% while another 30% proposed a GB proportion of more than 5% in relation to the total workforce. The resulted mean value is 6% GBs.

In summary, the results support the view that a minor representation of BBs and stronger representation of GBs is required in manufacturing SMEs compared to large manufacturing enterprises. As recommended on the basis of the outcome of this study, a BB proportion of less than 1% and a GB proportion of at least 5% in relation to the total workforce are proposed for manufacturing SMEs.

[2] Mean value calculated based on the suggestions of following researchers: Harry and Schroeder (2005), Pulakanam and Voges (2010), Miguel and Andrietta (2009), Keller (2003), Pyzdek and Keller (2014), Jesus et al. (2016), Snee (2004), Aboelmaged (2010), Buch and Tolentino (2006)

(6*1%+1*2%+2*5%)/9 = 2% BBs in relation to the total workforce

RESEARCH GOAL 3: To identify the required invested working time of the individual Six Sigma belts towards Six Sigma projects in manufacturing SMEs compared to large manufacturing enterprises

In large enterprises, BBs shall work full-time or spend at least 80% and GBs 30% to 50% of their working time towards SS projects (Linderman et al. 2003; Antony et al. 2007; Schroeder et al. 2008; Aboelmaged, 2010; Ingle and Roe, 2001; Pandey, 2007; Feng and Manuel, 2008; Pyzdek and Keller, 2014). However, as stated in chapter 2.2, employees in SMEs have usually several other roles on top of their key roles. Therefore, it is quite unrealistic that the SS belts in SMEs are able to invest their working time towards SS in the same manner as in larger enterprises. There are few conclusions with almost no empirical evidences by researchers of the current literature concerning the lower invested working time of the SS belts towards SS projects in manufacturing SMEs compared to large manufacturing enterprises. For this reason, the difference in working time was further examined in the framework of this dissertation. The results of the survey and statistical hypotheses tests exhibit that the working time of BBs towards SS in manufacturing SMEs shall be lower than in large manufacturing enterprises. A BB working time of 50% was most commonly selected by the surveyed SS experts and the resulted mean value is a BB working time of approx. 50%. This was also proposed by Nonthaleerak and Hendry (2008) as well as Schroeder et al. (2008) as the optimal solution for SMEs. Statistically speaking, the GB working time in manufacturing SMEs shall not be lower than the proposed minimum working time of 30% in large manufacturing enterprises. However, a GB working time of 20%, as also proposed by Antony et al. (2005 and 2008), was most commonly selected during this survey.

RESEARCH GOAL 4: To identify the possible number of projects that can be executed by the various Six Sigma belts in manufacturing SMEs compared to large manufacturing enterprises

As there are so far no findings in the current literature regarding the possible number of SS projects that can be executed by the various SS belts per year in manufacturing SME, this subject matter had to be researched from the beginning. About three quarters of the surveyed SS experts suggested that a BB can execute one to two SS projects per year which is significantly less than the estimated four SS projects[3] per year of BBs in large manufacturing enterprises. GBs shall execute an average of three to four SS projects per year according the surveyed SS experts which is almost similar to the proposal made by Antony et al. (2007) for large manufacturing enterprises. This is an additional finding that advocates the approach of a greater GB presence in manufacturing SMEs.

RESEARCH GOAL 5: To identify the possible cost savings by the various Six Sigma belts in manufacturing SMEs compared to large manufacturing enterprises

The situation appears to be similar regarding the possible cost savings that can be made by the various SS belts per SS project in manufacturing SMEs. The results of the survey reveal that BBs in manufacturing SMEs shall be able to save an average of around 30.000 € per SS project which is almost identical to the cost savings of around 35.000 to 40.000 € per SS project as proposed by Kumar et al. (2011). This is also considerably less than the estimated cost savings of around 100.000 €[4] per SS project in large manufacturing enterprises. The survey produced a similar result with regard to the cost savings of GBs per SS project, which are around 17.000 € on average, and thus less than the 45.000

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[3] Mean value calculated based on the suggestions of following researchers:
Krueger et al. (2014): 2 to 4 projects/ Mean value is 3
Snee (2004): 3 to 5 projects/ Mean value is 4
Leyendecker et al. (2011): 4 to 5 projects/ Mean value is 4.5
Brue and Howes (2006): 4 to 6 projects/ Mean value is 5
Pyzdek and Keller (2014): 3 to 7 projects/ Mean value is 5
(3+4+4.5+5+5)/5 = Around 4 projects can be executed by one BB per year

[4] Mean value calculated based on the suggestions of following researchers:
Around the year 2000: 120.000 € to 230.000 € per project/ Mean value is 175.000 € (Harry, 1998; Maguire, 1999; Pyzdek, 2000; Porter, 2002; Snee, 2004)
Around the year 2010 and after that: Around 85.000 € per project (Kumar et al. 2011) and around 45.000 € per project (Krueger et al. 2014)
(175.000 € + 85.000 € + 45.000 €)/3 = Around 100.000 € cost savings per project by one BB

€ per SS project in large manufacturing enterprises as suggested by Harry (1998).

Table 5.1 shows the main differences of the SS belt system structure between manufacturing SMEs and large manufacturing enterprises on the basis of the findings obtained from the literature review, survey and statistical hypotheses tests.

Table 5.1. Differences of the Six Sigma belt system structure in manufacturing SMEs and large manufacturing enterprises. Source: Based on the findings of the systematic literature review as well as the results of the survey and statistical hypotheses tests.

<table>
<tr><th>LARGE ENTERPRISE
(Based on the results of the systematic literature review)</th><th>SMALL ENTERPRISE
(Based on the results of the systematic literature review)</th><th>SMALL ENTERPRISE
(Based on the results of the survey and statistical hypotheses tests)</th></tr>
<tr><td>Master Black Belt
0.1% MBBs in relation to the total workforce
Full-time role</td><td rowspan="2">Black Belt
MBBs are not required

<1% BBs in relation to the total workforce
Part-time role
Between 35.000 € and 40.000 € cost savings per project

<u>Main roles and responsibilities</u>:
1. Mentor/Coach</td><td rowspan="2">Black Belt
MBBs are not required

<1% BBs in relation to the total workforce
Part-time role
30.000 € cost savings per project
One to two project executions per year

<u>Main roles and responsibilities</u>:
1. Mentor/Coach
2. SS expert
3. Leader of strategic projects

<u>Main skills</u>:
1. Coaching/training skills
2. Expertise in SS methods and tools
3. Analytical and leadership skills</td></tr>
<tr><td>Black Belt
2% BBs in relation to the total workforce
Full-time role
100.000 € cost savings per project
Between four and seven project executions per year

<u>Main roles and responsibilities</u>:
1. Change agent
2. SS expert
3. Coach

<u>Main skills</u>:
1. Analytical skills
2. Expertise in SS methods and tools
3. Data/fact driven</td></tr>
</table>

Green Belt 5% GBs in relation to the total workforce Part-time role or at least 30% of the working time towards SS projects 45.000 € cost savings per project Up to three project executions per year	**Green Belt** >5% GBs in relation to the total workforce 20% of the working time towards SS projects	**Green Belt** 5% GBs in relation to the total workforce 30% of the working time towards SS projects 17000 € cost savings per project Three to four project executions per year <u>Main roles and responsibilities</u>: 1. Analyst of root causes 2. Critical problem solver 3. Member of improvement projects <u>Main skills</u>: 1. Analytical skills 2. Problem-solving skills 3. Expertise in SS method and tools
Yellow Belt Support of GBs WBs are not required	**Yellow Belt** Support of GBs **White Belt** Between 10% and 15% WBs in relation to the total workforce 5.500 € cost savings per project Four to five project executions per year	**Yellow Belt** Support of GBs WBs are not required

RESEARCH GOAL 6: To identify the differences between the current and target status of the deployment of Six Sigma belts in manufacturing SMEs

The current literature presents one article of Timans et al. (2012) that included the proportion of the various SS belts in relation to the total workforce in manufacturing SMEs. However, this is too little data to draw conclusions and evaluate if the recommended guidelines from the literature and the surveyed SS experts are being followed in practice. For this reason, more SMEs had to be studied. Although the survey of this study reveals that SS is only implemented in 23 of the 108 manufacturing SMEs that employ the surveyed SS experts, the results of the survey and statistical hypotheses tests show that the SS belt deployment in these companies is largely in accordance with the recommended guidelines of the current literature and the surveyed SS experts.

The BB proportion of less than 1% as suggested by Kumar et al. (2011) and the surveyed SS experts as well as the proposed GB proportion of 5% to 6% by the surveyed SS experts and the researchers of the current literature are exceeded in most of the 23 manufacturing SMEs. On average, 3.2% BBs and 7.6% GBs in relation to the total workforce are deployed in the 23 manufacturing SMEs.

The BB working time towards SS is found to be at around 40% on average in those 23 manufacturing SMEs. Thus, it is fairly similar to the working time of 50% proposed by Nonthaleerak and Hendry (2008), Schroeder et al. (2008) and the surveyed SS experts. The GB working time towards SS is on average around 20% in the 23 manufacturing SMEs. These 20% are in line with the recommendation of Antony et al. (2005 and 2008) but not with the suggestion of the surveyed SS experts who proposed an average GB working time of around 30% towards SS.

5.2 Conception of an effective Six Sigma belt deployment structure

The research findings will be used as input for the conception of guidelines for an effective SS belt deployment structure in manufacturing SMEs (see table 5.2). It shall serve as a best practice guide for small manufacturing enterprises aiding the establishment of an effective and robust SS belt deployment structure in their organizations.

Table 5.2. Conception of an effective Six Sigma belt deployment structure in manufacturing SMEs. Source: Author.

Black Belt	
Mentor and coach	
Roles and responsibilities	**Skills**
1. Mentor and coach 2. Six Sigma expert 3. Leader of strategic projects	1. Coach/training skills 2. Expertise in Six Sigma method and tools 3. Analytical and leadership skills
Proportion in relation to the total workforce	**Invested working time towards Six Sigma**
<1%	Around 50%
Potential number of Six Sigma projects that can be executed	**Potential cost savings per Six Sigma project**
1-2 per year	30.000 € - 40.000 €
⇩	
Green Belt	
Driving force for improvement projects	
Roles and responsibilities	**Skills**
1. Analyst of root causes 2. Critical problem solver 3. Member of improvement projects	1. Analytical skills 2. Problem-solving skills 3. Expertise in SS methods and tools
Proportion in relation to the total workforce	**Invested working time towards Six Sigma**
Minimum 5%	20% - 30%
Potential number of Six Sigma projects that can be executed	**Potential cost savings per Six Sigma project**
3-4 per year	15000 € - 20000 €
⇩	
Yellow Belt	
Basic training form for other employees in the organization Support Black Belts and Green Belts	

6. CONCLUSION

6.1 Contributions to science

There are a number of personal views from practitioners and consultants about the deployment of the various SS belts in manufacturing SMEs, however, there are so far almost no empirical studies.

The conducted study is one of the first attempts to research the SS belt deployment structure in manufacturing SMEs empirically, thereby following-up the research gaps by Antony et al. (2019) and Alexander et al. (2019).

An important contribution of this research to science lies in its research methodology which is a combination of a descriptive and an explanatory quantitative-based research design. After a systematic literature review, a survey was conducted. Its data was used to test statistical hypotheses for the evaluation of respective research hypotheses. Thus, valuable mathematical findings regarding the probability value (*p-value*), effect size (d) or power of the test ($1\text{-}\beta$) could be identified.

A further novelty is the demonstration of the SS implementation and SS belt deployment status in German SMEs. Although SS is only implemented in a small portion of those SMEs that employ the 108 respondents, the SS belts deployment in these companies is largely done in accordance with the guidelines identified through the current literature and surveyed SS experts. It must also be mentioned that there is already a high proportion of certified SS belts in the remaining SMEs that did not implement SS yet. This would greatly facilitate a SS implementation in future.

In addition, the new empirical findings and the knowledge acquired through this research extends the body of knowledge in the field of SS belts. The study makes several contributions to the industrial management, quality management, operations management and SME literature that were shared in well-known peer-reviewed journals and conference proceedings (see list of author's publications on page 41).

6.2 Contributions to practice

The dissertation helps SMEs and their management with valuable information and provides knowledge on how to develop a proper and sustainable SS belt infrastructure for an effective execution of LSS projects despite several obstacles.

The research study shows that the SS belt system is already effectively implemented in some of those SMEs that employ the survey respondents. The cost savings from completed SS projects per year in those SMEs that already implemented Six Sigma as well as possible cost savings from a GB or BB per

SS project in SMEs prove the benefit of that continuous improvement initiative. These facts give the management of SMEs more certainty that SS can be applied successfully in any organization, irrespective of its size.

Another input of this research study is that it focuses on the strengths, weaknesses and challenges regarding the implementation of SS in manufacturing SMEs. This collection of information helps the SME management to gain awareness on what deficiencies they have to overcome before implementing SS.

Moreover, the research study provides a concept for an effective SS belt deployment structure in manufacturing SMEs. It can be considered as best practice approach or can be adjusted slightly according to respective circumstances and situations such as manufacturing type or industrial sector, production process complexity, product and production type, R&D expenditure etc.

Furthermore, the dissertation can have an additional effect, namely to attract more researchers and practitioners from different regions of the world to this field. The research results can be used to develop study materials for lectures, seminars and summer schools as well as to prepare students for a career in operations or quality in a manufacturing SME.

6.3 Limitations of the study

Despite the attempt to minimize weaknesses in this research work, there are some limitations that stand out.

Firstly, the present study focuses on the manufacturing sector on the whole. For this reason, it is difficult to carry over and generalize the findings to a specific type of industry such as automotive, consumer, chemical, energy etc. or to a manufacturing type such as metal, electrical, electronic, plastic or machinery products etc.

Secondly, more than 90% of the survey's respondents are from Germany. For this reason, other researchers and practitioners of this topic area must consider that the findings are primarily applicable to SMEs with up to 500 employees as per definition of the IfM Bonn (2016). Since there is a vast degree of inconsistency on a global level and no universal agreement concerning a SME definition, a comparison of the results on a global level may not be possible and using the findings of this research to make further investigations could be difficult for researchers from other countries. It also means that the developed concept for an effective SS belt deployment structure in manufacturing SMEs presented in chapter 5.2 is also not applicable for all SMEs worldwide. In the case of Chinese or American manufacturing SMEs that include more than 1000 employees (He, 2016; U.S. Small Business Administration, 2019), for instance, the guidelines need to be adapted.

Thirdly, since the data was collected from a survey, the approach used to answer the questions may affect the quality of the research results because each respondent has a different view and experiences and this may contain certain bias.

Last but not least, for some of the statistical hypotheses tests, the required sample size (*N*) to detect the relevant effect size (*d*) could not be met by the survey which caused an insufficient power of the test of lower than 80%. In this context, it also has to be mentioned that in some of these cases where *H0* was failed to be rejected, a decision in favour of *H0* could not really be made.

6.4 Outlook on future research

Finally, the following research gaps are identified by the dissertation and it is proposed to investigate these research gaps in future research contributions.

At first, it is recommended that future research studies about the SS belt deployment system in SMEs shall focus on a specific industry sector such as automotive, consumer, chemical, energy etc. or manufacturing type such as metal, electrical, electronic, plastic or machinery products etc. to receive a more precise and deeper knowledge about this research topic since this study considers the entire manufacturing sector on the whole.

Secondly, similar surveys shall be conducted in different countries of the world to investigate the SS implementation and SS belt deployment status there and compare the results with that study, since this study focuses mainly on the German industry. Also, the proposed concept including the guidelines developed in the context of this study must be verified.

Thirdly, since this research study focuses mainly on how the SS belts deployment shall be structured in manufacturing SMEs compared to large manufacturing enterprises, future research contributions shall primarily provide deeper knowledge about the reasons why the SS belt deployment structure in manufacturing SMEs differs from the traditional SS belt deployment structure used in large manufacturing enterprises.

Fourthly, a survey as research instrument was chosen in the course of this research study. For future research contributions, it is proposed to also include other research methods such as reviews, case studies, expert interviews, group discussions and conversations, observations, content analysis etc.

Fifthly, effect sizes (*d*) that present the magnitude of a statistical effect are known through this research study and can be used in future empirical studies to compute the required sample sizes (*N*) as well as be compared with other statistical hypotheses test results.

Sixthly, these statistical hypotheses tests where *H0* was failed to be rejected and the power of the test ($1-\beta$) was large enough (≥80%) can be repeated in future research studies with an increased sample size (*N*) to find out if smaller effect sizes (*d*) might possibly exist.

Seventhly, these statistical hypotheses tests where *H0* was failed to be rejected and the power of the test (*1-β*) was lower than 80% can also be repeated in future research studies with an increased sample size (*N*) so that the probability to detect the relevant effect sizes (*d*) is large enough (≥80%) and representative results can be received.

Last but not least, the described benefits of the WB type for SMEs in the current literature could not be confirmed by this study. Future research contributions must place special focus on the WB category since it is still a grey area. More SS experts of SMEs from the entire world have to be surveyed about this SS belt type and share their experiences.

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