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A framework for developing portfolios of improvements projects in manufacturing

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Abstract

The outcome of improvement programmes such as Lean Manufacturing or Six Sigma is only partially determined by the success or failure of its individual projects. Also of significance is how well the programme and its projects are aligned to the company's strategy. Frequently practitioners will select projects on their individual merits, rather than with proper reference to their contribution to business strategy. In this manner, it is therefore possible to build portfolios of projects that are at best suboptimal and at worst counter to the company's overall strategic direction. The construction of project portfolios is thus a critical step in effective programme management and this would suggest that organizations would benefit from a framework to assist them with the selection of projects and portfolios that are aligned with the company's overall strategy. While tools such as Critical to Quality Flow-down are available to translate the voice of the customer to metrics and goals, practitioners do not have a structured approach to construct and assess portfolios.

In this paper we present a framework to assist programme managers to develop portfolios of improvement projects targeted to fulfil their company's strategic needs and also align with the organisation's objectives and measures. Consideration is given to quantitative and qualitative aspects of strategy and how these may best be related to provide a set of orthogonal and common metrics.

Keywords: Strategy; Process Improvement; Project Management; Lean manufacturing; Six Sigma

1. Introduction

In addressing the question 'What is Strategy?' Porter began by pointing out that it is not the same as operational effectiveness, since effectiveness on its own does not create sustainable differentiation [34]. Yet many forms of strategic differentiation rely upon the implementation of appropriate operational effectiveness activities for their realization. Realized strategy is, in Mintzberg's terms "a pattern in a stream of decisions" [28] and creating a pattern which is coherent with strategy is therefore of utmost importance to the continued success of a business. Coherence necessitates that clear cause and effect relationships are established between strategy and operational outcomes [11]. Without such coherent patterns, neither activity can make complete its proper contribution to the organization.

While the literature on strategy is extensive, so too is the record of strategy failure. We have previously written that this is frequently due to the lack of a formal framework for linking strategy to process improvement implementation [23]. In this paper, we examine how a simple framework may be used to map strategy to portfolios and how this might help to identify misalignments or gaps in shop-floor execution of strategy.

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1.1. Project selection frameworks

If one considers projects to be the fundamental expression of business strategy [30] then it follows that an organization must be careful in how it selects them [17,22]. Hoshin Kanri [16] and its precursor Quality Function Deployment (QFD) [4] have been successfully employed by sophisticated enterprises since the 1960s to align strategy to projects and objectives, however smaller and less mature organizations are not always successful in making that link. For example, in the study by Cagliano et al. [10] firms chose projects that aligned with strategy only 43% of the time. This should not come as a great surprise since, while researchers recognize that project selection is critical for the success of continuous improvement programs [2,37], such discussion is generally absent from the popular press [5,6,8,27,31,35,36,40] leaving practitioners to develop their own approaches to strategy alignment.

The result is that industry practitioners often use more or less subjective approaches when selecting and prioritizing improvement projects. Recently we reported on a survey in which we found that only half of the respondent organizations had defined value streams for all strategic value creation activities and less than half explicitly linked their Value Stream Maps (VSMs) to strategy using metrics [24]. While in a study of companies in the United Kingdom, Banuelas [3] found that practitioners predominantly used brainstorming to identify projects and, despite recognizing the importance of linking projects to business strategy, used prioritization tools that were, at best, only loosely connected to strategy.

As it is unlikely that a portfolio so conceived might deliver an optimal outcome, or that one might have a priori knowledge whether this is the case, we proposed that practitioners use the process shown in Figure 1 to generate portfolios [23].

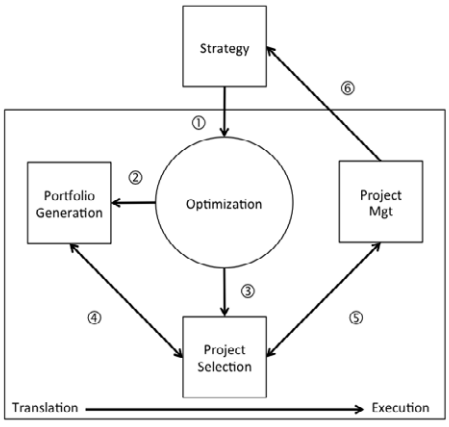

Fig 1: Framework for linking strategy to process improvement.

In this approach, the *optimal* future is first modeled (step 1) and differences between the current state of the business and the optimal state then drive portfolio creation (step 2) followed by the use of formal methodologies that select an optimal subset of the strategic portfolio (steps 3 and 4).

The ensuing project portfolio must fulfill multiple objectives, which will vary depending upon the organization's chosen strategy. Organizations should therefore attempt to ensure the portfolio is both capable (each project has the potential to successfully address the target issue) and complete (the entire portfolio addresses all dimensions from the multiple objectives of strategy). A discussion on capability goes to the heart of improvement methodologies such as Six Sigma or Lean and is thus out of the scope of this paper. Rather, we are interested in how organizations may determine whether or not a portfolio may be considered to be 'complete'.

The remainder of this paper investigates this question and a simple framework is presented for use in Small to Medium Enterprises (SME). The paper is organized as follows: in Section Two we discuss the structural framework of strategy and manufacturing practice bundles; in Section Three we describe a process whereby strategy is mapped to metrics and then to projects, describing the results from the application in an SME; finally in Section Four we make concluding remarks.

2. Strategy and Practice Bundles

According to Kotha [25] there are four levels at which strategy is developed: Industry (industry policymaking by Government); Corporate (defining the nature of the business and resource acquisition and allocation); Business (strategic business unit boundaries, scope, direction and the basis of competitive advantage); and Functional (how a function such as manufacturing supports the Business level and other Functional level strategies). Since one determinant of competitive advantage is how well the organization's internal capabilities fit the external environment [9], the concept of portfolio 'completeness' can be defined as the match between the Business level strategy and Functional level actions. This will hold true whether an organization's strategy is market-led or resource-led, since either will necessitate various improvement actions or decisions from within manufacturing that will impact business performance [7,12,13]. Thus, whilst our interest lies at

the Functional level, we must necessarily begin with a brief discussion of business level strategy.

2.1. Generic Strategies

The purpose of this paper is not to enumerate or extend the literature on business strategy; nevertheless we require a reference point from which we can explore the strategy–portfolio linkage. Whilst a number of authors have developed various schemas describing Business Level 'generic strategies', Michael Porter's generic competitive strategy model has made the most significant contribution to business and the literature on business strategy over the past 30 years [1,32]. Although it has not received universal support and has some empirical and methodological issues, its broad application makes it a reasonable as an exemplar from which readers may then choose to apply this approach to other strategy frameworks.

Porter [33] set out three strategic generic stances that an organization might adopt – Differentiation, Cost Leadership and Focus. Whilst not entirely orthogonal, Porter took the view that an organization must select one or other of these positions lest it be caught 'stuck in the middle' – losing strategic focus. Organizations choosing to position themselves in a differentiation strategy, would seek to provide unique values (either tangible or intangible) in its products or services through innovation, agility, quality or timeliness. Alternatively, an organization could choose to implement a cost leadership strategy, in which it would seek to create competitive advantage through a sustainable cost (and therefore price) advantage, through the pursuit of scale economies in production or distribution, cost saving technologies, product and process design, input cost, capacity utilization of resources, and access to raw materials. Finally in the Focus strategy, a firm will select and target a particular market segment (customer, geography or product) and deliver cost or differentiation.

Ultimately any strategic thrust will depend upon one or more of only five competitive manufacturing capabilities - cost, quality, delivery performance, flexibility and service [13,39]. For example a differentiation strategy might be built on quality and service capabilities. For any particular firm, though, each of these capabilities is composed of unique bundles of manufacturing practices such as Total Quality Management (TQM) or Six Sigma [12,13] driving actions and performance as shown in Figure 2.

2.2. Practice Bundles

These practice bundles may be broad ranging, overlapping and multidimensional. For example, Six Sigma is a broad ranging practice since, while it is a methodology that focuses on the reduction of process variation, process variation can improve product quality through tightened production outputs; reduce scrap and therefore production expenses; or improve delivery performance through reduced variation in processing time. Practice bundles that are very different may have overlapping impacts, for example it is possible to reduce WIP through both the scrap reduction impacts of Six Sigma and the implementation of kanbans and pull production in Lean. Finally, projects do not often impact a single dimension of a business - improving product quality, for example, is also likely to reduce scrap (and therefore cost), inspection and rework (and therefore overhead) and WIP (and therefore improve cash-flow).

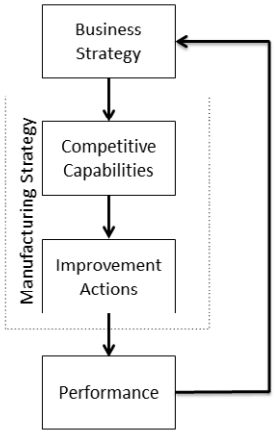

Fig 2: Competitive capability and strategy (24).2

Earlier we mentioned that projects need to be 'capable' and it should suffice to note here that there might be many alternative approaches to solving any single problem. Thus, whilst strategy is set top-down, improvements are generally identified bottom-up and so while understanding practice bundles can assist practitioners in targeting strategic outcomes, the problem of ensuring that a complete mapping from strategy to performance remains.

3. Linking Improvements to Strategy

We therefore propose the following process to generate a strategy-project matrix and thereby reconcile these top-down and bottom-up practices, ensuring that all strategic outcomes are met:

1. Map strategies to metrics.
2. Select projects and identify outcomes.
3. Map project outcomes to strategy metrics.
4. Identify gaps and overlaps.
5. Repeat steps 2 to 4 to minimize gaps and overlaps.

3.1. Mapping Strategy to metrics

Much of our extant business measurement structure remains unchanged since the early part of the 20th century [29] however, on their own, traditional financial measures can prove problematic and even drive aberrant behaviors resulting in local optimization [38] and hindering progress towards excellence in manufacturing. Non-financial performance measures can help organizations to make the link between manufacturing and global financial outcomes [14,15]. Recognizing this problem, Kaplan and Norton proposed the Balanced Scorecard (BSC) to more broadly account for factors that would drive business performance [19,20]. The BSC encompasses measures that are short and long term; lead and lag; take an internal and external focus and account for the multiple perspectives of stakeholders.

As the result of criticism of the BSC, Kaplan and Norton extended the approach to represent the cause and effect relationships between organizational strategy, activities and outcomes [18,21]. The BSC became the Strategy Map and this offers a standardized way to represent strategy as business intangibles – processes and human capital – and target outcomes. Moreover, it ensures that all strategies are mapped to competitive capabilities and then to outcomes and thus results in a performance measurement system that is consistent with strategy without gaps or extraneous metrics.

Where a well-articulated Strategy Map does not exist, it is possible to translate strategic goals to individual process metrics using the Six Sigma method 'Critical to Quality (CTQ) Flow-down' [26], translating each strategy into a manufacturing capability, the capability into a process metric and then to a process target. In either case, the resultant map will set out strategies and metrics as the row entries of our matrix (Figure 3).

Strategy 1	Metric 1
	Metric 2
	Metric 3
	Metric 4
Strategy 2	Metric 5
	Metric 6
	Metric 7
	Metric 8

Fig 3: Row entries showing CTQ of strategies to metrics.

3.2. Project Mapping

It is generally the case that practitioners identify projects from the bottom-up and in a manner that is only loosely concerned with strategy [3,24] - indeed TQM and Lean encourage this through Quality Circles, Kaizen and A3 projects. So the next step in this process is to gather the portfolio projects, organizing these into practice bundles. The reason for this grouping is twofold: it allows one to more easily determine strategy impacts and also where there is potential for more (or less) effort. The portfolio becomes the columns of our matrix as shown in Figure 4.

Practice Bundle A		Practice Bundle B	
Project A	Project B	Project C	Project D

Fig 4: Column entries showing the project portfolio.

Since the nexus between strategy and project will be the metric, each project must have clearly defined targets including secondary and subsidiary outcomes. For example, a project to reduce scrap will also impact on WIP, material cost and so on. Such secondary impacts will become increasingly important once the entire portfolio is mapped as can be seen in the final matrix in Figure 5.

		Practice Bundle A		Practice Bundle B	
		Project A	Project B	Project C	Project D
Strategy 1	Metric 1	■			
	Metric 2		■		
	Metric 3				■
	Metric 4	■			
Strategy 2	Metric 5			■	
	Metric 6			■	
	Metric 7				■
	Metric 8				■

Fig 5: The strategy-portfolio matrix.

In this matrix, each project is mapped by its nominal outcomes (as defined in the project plan) to the corresponding metric(s) from the Strategy Map or CTQ, providing a simple visual reference of strategy-project alignment.

3.3. Gap and Overlap Assessment

We applied this approach to the manufacturing arm of a local SME and a redacted subset of the matrix is shown in Figure 6. This organization has been applying Six Sigma and Lean manufacturing over the past four

years and has recently implemented a form of BSC, which cascades strategy from the Manufacturing Division, to the Region and then to individual plants. As a result, this plant already had a BSC with 25 metrics. In addition, the plant had developed VSMs for each of its 5 product families, which it reviews bi-annually to adjust its project portfolio which numbers nearly 100.

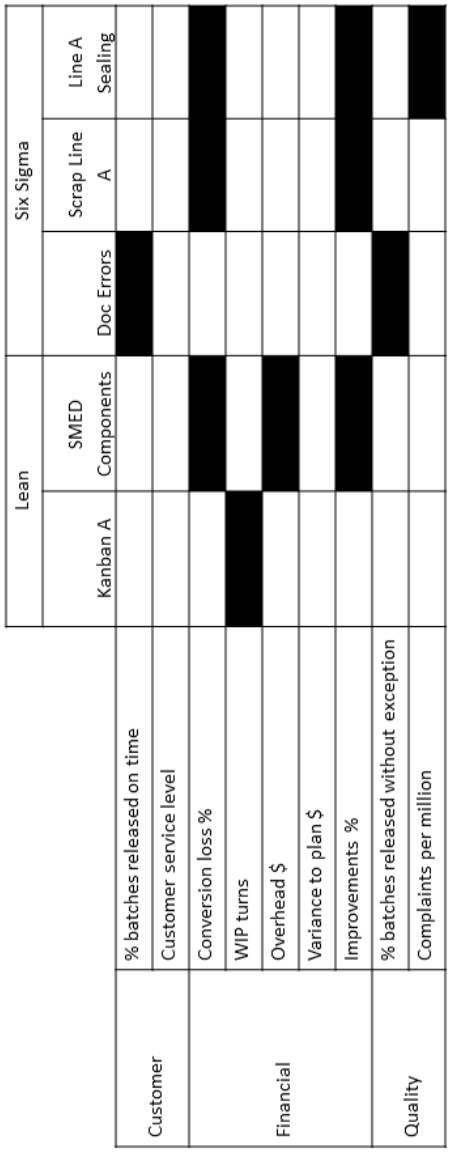

Fig 4: Strategy-project matrix excerpt.

This excerpt reveals the following insights:

- There are two strategic outcomes that are not addressed by any improvement projects (customer service level and variance to plan). The organization should therefore set out to identify suitable projects to address these specific issues.
- Four other strategic outcomes (batches released on time, WIP turns, batches released without exception and complaints per million) are each supported by only one project. This raises two issues that the organization ought to consider: is management confident that these projects will have sufficient impact to meet the target; should any of them fail, how will the outcomes be realized? These questions might lead the organization to reconsider its portfolio and add additional projects or to identify optional projects as alternatives, should the primary projects fail.
- A number of projects focus on conversion loss and efficiency (financial) improvement leading us to question whether too much emphasis has been directed here. Some of these projects might be traded off against additional projects in the points above.

As an extension of this latter point, we noted that this organization has relied predominantly on Lean Manufacturing techniques. These have yielded overall improvements to flow and WIP but are less able to have impact on the scrap and quality defects seen. A potential inference could be that the organization needs to broaden its improvement agenda to include a wider range of Industrial Engineering practices.

Our review of the project list also identified several projects that were not linked to strategic metrics at all. This should raise some interesting questions for an organization: do all projects need to be linked to strategy; is the strategy/ scorecard complete; should we be working on orphan projects? Our objective in this paper has been to demonstrate a simple approach to ensuring that a strategic portfolio is complete. That should not preclude an organization from undertaking any number of projects for operational or even purely exploratory purposes but it should help the organization to better understand the nature of its project activities and make considered judgments about which activities to continue, to expand or to cease.

4. Conclusions

We have set out a simple process and framework can be used to determine the completeness of process improvement project portfolios, which is nevertheless based on sound practices from the literature. Its purpose is to be used by practitioners in industry and to give clear and visual pointers to potential gaps or areas of too much focus. When applied in an SME, its use highlighted a number of areas for discussion and

improvement, some of which went beyond the portfolio itself.

In creating such a simple process, the method is necessarily limited. Perhaps most significantly, we do not account for the capability of improvement projects or the effort involved. In our case study, we identified that a single project had been identified for improving batch release times and we questioned the validity of this decision. A more complex methodology might be better able to assess this or to assess the complex interaction between the three projects targeted at conversion loss. It is our belief, however, that a simple framework such as this is more likely to be applied than a complex one (particularly in smaller firms) and can therefore have a greater overall impact on industry practice than a complex framework implemented by a few.

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