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Industrial automation systems and integration - Standardized procedures for production systems engineering - Part 4: Key performance indicators (KPIs) in production planning processes

工业自动化系统与集成 生产系统工程的标准化程序 第4部分：生产计划过程中的关键绩效指标

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1 Scope

The document lays down a set of key performance indicators (KPIs) for production planning, which allow the planning process to be compared and monitored within a standardized framework. It first sets out in detail how the KPIs are used, so that the indicators may be organized in a multi-level system while the different scopes of the planning process are taken into account. The development of that multi-level system is the core of the document. The range of planning processes discussed is limited to the production planning of a series product, and the approach considers only the tasks carried out during the production planning process.

All the key indicators proposed in the document are recommendations; they may also be used according to the general validity of the reference process of ISO 18828-2, in connection with the content described in the document.

2 Normative references

The document has no normative references.

3.1 Terms and definitions

3.1.1 Key performance indicator, KPI: quantified level at which a key objective is achieved. A note states that a KPI is derived directly from physical measurements, from data and from other KPIs, or is obtained through an aggregation function of physical measurements, data and other KPIs. The source given is ISO 22400-1:2014, 2.1.5.

3.1.2 Area type rate, ATR: the ratio of the area of a particular type of area to the total area. A note gives storage area and assembly area as examples of a particular type of area.

3.1.3 Area utilization rate, AUR: the ratio of the production area required to the area allocated.

3.1.4 Bottleneck information rate, BIR: the ratio of the amount of critical information to the total amount of information, critical information being the information whose absence causes delay.

3.1.5 Container: general transport container. The examples given are blister packaging, compartment boxes and small part containers.

3.1.6 Container type rate, CTR: within a defined observation period, the ratio of the storage container types to all the container types.

3.1.7 Information type rate, ITR: the ratio of the amount of information of a particular type to the amount of information of all types. A note gives missing information and used information as examples of a particular type of information.

3.1.8 Information procurement time, symbol t with the subscript IPT: the time needed to obtain information when the planner searches for it actively.

3.1.9 Information fulfilment rate, IFR: the ratio of the amount of information supplied by the actual process to the amount of information needed by the target process.

3.1.10 Information supply rate, ISR: the ratio of the amount of information available for a planning task to the amount of information needed.

3.1.11 Information utilization rate, IUR: the ratio of the amount of information used to the amount of suitable available information. A note states that it describes a measured value of the amount of available information used in the planning process.

3.1.12 Information waiting time, symbol t with the subscript wait: the time spent waiting for the information needed for the planning process to continue.

3.1.13 Storage container rate, SCR: within a defined observation period, the percentage of storage containers among all the containers used.

3.1.14 Planning procedure alternatives, PPA: the ratio of the number of planning tasks that can be handled at the same time to the number of all the tasks required.

3.1.15 Planning type rate, PTR: the proportion of a particular planning type among all the planning types. A note gives digital planning and workshops as examples of a particular

planning type.

3.1.16 Planning iteration number, PIN: the number of iterations of a particular planning task. The example given is a revision after the planning task has been carried out successfully for the first time.

3.1.17 Planning iteration rate, PIR: the proportion of repeated planning tasks. The example given is all the tasks carried out twice.

3.1.18 Planning cycle time, symbol t with the subscript CT: the cycle needed to handle a particular planning task.

3.1.19 Planning work in progress, PWP: the aggregate number of work tasks waiting to be handled within the scope of the process.

3.1.20 Process detail level, PDL: the number of sub-process steps of the process plan. The example given is the description of a defined assembly process.

3.1.21 Response time, symbol t with the subscript RT: the time between the receipt of the planning request and the start of the planning operation.

3.1.22 Sub-process: a process step that is part of a higher level process. The examples given are assembly, and pre-assembly and final assembly.

3.1.23 Transport plan rate, TPR: the ratio of the number of transport plans planned to the number of all the plans theoretically possible.

3.1.24 Time type rate, TTR: the ratio of a time type to the total working time. A note gives waiting and searching as examples of time types.

3.1.25 Work plan rate, WPR: the ratio of the number of work plans scheduled to the number of work plans used during the manufacturing run. A note states that a representative product variant is one example of a scheduled work plan.

3.1.26 Work plan homogeneity level, WHL: the measure of the homogeneity, or even distribution, of the duration of the sub-process steps relative to another process.

3.2 Symbols and abbreviated terms

The symbols for areas are: total area; allocated area; assembly area; required area; sanitary area; storage area; and the area of a particular set-up, each written as the letter A with the corresponding subscript.

The symbols for containers are: total number of containers; number of containers by dimension, small, medium or large; number of supplier containers; number of internal containers; number of special containers; number of standard containers; number of storage containers; and a particular container type, each written as the letter C with the corresponding subscript.

The symbols for planning tasks are: all the planning tasks required; the planning tasks carried out in a team or a workshop; the planning tasks carried out with digital planning support; the number of planning tasks waiting to be handled; the planning tasks carried out by the planner, that is by a team or a department; the planning tasks actually carried out at the same time; the planning tasks that can be handled at the same time; the planning tasks carried out according to the standard work flow; and the planning tasks carried out with a particular planning type, each written as the letter D with the corresponding subscript.

The symbols for information are: information accepted; information supplied in the actual process; the sum of all the information; available information; critical information; digital information; primary information; required information; secondary information; the information needed by the target process; information used; and a particular information type, each written as the letter I with the corresponding subscript.

The remaining symbols are: the detail level of the transport plan and the detail level of the work plan, written as the letter L with the corresponding subscript; the number of planning cycles caused by errors, the number of planning cycles and the number of planning cycles after the planning result has been released, written as the letter M with the corresponding subscript; the number of sub-processes, written as the letter N with a subscript; the total number of all the process elements, the number of iterated process elements caused by errors and the number of iterated process elements, written as the letter P with the corresponding subscript; the end time of the planning process, that is when the planning task has been completed, the expected time of the planning task waiting to be handled, the time at which the planning request is received, the search time, the duration of a sub-process, the total duration of the process, the average duration of a sub-process, the start time of the planning process, the value adding time, the working time, which does not include emergency time and unexpected time, and a particular time type, written as the letter t with the corresponding subscript; the number of transport plans scheduled and the number of transport plans used during the manufacturing run, written as the letter T with the corresponding subscript; the number of work plans created and the number of work plans used during the manufacturing run, written as the letter W with the corresponding subscript.

The abbreviation SOP stands for start of production.

4.1 System of key performance indicators for production planning

The key performance indicators of production planning are organized in a multi-level system of key performance indicators, which provides different levels of key indicators for the process. These levels include the assessment of the planning process among the process oriented key indicators, for instance by analysing time data, process types and information requirements, and they also include the assessment of the results of particular planning tasks. Within this organizational structure, the process oriented key indicators are valid