

# **STRATEGIC SME SUCCESSION PLANNING: ENHANCING VALUE & WEALTH VIS-À-VIS ORGANIZATIONAL DIAGNOSIS**

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## **ABSTRACT**

*Baby Boomers and other business owners are divesting their Small and Mid-Sized Enterprises (SME) for several reasons. Absent a well-planned Business Succession Plan, decades of knowledge, innovation, and wealth can be lost both to stakeholders and society alike. Although Succession Planning has been a strategic management part for many years, only recently has it become recognized for its importance, particularly as it relates to the creation of value that makes mergers, acquisitions, and strategic alliances possible, thus resulting in the continuation of an SME's past and current efforts. Only since 1991 has Intellectual Capital (IC) / Intangible Assets (IA) of SMEs start to become recognized as a trove of untapped wealth that could enhance the value and continuation of any organization. Notwithstanding the current difficulty in quantifying IC/IA, we propose that through the combination of strategic succession planning with organizational diagnosis may a forthcoming exit stakeholder find internal business assets that may be improved upon to maximize value and wealth for the SME, while simultaneously improving the chance of transition success at the time of exit execution. Exploration of this subject matter may serve to give Scholars and Practitioners fodder for theoretical/empirical research and practical application.*

**JEL:** A12; L22; L25; M10; O34

**KEYWORDS:** Baby-Boomers, Intangible Assets, Intellectual Capital; Organizational Diagnosis, SME, Strategic Succession Planning, Wealth

## **INTRODUCTION**

**V**alue is created when organizations develop innovative ways of doing things using new methods, modern technologies, and/or new forms of raw material (Porter, 1985). However, it is difficult to find literature consensus as to what value creation is; the process by which value is created and the mechanisms to create, capture and retain value. We propose that creation, capture, retention, and liquidation are four progressive and distinct processes. Alternatively, failure to maintain what value that had been created is 'valuation depreciation'. Each of the four processes (creation, capture, retention, and liquidation) may be examined from an individual, organizational and societal perspective. It is the individuals' effort in developing or performing a task, product or process; the organizations' efforts are usually directed to the introduction of a new or redeveloped product or process while society controls the nation's industrial infrastructure and the 'will' of competitive marketplaces in either accepting or rejecting the creation and capture of value (Porter, 1990).

It is a well-established, if not a generally accepted belief that innovative organizations create new value when they use their individualistic collective knowledge to introduce new products, processes, practices, and services. Ironically, innovation tends to occur during times when enterprises face uncertain environments (Brown & Eisenhardt, 1997). As value is created and captured, the gap between market value

and book value increases in multiples. This gap is commonly and often interchangeably referred to as Intellectual Capital (IC) and Intangible Assets (IA). There is no one universally accepted definition of IC/IA. We believe Edvinsson's definition of IC is a good description that continues to remain strong which "is the possession of knowledge, applied experience, organizational technology, customer relationships, and professional skills" that serves to provide an organization with a competitive position in a specific marketplace (Edvinsson & Malone, 1997). Despite the number of definitions available, almost all involve some element of profit and value creation. Accordingly, IC/IA may be viewed as a driver of future earnings, thus the forefront of research and practice.

As an example of the growing accumulation of IC/IA value, it is estimated that the total value of U.S. intellectual capital runs between \$5.0 trillion to \$5.5 trillion for the year ending 2005. For the year ending 2011, it is estimated that the value of the intellectual capital in the U.S. economy has increased to between \$8.1 trillion and \$9.2 trillion. If one includes economic competencies along with intellectual capital, the U.S. economy totals an estimated \$14.5 trillion in 2011 (Cuganesan *et al.*, 2006). Innovation, a component of IC/IA, unquestionably drives economic growth. Such a position appears to be considered one of the most consistent findings in macroeconomics, and has been very true since the Industrial Revolution. The contribution of technological innovation to national economic growth has been well established in the economic literature, both theoretically (Solow, 1956; Romer, 1986) as well as empirically (Mansfield, 1972; Nadiri, 1993). There is an expansive litany of literature supported by a dearth of evidence that postulates a direct correlation of technological innovation (IC/IA) being directly correlated to growth, productivity, and increasing incomes of modern economies. More than any other single factor, macro-economists have calculated that up to 50% of the U.S. annual GDP growth is attributed to increases in innovation (IC/IA).

Cuganesan, Petty & Finch examined the average intensity of intangible assets in 24 industries. In 2006, it was discovered that an industry's value as a share of an industry's total market value, was more than 79 percent. For the period from 1975 through 2015, the percent of intellectual capital has significantly increased. Accordingly, this study among others provides increasing evidence that the drivers of value creation in modern competitive environments lie in an organization's intellectual capital rather than in its physical and financial capital (*Id*). Acknowledging that there is an increasing amount of value being created, logically it would be reasonable to express that there is an increasing amount of 'value depreciation', particularly since there could be more than five million business owners either dying or retiring over the course of the next 15 – 20 years. For it was only in 2011 that the first baby-boomer reached the age of 65. At an approximate rate of 10,000 workers per day, it will take until 2030 before the baby-boomer generation will be fully retired (U.S. Census, 2012). Therefore, an issue that appears to be ripe for review and to partially address in this paper is the process of orderly transference of enterprise 'created value' (wealth) from one generation of stakeholders to an ensuing generation of stakeholders.

The remainder of this paper intends identify the consistency of definition and agreement for succession planning, consensus in research for the terms intellectual capital and intangible assets, present a case study to illustrate succession planning, organizational diagnosis, intellectual capital/intangible assets, concluding with a discussion concerning the benefit to orderly transition and succession planning utilizing an organizational diagnosis process and model while encouraging further practical and scholarly research to further develop the means to create, capture, retain and liquidate business value.

## LITERATURE REVIEW

### Strategic Succession Planning

SME Succession (250 employees or less) first appeared in the context of general business management under the auspices of leadership planning and change management in the early 1950s (Christensen, 1953; Gouldner, 1954). William Rothwell defined succession planning as the "deliberate and systematic effort by

an organization to ensure leadership continuity in key positions, retain and develop intellectual and knowledge capital for the future, and encourage individual advancement” (Rothwell, 2001). Succession planning is an important component of business management. The implementation of planned succession is important simply because the orderly transfer of leadership, whether internally or externally, determines the enterprise's future strategic direction and performance. Broadly speaking and from the perspective of the entrepreneurs who seek to exit from his or her business, they essentially have three broad categories to choose from: (1) decide to sell their organization (Wennberg, *et al.* 2010); (2) turn over the organization to those closely related to the existing owner(s) (Sharma, 2003) or (3) decide (or be forced) to cease operations of their organization (Shepherd, *et al.*, 2009).

Evidence regarding organizational succession has been mixed in both management, economic and organization literature. Some researchers argue that the tensions and instabilities associated with leadership change will precipitate a decline of performance and enterprise value (Beatty & Zajac, 1987; Grusky, 1960 & 1963). Other researchers have found little or no difference in organizational performance substantiating the ‘scapegoating’ view of succession (Brown, 1982; Gamson & Scotch, 1964; Lieberman & O'Connor, 1972), while others have found that leadership turnover and succession will lead to improved organizational performance (Guest, 1962). Although the mixed reviews concerning organizational succession have not changed much over the past 50 years, the concept of Intellectual Capital/Intangible Assets has added a new dimension as to how organizational succession is now viewed. Succession planning is presently deemed as an important organizational resource that sets the path for the enterprise’s strategic direction by focusing on the unique knowledge, skills, abilities, perspectives, and experience that an owner and other senior management may bring to the succession process. (Strober, 1990; Finkelstein & Hambrick 1996; Hambrick & Mason, 1984).

#### Intellectual Capital (IC) / Intangible Assets (IA)

As society ventures into a ‘knowledge-based’ economy, IC/IA commences the replacement of financial capital with the headspring of value creation and enhancement for modern enterprises. Traditionally, economists have examined physical and financial capital as key resources for the organization that facilitates productive and economic activity. However, knowledge, too, has been recognized and is becoming accepted as a valuable resource by economists and others in the management field. Although the concept of IC was first proposed by economist James K. Galbraith in 1969, its first notable appearance occurred in the early 1990s when the subject matter was addressed by Fortune Magazine in 1991 and the first book by William Hudson titled Intellectual Capital: How to Build It, Enhance It and Use It which appeared in 1993 (Masoulas, 1998). In reviewing the bulk of IC/IA literature, one cannot but notice an impressive array of conceptual work on the nature and constituent elements of IC/IA (*e.g.*, Edvinsson & Malone, 1997; Sveiby, 1997).

Defining the concept of IC/IA is not an easy task given the amount of scholarly literature that exists. Given the context of the paper, we will distinguish our proffered definition from the perspective of an accountant and non-accountant perspective. To accounting researchers (Ohlson, 1995; Feltham & Ohlson, 1996; Holthausen & Watts, 2001), the difference between the market value of the entity and the book value of the entity’s *identifiable* assets is defined as “goodwill” which is slowly becoming equated with IC/IA. Non-accounting researchers define “intellectual capital” as the “difference between the firm’s market value and its book value of entity” (Edvinsson & Malone, 1997; Stewart, 1997; Sveiby, 1997; Mouritsen *et al.*, 2001). We tend to concur with The Economics Institute of Washington, D.C., when it expressed its understanding of IC/IA as “the economic value of the nation’s productivity [as dependent] more upon employee skills and knowledge and business problem-solving aptitude than it does the market value of the firm’s commercial output.” (Nuryaman, 2015). Many case-based and large sample empirical studies on the relationship of IC/IA and its performance implications in various contexts has been and continues to be undertaken worldwide. Based on numerous qualitative and quantitative studies, it appears that the possession of IC/IA

leads to superior organizational performance, that is, a significant portion of IC/IA is correlated with high performance (Hsu & Sabherwal, 2012). From a performance aspect, while the level of IC/IA and how it impacts on performance has been thoroughly researched, only a handful of studies have empirically examined how the strategic management of intangibles impacts value creation.

It appears that there have been numerous attempts to categorize intangibles in a general convergence towards a three-grouped framework consisting of: (1) human capital; (2) organizational (structural) capital; and (3) customer (relational) capital. This framework has been extensively studied thus withstanding the test of time (1997- 2017) with little variation and is considered a staple of Intellectual Capital. However, Annie Brooking (1997) opined that a fourth category titled “Intellectual Property Assets” should be added to the Intellectual Capital genre developed by Sveiby (1997), Steward (1997), Edvinsson (1997) and Bontis (1998).

## DATA AND METHODOLOGY

To express our proposition in a succinct manner, we have chosen to use the hybrid of a Commentary and Case Study to illustrate that strategic succession planning and organizational diagnosis creates and enhances value. In 2008, the Owner, a 60-year-old male, of Company ABC contacted Rutherford Advisors, Inc. doing business as The Executive Suite (TES) concerning his 20-year-old marine repair company located in the U.S. Northeast. The information initially provided reflected that ABC was a ten-month seasonal business comprising of seven full-time employees (four Diesel Mechanics/Service Technicians, one Bookkeeper, and one Customer Service Manager). The Owner’s justification to develop a transition and succession plan was due to the amount of time and energy that was needed to manage the enterprise at his age.

At the time of engagement, ABC generated approximately \$525,000 in annual revenue and incurred approximately \$590,000 in annual operating expenses leaving no discretionary earnings for the Owner. The company did not own any real estate and owned approximately \$150,000 in tools and equipment. Competition within the local geographic region was moderate. As with many small enterprises, ABC had neither a budget nor a business plan. At first blush, it appeared that ABC was the classic case “of the Owner working in, not on, the business”. Over the course of the preceding 7-8 years prior to engagement, the Owner made a few poor to bad business decisions which required \$400,000 of funding for ABC. This \$400,000 was drawn on a personal home equity loan. Ultimately, it was the Owner’s objective to develop, with the assistance of professionals, a transition & succession planning strategy that allowed the Owner to sell the business and retire. In the interim, TES was requested to assist in the preparation of that transition and succession plan and preserve, if not improve ABC during the time that a comprehensive transition & succession strategy was implemented and executed.

## RESULTS AND DISCUSSION

To use a rather over-simplified analogy, for one to know how to get somewhere, they must first need to know where they are presently at. It is our humble proposition that to enhance and retain company value with the hope of transference (in this case to the Owner on a personal basis) without significant ‘capital depreciation’, an assessment of the organization must first occur. Organizational diagnosis is a method used for analyzing an organization to identify organizational shortcomings so that the shortcomings would be neutralized through organizational change. Organizational diagnosis is a parallel concept related to the concept of organizational analysis, to which there is a distinction between the two concepts. Organizational analysis is in many ways like organizational diagnosis, but there are some notable differences. The main resemblance between organizational analysis and organizational diagnosis lies in the fact that both methods focus on understanding the organizational content, *i.e.* on identifying the elements of an organization and its nature, as well as the relationships between the two methods. Both methods start with certain organizational models and use similar techniques for data collection and processing. The key difference

between organizational analysis and organizational diagnosis is each method's purpose: the aim of organizational analysis is to understand the organization for its exploration, while the aim of organizational diagnosis is to understand the organization to change the organization. It could be said that Organizational Diagnosis is a specific form of organizational analysis – a form focused on undertaking organizational change for improving organizational performance and valuation (Janicijevic, 2010).

The main task of diagnostic models is to simplify reality. Many consultants and researchers working with organizations are unable to treat the organization in all its diversity and multidimensionality. Thus, the predominant role of a robust diagnostic model is to explain an understanding of the organization along with its strengths and weaknesses within the organization. Ironically, the main advantage of diagnostic models is, at the same time, also its main disadvantage. By simplifying reality, the diagnostic model makes it easier to understand the organization, but by doing so, the model places consultants and senior management in a situation where the consultant and senior management understands the multidimensional reality and accordingly acts in a one-dimensional manner. By overlooking other important dimensions of the organization, except the one addressed by a specific diagnostic model, all become “prisoners” of each specific diagnostic model used, and thereby of just one perspective.

This is precisely the same issue that consultants must address when approached by senior management to assist in resolving organizational issues. Often Senior Management will approach a Consultant with what they may believe, in accordance with their perspective, as to what the problem may be and select the most qualified Consultant to resolve the specific problem. It has been the experience of these authors that what is initially defined as the “problem” eventually is nothing more than an outward symptom and not the “root problem”. One’s perception leads to the interpretation of a problem to be resolved and action undertaken by the Consultant which only serves to temporarily resolve the problem and with the passage of time erosion will undoubtedly occur thus undoing all that was done. For this reason, a deeper dive may need to be commenced to inform all parties concerned of the true issue to be addressed, thus saving valuable resources and time. Given the intricacies of the organization, a systematic means of diagnosis must be the endeavor prior to any action. TES did indeed undertake a deeper dive into the inner-workings of ABC to best craft a Transition & Succession strategy. In the context of seeking a company Bookkeeper/Comptroller and although ABC owned a cutting-edge accounting software program, technology was not being fully utilized.

Clearly, replacement of the company’s Bookkeeper/Comptroller falls squarely within the sphere of ‘human capital’ and perhaps ‘relational capital’. What *processes* that may or may not exist falls within the sphere of ‘structural capital’. In this instance, ABC’s IC/IA needs to be addressed along with the creation of a Transition & Succession strategy. The transition and succession strategy included both a personal transition and business transition strategy. The former focused on the personal plans for physical health, intellectual stimulation, recreational/creative, activities with partner and family, residence, social connections, spirituality/faith, income producing work, and volunteer/philanthropic lifestyle choices. The latter focused on legacy, finding the best new owner, and identifying the why and how-to ways to increase company value. In utilizing an Organizational Diagnosis/Assessment systematic course of action, customer service, sales, marketing and financial review processes had to be developed and implemented. Within weeks of engaging TES to search for and subsequently find the most appropriate person for ABC’s Bookkeeper/Comptroller position, communications and relations both internally and externally showed a noticeable improvement. Enough that some of the Owner’s burden had been lifted.

The Organizational Assessment reflected that the Mechanic’s billing rate did not contemplate for time off, overhead or profit (Financial Capital). Accordingly, hourly billing rates were increased from \$90 to \$120 per hour with a policy being implemented to review and ensure that the billing rates were both competitive and reflective of company standards. A process was developed that allowed for the company’s accounts receivable more than 120 days old to be addressed by implementing a mail and call procedure to late/not-paying customers. Within 60 days, the company’s accounts receivable improved to 30 days, thus

significantly improving cash flow. Since ABC did not have a developed budget, unnecessary expenses were 40% greater than what they should have been. Within 9 months following implementation, net profit grew by 10%. Customer service (Rational Capital) procedures were non-existent, as were marketing upsell activities to existing customers. Another process was designed, developed, and instituted to transmit “slow season” mailers, inviting customers to receive notifications by email of special promotions. With this process implemented, it was evident that an advanced scheduling process could be developed for spring and fall decommissioning to ensure work performed prior to Memorial Day (Last Monday of May) and after Thanksgiving Day (3<sup>rd</sup> Thursday in November). With the establishment of a controlled work schedule, it was possible for ABC to schedule winter work for larger jobs. Within 60 days of implementation, work orders increased by 200%, resulting in additional \$100,000 of revenue for a 2-month period.

Under the auspices of customer service (Relational Capital), work was often performed late. There were numerous instances of change orders resulting in not only an increase in billing but, more importantly, an increase in the frustration of existing customers that the Mechanics/Technicians were not attentive to the customer’s needs. This is particularly important in that boaters want their boats operating at peak efficiency and in the water at the season’s first available opportunity. These weekend boaters had expensive boats and tastes, yet lacked much-needed quality service that they were accustomed to. As an outcome to diagnosing the ineffective processes of customer service, a customer care program was developed and implemented. Assigned to the specific task of meeting the process goals, the Customer Service Manager responsibility made it a priority to ensure work was completed on time, on budget, and to the customer’s satisfaction, which would often include the Mechanics/Technicians in helping the boater to “pre-launch” their boat prior to the first day of the season, all fully functional and worry free. It was also the Customer Service Manager who took responsibility for implementing a “monthly check-up” program during the boating season (*e.g.*, upsell service). For all practical purposes, Marketing (Human & Relational Capital) did not exist. New customers came by referral from existing customers. While effective, it did not increase the customer base sufficiently to grow the business. As a result, a new customer incentive program was developed offering a 10% discount on service to existing customers for each new prospect who was referred.

Additionally, a 10% discount was offered on ‘season-opening services’ to all new customers. Within 6 months of implementation, the client list doubled, increasing revenues from new customers \$80,000 to \$90,000 including accounting for discounts. In the Management arena (Relational Capital), the Owner indicated he could not locate and retain staff to complete a job on time and within the service quote. Additionally, staff was regularly absent from work. Upon further investigation, it was identified that the Owner managed, as he was taught, essentially practicing “yelling and telling.” The Owner was coached as to the practice of “ask and task.” Thirty days’ after implementing a modified method of managing staff, the Owner disclosed that staff absenteeism had disappeared and the staff was performing work within the service quote. Unexpected was that staff embraced asking customers for additional service work through a developed upsell process. When and only when the company’s shortcomings were identified and steps were taken to rectify all outstanding issues was it possible to undertake the very purpose of the consulting engagement *i.e.*, development of a Transition & Succession Plan which eventually was to sell ABC in 8 years (the last 3 years showing no debt and a continued increase in tangible and intangible assets). Contemplating what the Owner desired to do post-ownership of a marine repair company (relocate to a beach house in North Carolina amongst other personal plan choices), the Owner’s business transition plan focused on an internal sale to a motivated and inspired technician, and continued development, implementation, and expansion of the processes described above.

By implementing readily available business recovery actions, ABC at the close of 2009, reflected approximately \$625,000 (vs. \$525,000) in sales with a net profit of \$90,000 (vs. -\$65,000) for the first year of post-recovery. The second and subsequent years, net profit was near \$100,000 adjusted for increased cost of doing business and not the initial \$155,000 increase (\$90,000 + -\$65,000). In 2016 (8 years later), the Owner, as planned, sold ABC to his senior technician for approximately \$450,000 including the lease

and tools/equipment, thus permitting the Owner to exit the business with \$525,000 of IC/IA value captured. Although the Owner sold the business for the net amount necessary to pay off his personal home equity loan, the Owner retained on an average approximately \$75,000 per year over a 7-year period (\$525,000 which happened to be 1 year of the company's initial annual sales revenue). In turn, the successor (senior technician) acquired a solid and growing base of customers along with a team of highly skilled and motivated service technicians and staff who valued their customer first, provided excellent repair, maintenance, and upsell services.

## CONCLUDING COMMENTS

At the outset of our paper, we “proposed that through the combination of strategic succession planning with an organizational diagnosis may a forthcoming exit stakeholder identify internal business assets that may be improved upon to maximize value and wealth for the SME, while simultaneously improving the chance of transition success at the time of exit execution.” Using a client company to illustrate strategic succession planning and organization diagnosis where emphasis is placed on enhancement of various intangible assets to improve value and wealth demonstrates the benefit this model can have on a successful and profitable stakeholder exit. Our findings primarily indicate the benefit of integrating a transition and business succession plan with an organizational diagnosis and assessment process such that prominence is placed on enhancing intangible asset appreciation, as further discussed below.

This actual illustration happens to reflect an instance when a Transition and Business Succession Plan in conjunction with Organizational Diagnosis/Assessment served to retain a business’s value (*e.g.*, no ‘value depreciation’) but also served to prevent the potential loss of personal wealth (*e.g.*, equity in the home of the Owner). Succession Planning is not a new concept; Organizational Diagnosis is not a new concept and Intellectual Capital/Intangible Assets is not a new concept. What we are attempting to propose is a new way of looking at how value can be created, captured, retained and liquidated. In this paper, we hope to have demonstrated that by using Succession Planning and Organizational Diagnosis/Assessment (two of many management tools) with the perspective of exploiting non-tangible assets (IC/IA), the business value may be converted into a liquid asset upon transference of the very entity that created the liquidated asset.

A secondary effect of this illustration is the issue of timing. In the cited case history, the ABC Owner was 60 years old when a decision was made to consider developing a transition and succession strategy. Although it took until he was about 68 years of age, the Owner continued to create value even just prior to liquidating the value created. Naturally, commencing execution of a strategic succession plan years earlier would only have served to provide for an earlier exit from the organization or greater value capture and liquidation. For larger companies with a greater number of contingencies, an earlier exit process would certainly ensure the orderly transition of a going-concern. Retrospective application of the methodology can appear to allow the data to fit the method. We believe the further application of the methodology will yield more comprehensive and measured results when there is a conscious effort to apply the methodology to an existing or future business client. In such an instance, it will be important to establish, with greater specificity, data and metrics to be analyzed, benchmarks to establish, and results measured. Of course, as noted below, further research should focus on the various categories of IC/IA.

It is possible and we encourage our fellow colleagues to identify, contemplate, research and publish other means to create, capture, retain and liquidate business value. This research process may be accomplished by considering the various categories of IC/IA (*e.g.*, Human, Structural and Relational) and their respective sub-categories (Structural Capital: Marketplace; Organizational; Business Processes & Development Human Capital: Competence; Attitude & Intellectual Agility Relational Capital: Owners; Investors; Management; Employees; Customers; Board of Directors & Strategic Alliances). The scope of examination may be enlarged when existing management tools are applied as we have done in the context of this paper. We opine that by shifting the paradigm in which we envision business value and personal wealth, the inter

and intra-relationships between the various categories and sub-categories of IC/IA will only serve to provide a fertile field for ‘value’ research and subsequent implementation of means and methods to the individual, organizational and societal value.

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# CONFIGURATION ELEMENTS FOR RESTRUCTURING MANUFACTURING AND ASSEMBLY AREAS

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## ABSTRACT

*This article introduces the fundamentals of factory planning and restructuring projects, before reviewing the current state of techniques and research gaps. Following that, we outline the goal and procedure for developing a model for configuring restructuring projects. Next, we explain the procedure we followed to identify relevant configuration elements when restructuring manufacturing and assembly areas and present our results. We refer to relevant factory planning approaches found in already published research. Moreover, we analyzed and evaluated 22 restructuring projects. The identified elements were verified via expert interviews with seven cooperation partners from different industrial companies. Through this process, 62 configuration elements were identified.*

**JEL:** L23, L60

**KEYWORDS:** Factory Planning, Restructuring Planning, Project Configuration

## INTRODUCTION

Due to a turbulent environment, factory planning projects are increasingly required. Consequently, they are being initiated in shorter and shorter intervals, becoming a continual task for enterprises (Nyhuis et al., 2004, Pawellek, 2008). For factory planning projects with constructional changes, enterprises generally contract external planners (e.g., factory planners, logistics planner, architects). In comparison, projects that do not require constructional changes are frequently conducted under internal direction, so that costs related to a specialized, external planning team can be saved and because the complexity of re-planning is underestimated (Koebler and Pleuler, 2011). With smaller projects, such as integrating a new machine in an existing manufacturing or assembly structure, it is usually not necessary to hire an external planner. Due to the numerous links between production areas and equipment however, more extensive projects require more extensive planning. For example, increasing factory output by introducing industry 4.0 technology or lean principles, can reach a planning complexity similar to new building projects (Wiendahl et al., 2015, Snow, 2002).

Corporations, with their larger workforces, can employ and integrate workers with an array of competencies. SMEs must concentrate their workforce on their key expertise (Wirth et al., 1999). Consequently, the majority of tasks in planning the restructuring of SMEs are conducted by ‘non-experts’ as an addition to their day-to-day business roles (Koebler and Pleuler, 2011, Snow, 2002). SMEs often reach their limits in terms of capacities as well as content-wise and organizationally. As a result, improvements seldom reach the desired extent. In this article, we examine the fundamentals of factory planning and the problem of limited success in factory planning in general. We focus specifically on restructuring projects. We review current techniques and research gaps before introducing the goals and procedure of this research project and presenting the initial results. The paper then concludes with a summary.

## Fundamentals of Factory Planning and Configuring Projects

“Factory planning is the systematic, target-oriented process of planning a factory, implemented in progressive stages and with the aid of various methods and tools” (VDI, 2011). Publications differentiate projects into *new*, *expansion* and *restructuring* plans. A new plan corresponds to building a new factory on a so-called greenfield, while an expansion plan refers to extending an already existing building. A restructuring plan represents modification of the production sequence and utilization of space without any constructional changes. Restructuring plans are by far the most frequent projects (Ireson, 1961, Lübke et al., 2015) and since the already existing premises might only be changed minimally. They are also projects with the greatest restrictions (Tompkins et al., 2010).

Depending on the business strategy and given conditions, factory planning projects can be oriented on different goals e.g., changeability, supporting communication, sustainability (Eversheim and Schuh, 1999). The overall success of a factory planning project is measured by, among other things, the degree to which it fulfills the factory goals derived from the business strategy (VDI, 2011). Since the cost of changes in the proposed plan climbs exponentially over the course of the project, the initial phase of the project should already be oriented on the goals set for the factory and structured accordingly (Tompkins et al., 2010). Further factors that signal the success of a factory planning project include schedule compliance and quality at the agreed upon costs. Factory planning projects today usually meet these targets only partially. According to REINEMA (Reinema et al., 2013), an empirical study showed that completion dates are not met in 60 % of factory planning projects, quality is insufficient in 12 % and cost goals are exceeded in 72 % of projects.

According to a survey of enterprises, the top five most frequent problems in projects are insufficiently defined goals, incomplete project resources plans as well as poorly defined roles and interfaces between the internal organization and external project partners (Rietiker et al., 2013). Another survey finds that the short comings and incomplete configuration of projects have a strongly negative influence on the success of a project. Among the factors that negate the success of a planning project are changes in project goals, unrealistic structural plans, inadequately cast teams and project teams that lack required competencies (Gasco, 2013). One key lever for successfully conducting a factory planning project lays in the initial configuration of the project. This involves clearly defining all planning objects and areas relevant to attaining the project goal along with the manifold dependencies between them (Hyer and Wemmerloev, 2002). Moreover, the right planning tasks including suitable methods and tools to be identified and the necessary responsibilities and resources for planning the factory have to be determined (Litke, 1993).

## LITERATURE REVIEW

Numerous procedures for planning factory projects are described in existing research (Hilchner, 2012). Most notable are traditional approaches such as the factory planning stage model, developed in collaboration with the Institute of Factory Planning and Logistics (IFA) in accordance with the guidelines VDI 5200 (VDI, 2011). The VDI guideline outlines a factory planning project in seven phases, which are conducted sequentially and partially iteratively. The completion of each phase is marked by a milestone, at which the results of the respective phase need to be available. The project manager can then approve the start of the next phase. Depending on the content and extent of the plan, all seven planning phases can be conducted or only a number of them (VDI, 2011). The phase model is advantageous in that it is reproducible and transferrable to any planning situation. However, since the phase model according to VDI does not stipulate any standardized model for configuring projects, there is still the possibility for serious errors to be made before the project starts. Further approaches can be divided into *methods for designing changeable systems* (e.g., fractal factories, Warnecke et al., 1999), *cooperative factory planning methods* (e.g., synergetic factory planning, Nyhuis et al., 2004), *digital factory approaches* (e.g., PL@NET, Aslanidis et al., 2003) and *configurable factory planning methods* (e.g., state based factory planning, Nöcker, 2012, and type-oriented planning with solution space management, Hilchner, 2012). Configurable factory planning

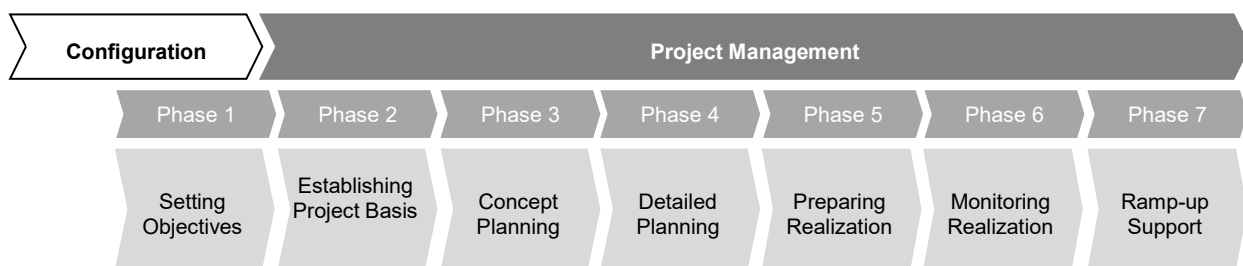
methods were the first to consider project configuration as a discrete success factor. However, they lack a consistent systematization of the configuration and too strongly limit the solution space.

Nöcker (2012) developed a procedural model that focuses on configuring factory planning tasks. With the specification of project goals and the selection and structuring of so-called planning modules, key elements of the project configuration are already identified. Nevertheless, the selection of planning modules is not systematized and lacks a detailed description of the planning tasks involved in the modules and methods and competencies required. Based on Nöcker’s (2012) planning modules, Hilchner (2012) introduced a procedural model for type-oriented planning with solution space management in factory planning. The relevance, sequence and solution space is determined for each planning module and transferred to a project plan. The methods and competencies required for conducting the planning tasks are however not depicted in the model. Furthermore, the procedural model limits the overall solution space to four types of reference models for factories, whose subsections strongly resemble each other. For example, all four factory types represent complete factories with a medium degree of processing technology. Planning a factory or individual factory sections with more simple or complex processing technology can not be represented using this approach. An extensive review of research has shown that existing procedures do not yet allow factory planning projects to be holistically configured (Bussemer et al., 2017). In summary, the problem of how to configure a process for factory planning projects in SME producers is not yet resolved. This lack of a corresponding model poses a gap in application-based research. In addition to the holistic nature, the challenge is to ensure universal applicability in terms of transferability to all planning situations (in particular the most frequent planning case i.e., restructuring) and suitability for SMEs.

**METHODOLOGY**

To close this research gap, we developed a project configuration model for restructuring manufacturing and assembly divisions. The model allows SMEs to properly define the project goals of the restructuring right from the start without the support of expert planners. It also allows firms to determine the planning tasks needed for attaining these goals. The model should result in a project plan which, depending on the selected project goals, represents all the planning tasks incurred in restructuring a manufacturing and assembly division. To do so, the proven and universal guideline VDI 5200 (VDI, 2011) is expanded to include a preceding *project configuration* phase, which is closely connected to the *target definition* phase and whose results ensure the basis for successfully conducting the project, see Figure 1.

Figure 1: Project Configuration Phase Extended Phase Model (Acc. VDI, 2011, Bussemer et al., 2017)



*This figure depicts the seven phases of factory planning according to VDI 5200 (VDI, 2011), which are conducted sequentially and to some degree iteratively. After completing each phase, a milestone is attained at which the results of the respective phase must be available. Parallel to the seven technical factory planning phases, there are related organizational tasks which project management needs to conduct. The model being developed should support these project management tasks.*

The model will be developed in four progressive steps. First, the knowledge base for describing the complete system of restructuring manufacturing and assembly divisions will be compiled. To do so, catalogues containing all relevant configuration elements (restructuring goals, planning tasks; responsibilities and planning methods), will be developed. Subsequently, the acquired catalogues will be linked. This will be accomplished by identifying and describing the subsystems’ internal and overarching dependencies between the configuration elements. The results of the preceding work package will then be

transferred to a procedural model, which will then lead users step-by-step in the proper sequence through the project configuration. Following that the functionality and applicability of the demonstrator will be tested by applying it in SMEs using actual restructuring projects and if required, it will be modified once more.

## RESULTS

To identify the fundamental configuration elements when restructuring manufacturing and assembly areas, we introduce the framework of the analysis before describing the procedure and results. To limit the realm of investigation, Nyhuis et al. (2005) and Wiendahl (2005) provide a factory framework using a matrix which comprises both the factory design fields such as technology, organization and space (horizontally) and factory levels such as plant, factory, division, workstation (vertically). Taking the factory framework into account, a literature search was carried out and restructuring goals, planning tasks, responsibilities and planning methods were collected and catalogued using existing factory planning approaches. In addition, 22 documentations of restructuring projects were analyzed and the catalogue entries were examined according to their practical relevance. These project documentations were based on individual consultations conducted by the Institute of Production Systems and Logistics, in which factories were successfully reorganized. The projects were realized together with industrial production enterprises of varying size (number of employees, sales and machinery) and from different branches (e.g., metalworking, process industry, mechanical engineering) during the last 10 years. The examined project documentations included the spectrum of services offered in the project contract as well as the analyses, project meetings and result presentations. We first analyzed the project documentations with regard to frequency distribution of configuration elements. In the project documentation, we were able to identify a total of 14 different objectives for the configuration element restructuring goals. In 16 projects the goal pursued was changeability, following that was profitability (14 mentions), communication (13 mentions) and transparency (12 mentions). Table 1 lists the objectives identified for the ‘restructuring goals’ element.

Table 1: Analysis of the Project Documentation concerning Restructuring Goals

Restructuring Goal	Number of Mentions
Changeability	16
Profitability	14
Communication	13
Transparency	12
Employee Orientation	8
Product and Process Quality	7
Material Flow Orientation	3
Organizational Compatibility	3
Ecology	3
Expandability	2
Flexibility	2
Sustainability	2
Aesthetics	1
Interconnectivity	1

*This table outlines the analysis of 22 project documentations with regard to their reorganization goals, sorted in decreasing frequency. In the left column are the identified reorganization goals and in the right column the respective number of mentions. As can be seen, in almost 75% of all projects, the restructuring goal ‘changeability’ was pursued.*

Subsequently, an expert interview was conducted with seven employees from different industrial companies SMEs: Buenemann & Collegen GmbH, GREAN GmbH, Andreas Schlueter Maschinenbau GmbH, Laserworking Garbsen GmbH, Intorq GmbH & Co, KG along with corporations: Heinz Schwarz GmbH & Co. KG, Sartorius AG. Catalogue entries collected were verified with regard to their relevance for successfully implementing restructuring measures. The interview was conducted in a joint workshop on May 24, 2017 at Laserworking Garbsen GmbH. Those questioned from the participating enterprises included business and production managers, employees from the planning department and architects. During the interview they were asked to estimate the practical relevance of the identified restructuring goals. The relevance was assessed using qualitative evaluation criteria (low, medium, high). Afterwards, the identified restructuring goals were condensed to those highly relevant for SMEs. The seven main restructuring goals were catalogued as *changeability, profitability, communication, transparency, compliance with standards,*

*sustainability and organizational compatibility*. Each were described with corresponding criteria. In the subsequent course of the project, the criteria serves as a benchmark for the degree of goal achievement. For example, the restructuring goal ‘communication’ is described as “reducing the length of communication distance between the single *compliance* departments”. A similar procedure to the one described above for identifying and defining the restructuring goals was applied to the other configuration elements. The results are listed below:

The 15 main planning tasks were catalogued as designing workplaces, dimensioning, planning communication concept, planning storage equipment, planning the layout, planning the logistics concept, planning special equipment, planning the production concept, planning production equipment, planning quality assurance concept, organizational planning, planning transportation equipment, planning of technical installations (distribution), planning information technology and project management. The eight main responsibilities were catalogued as production equipment planner, factory planner, facility manager, information technology planner, storage equipment planner, logistics planner, production planner and quality planner. The catalogue planning methods contains 32 methods (e.g. material flow matrix, value stream design).

## **CONCLUDING COMMENTS**

This paper shed light on the problem of limited success when planning factories and in particular, restructuring projects, while demonstrating the corresponding need for research. Following that, the initial results of the research project were presented. The developed catalogues (restructuring goals, planning tasks, responsibilities and planning methods) represent an important basis for configuring restructuring projects. In the course of future research, the elements of the catalogues will be described further (e.g. input and output information for the planning tasks). This allows data to be easily and systematically compiled. Moreover, by depicting input and output information, dependencies between the individual planning tasks can be shown. Furthermore, the dependencies between the catalogues will be described. This will make it possible to determine necessary planning tasks, methods and responsibilities according to the selected restructuring goal. Based on that, a procedural method will be developed and the practicality will be verified.

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