Overview of Key Performance Indicators (KPIs)

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Abstract— **A set of key performance indicators (KPIs) for manufacturing operation management is introduced in the ISO 22400 standart. In this paper, a framework is introduced in order to solve the problem of dividing into types all the 38 KPIs.**

Keywords— key performance indicators; KPIs; classification of KPIs; ISO 22400; types of KPIs

I. INTRODUCTION

Key performance indicator (KPIs) are defined as quantifiable and strategic measurements that reflect an enterprise's critical success factors. KPIs are very important for understanding and improving manufacturing performance, both from the lean manufacturing perspective of eliminating waste and from the corporate perspective of achieving strategic goals.

These KPIs are developed or identified by passing it through a complete lifecycle as shown in Figure 1.

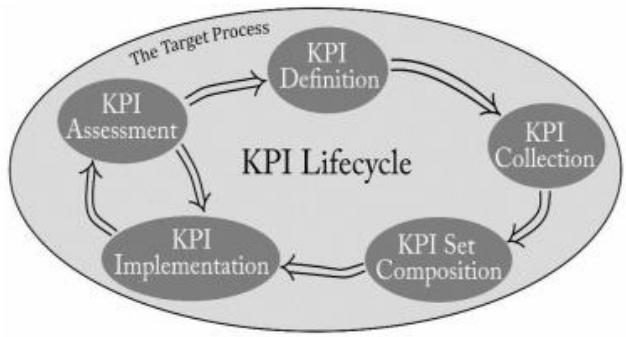

Figure 1. KPI Lifecycle [1]

II. TYPES OF KPIS

The 38 KPIs defined at MOM level in [2] are divided in to five types based on different processes in the manufacturing systems:

- Production operations management KPIs.
- Maintenance operations management KPIs.
- Quality operations management KPIs.
- Inventory operations KPIs.
- KPIs for energy management

The production operations management KPIs deal with production line activities, such as monitoring the flow of production orders and batches, scheduling machines and workers, ensuring completion of orders in time. These KPIs are mostly related to product managers and workers that work close to the production line. For example, KPIs in this category are availability, allocation efficiency, utilization efficiency and technical efficiency.

The maintenance operations management KPIs are regarding the maintenance of all the manufacturing resources, such as machines, robots and other tools. It includes planning maintenance activities for the production line periodically. For instance, KPIs in this 19 category are mean time to failure, setup rate, mean time to restoration and corrective maintenance ratio [3].

The quality operations management KPIs are of great importance in any manufacturing system, they ensure that all products produced are of best quality. These KPIs indicate the performance of whole production line in terms of quality perspective. Top-level management is mostly interesting in the quality of the products produced rather than small details about the production line, thus these quality operation management KPIs can help them in getting the overview of the whole manufacturing plant. Example of vital quality KPIs are quality ratio, rework ratio and Actual to planned scrap ratio.

Inventory operations KPIs deal with activities such as transportation of raw material from warehouse to work centers, dispatching of finished products and keeping track of inventory in the storage. For example, KPIs in this category are inventory turn and Finished goods ratio.

KPIs for energy management support the evaluation of direct energy consumption per work unit or per order, and per manufactured product item. For example, KPIs in this category are direct energy consumption effectiveness, direct energy efficiency, direct net energy efficiency and direct net energy consumption effectiveness [4].

The following Table 1 divides the 28 KPIs in to three above-mentioned categories, such as production operations management KPIs, inventory operations KPIs and KPIs for energy management.

TABLE I. TYPES OF KPIS

Key performance indicators	Types of KPIs		
	Production	***Inventory***	***Energy management***
Worker efficiency	V		
Allocation ratio	V		
Throughput rate	V		
Allocation efficiency	V		
Utilization efficiency	V		
Overall equipment effectiveness index	V		
Net equipment effectiveness index	V		
Availability	V		
Effectiveness	V		
Inventory turns		V	
Setup ratio	V		
Technical efficiency	V		
Production process ratio	V		
Machine capability index	V		
Critical machine capability index	V		
Process capability index	V		
Critical process capability index	V		
Comprehensive energy consumption	V		
Finished goods ratio	V		
Integrated goods ratio	V		
Production loss ratio	V		
Storage and transportation loss ratio		V	
Other loss ratio		V	
Equipment load ratio	V		
Direct energy consumption effectiveness			V
Direct net energy consumption effectiveness			V
Direct energy efficiency			V
Direct net energy efficiency			V

The following Table 2 divides other the 10 KPIs in to two above-mentioned categories, such as quality operations management KPIs and maintenance operations management KPIs.

TABLE II. TYPES OF KPIS

Key performance indicators	Types of KPIs	
	Quality	***Maintenance***
Quality ratio	V	
Actual to planned scrap ratio	V	
First pass yield	V	
Scrap ratio	V	
Rework ratio	V	
Fall off ratio	V	
Mean operating time between failures		V
Mean time to failure		V
Mean time to repair		V
Corrective maintenance ratio		V

The aforementioned five different types of KPIs defined in Table 1 and Table 2 are further divided in to eight different subcategories to make it easy for the industry to interpret and classify these KPIs across their entities [5]. These subcategories include resource management, detailed scheduling, definition management, dispatching, tracking, data collection, execution management, and analysis.

REFERENCES

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