Kanban system: controlling material flow according to the consumption principle

The Kanban system is a method of pull-controlled material scheduling in which consumption automatically triggers replenishment. Instead of central demand planning, containers, cards or electronic signals control replenishment in defined quantities. For buyers and supply chain managers, the system reduces stock levels, waste and stockout risks – but it requires stable processes and reliable suppliers.

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Key facts at a glance

01 Kanban is a pull system: actual consumption at the point of use triggers the replenishment order.

02 Typical control parameters are loop quantity, number of Kanbans and replenishment lead time (cycletime).

03 In practice, Kanban frequently reduces stock levels by 30 to 50 per cent, provided demand and transport times are stable.

04 Kanban is suitable for C and B parts with steady consumption; high-value A parts and demand peaks require supplementary scheduling methods.

05 Electronic variants (e-Kanban) integrate suppliers and bridge the gap to the procure-to-pay (P2P) process.

06 Key performance indicators are inventory turns, fill rate, and replenishment lead time and reliability.

Definition: Kanban system

A Kanban system is a control concept for material and information flows in which signal cards (Japanese: 'Kanban') trigger replenishment according to the consumption principle. It belongs to lean production and replaces the central advance determination of demand with a decentralised,

self-regulating control loop solution.

Pull principle instead of forward planning

Under the pull principle, every replenishment movement is only triggered once material has actually been withdrawn. The consumer – assembly workstation, production cell or warehouse – signals the demand, and the supplier in the network responds. This eliminates error-prone forecasts for many parts. Kanban is therefore a counter-design to classic, forecast-based material scheduling, but it can only replace the latter for stable, regularly consumed positions.

Distinction from other scheduling methods

Unlike reorder point processing or MRP-based demand planning, Kanban does not involve a lot-size calculation per transaction but rather a fixed loop quantity. The number of circulating containers determines the stock level. While SAP- or ERP-supported methods rely on master data and schedulers, Kanban regulates itself via physical signals – an approach that is also gaining relevance in the context of agile procurement because it reduces planning costs and shortens response times.

Structure and functioning of the control loop

A Kanban loop connects the consumer and supplier via two or more buffer points. Material is provided in standardised containers with a defined quantity; each container carries a signal that triggers a replenishment movement upon withdrawal.

Kanban cards and control containers

The classic card contains the part number, quantity, container type, source and destination, and, where applicable, an order or drawing number. It also serves as a transport, production and identification document. Alternatively, pure container loops operate without a card: an empty container is itself the signal. Important for buyers is that container size and card count directly define the stock at the point of consumption and are therefore negotiable control parameters.

One-card and multi-card systems

In the one-card system, the card travels with the container from the consumer to the supplier and back – simple, but with limited separation of transport and production. The two-card system uses separate transport and production Kanbans and allows finer buffer control where transport distances are longer or there are several production stages. In series production, a multi-stage Kanban has frequently become established, synchronising several stages of value creation.

E-Kanban and system support

Electronic Kanbans replace the paper card with scanner, RFID or web portal signals. The withdrawal process automatically generates an order or delivery note in the supplier's system. Kanban thus merges with the procure-to-pay (P2P) process: consumption, ordering, goods receipt and invoicing are handled largely automatically, which significantly reduces manual effort in operational procurement.

Methods and approach for implementation

Implementation follows a clear sequence: part selection, loop dimensioning, agreement with the supplier, piloting and monitoring. The selection of suitable parts determines the success or failure of the undertaking.

Part selection and value driver analysis

Suitable items are those with steady demand, manageable quantities and low to medium value – typically catalogue parts, fasteners and standard components. A value driver analysis by commodity group helps assess the cost-benefit ratio per segment: for C parts, savings in scheduling effort predominate, while for A parts, capital tie-up and obsolescence risks frequently predominate. It should also be checked in advance whether quality-related release processes, such as a deviation approval, conflict with regular replenishment.

Loop dimensioning and parameters

Dimensioning follows a simple logic: number of Kanbans equals demand during the replenishment lead time plus safety buffer, divided by container size. In practice, container sizes typically range from a few units for expensive parts to several hundred for small parts. Key inputs are the measured replenishment lead time including transport and the reliability of the supplier; uncertain transport routes require larger buffers and increase stock levels.

Supplier selection and agreements

Kanban transfers scheduling responsibility to the supplier and presupposes that supplier's reliability. Clear agreements on response times, quantity bands, packaging, container responsibility and invoicing are required. Before switching suppliers to a Kanban-capable partner, existing processes should be examined via a structured enquiry – such as a request for information (RFI) – for logistics competence, IT connectivity and capacity flexibility. Relocating suppliers closer to the point of use is a common way in practice to secure short and stable replenishment lead times.

Key KPIs for control and monitoring

Kanban depends on the continuous monitoring of its control parameters. Without regular KPI reporting, loops drift gradually – through extended replenishment lead times, shifts in demand or manipulated container quantities.

Stock and turnover metrics

The key metric is inventory turns, i.e. the turnover rate of the Kanban stock per year. Falling values indicate too many Kanbans or shrinking demand. In addition, stock cover per storage location, tied-up capital and the proportion of obsolete or unused loops must be monitored. In practice, Kanban stock levels are reconciled with actual consumption trends at least quarterly.

Supply metrics

The fill rate measures the proportion of demand cases that could be met from the buffer without a supply gap; in well-established loops, benchmarks typically exceed 98 per cent. In addition, replenishment lead time (cycletime), supplier on-time delivery performance and the number of empty shelf positions are recorded. Supply interruptions must be analysed systematically, for example using an Ishikawa diagram, to identify causes in transport, packaging, data quality or supplier capacity.

Process and data metrics

With e-Kanban, process metrics are added: the proportion of automated orders, the error rate in signal transmission and the currency of master data. After all, even a physically sound loop fails due to poor data quality in part numbers, container sizes or delivery addresses. Master data governance ensures that master data changes – for example to units of measure or packaging regulations – are reliably carried over into all systems involved.

Risks and control mechanisms

Kanban stabilises supply and stock levels only under approximately stable conditions. Demand peaks, supply problems and process changes require active countermeasures and clear responsibilities.

Demand and structural risks

With highly fluctuating or declining demand, fixed loops lead to excess stock and scrap risks; with growth, supply gaps threaten. Countermeasures include dynamic Kanban quantities, temporary special Kanbans for projects and the consistent withdrawal of loops that are no longer needed. Residual quantities and obsolete parts must be inventoried regularly and settled via contractually agreed take-back or disposal arrangements.

Supplier and quality risks

If the supplying supplier fails, this immediately affects production – a buffer of only a few hours is common with Kanban. Risk-minimising designs use dual sourcing, appropriate safety Kanbans and defined escalation paths. Quality fluctuations must not be compensated with larger stock levels; instead, incoming inspections, supplier evaluations and, in the event of deviations, a clear deviation approval process are required. Misuse of the cards – for example maintaining 'shadow loops' – can be uncovered through container stocktakes and card checks.

Contractual and legal safeguards

Kanban agreements should govern transfer of title, retention of title to the circulating container material, stocktaking responsibility, price commitment and adjustment mechanisms. For longer-running call-off contracts, a price escalation clause can reflect material price changes in a transparent manner. Incoterms such as EXW or DPU determine when risk and transport costs pass to the buyer – for short, reliable replenishment lead times, the transport law arrangement is part of loop planning. Contracts and procedures should be reviewed legally on a case-by-case basis.

Current developments: digitalisation and hybrid models

Kanban is evolving from the physical container loop to networked, data-based control. Hybrid models combine physical signals with digital transparency and planning systems.

From e-Kanban to the connected supply chain

Modern systems connect consumption signals directly to supplier portals and transmit call-offs, delivery notes and quantity notifications automatically. This creates an end-to-end, digital supply chain without manual ordering processes. In addition, data lake and BI analyses are gaining in importance: consumption figures, replenishment lead times and stock trends are collected in order to readjust loops on a data-driven basis. However, high data quality in master data and transactional data remains a prerequisite.

Hybrid models and demand flexibility

In practice, hybrid solutions have proved their worth: stable series parts run in the pull loop, while fluctuating positions are controlled via scheduling or delivery call-offs. With new, adaptable Kanban parameters, even irregular demand profiles can be served by varying buffer sizes seasonally or depending on the project. For buyers, this means an active role in ongoing parametrisation rather than a one-off set-up.

Typical metrics

Metric	Typical value
Fill Rate	> 98 % *Proportion of demand cases supplied as required within the Kanban loop*
Inventory Turns	typically 6–12 p. a. *Turnover rate of the Kanban stock; low values indicate oversized loops*
Replenishment lead time (Cycletime)	a few hours to 2 days *Determines the required number of Kanbans; should be measurable and contractually agreed*
Inventory reduction	frequently 30–50 % *Typical benchmark after introduction for suitable part classes*
Proportion of automated orders (e-Kanban)	> 90 % *Target value when the loops are fully connected electronically*

Practical example

A medium-sized mechanical engineering company supplied around 2,400 standard parts (fasteners, small electrical components, hydraulic components) via classic scheduling, with high stock levels and frequent stockout notifications. After a pilot phase with 300 Kanban positions at three regional suppliers, the system was gradually expanded and connected electronically.

- Selection of parts according to consumption stability and value via a value driver analysis by commodity group
- Agreement with two suppliers on defined replenishment lead times with several collection routes per day (milk run)
- Introduction of e-Kanban with automatic order generation and integration into the P2P process
- Monthly KPI review of fill rate, inventory turns and stock development with readjustment of Kanban quantities

Conclusion

For stable, recurring material demand, the Kanban system is one of the most effective instruments for reducing stock levels and effort. It relieves the burden on scheduling, shortens response times and creates transparency between consumer and supplier. Prerequisites are carefully dimensioned loops, reliable supply partners and well-maintained master data. Those who continuously monitor the control parameters and actively adjust to changes in demand benefit permanently from lower stock levels and higher security of supply. Combined with electronic processing, Kanban becomes a building block of a modern, automated procurement process.

Frequently asked questions

? What is a Kanban system in simple terms?

With a Kanban system, the actual consumption of material automatically triggers replenishment, controlled by cards or container signals. There is no central order planning; instead, a self-regulating cycle operates between the consumer and the supplier. The goal is low stock levels with a high security of supply.

? Which parts is Kanban suitable for in procurement?

Kanban is particularly suitable for C and B parts with steady consumption, such as fasteners, standard components or packaging. High-value A parts, highly fluctuating demand or long procurement lead times require larger buffers or alternative scheduling methods. A value driver analysis of the commodity groups helps with the selection.

? How many Kanban cards or containers are needed?

The number is calculated from consumption during the replenishment lead time plus a safety buffer, divided by the container size. In practice, two to six containers per position are commonly used,

depending on delivery lead time and reliability of supply. The parameters should be reviewed regularly and adjusted to actual demand.

? What is the difference between Kanban and Just-in-Time?

Kanban is a control instrument based on consumption signals, whereas Just-in-Time is an overarching procurement and production concept with minimal stock levels and precisely timed delivery. Kanban can serve as a method for implementing Just-in-Time, but it also works without a full JIT strategy. Just-in-Time places higher demands on delivery reliability and process stability.

? What does e-Kanban mean?

E-Kanban replaces the physical card with digital signals such as barcodes, RFID or portal notifications. Material consumption automatically generates an order or delivery call-off with the supplier. This reduces manual effort, cuts errors and connects Kanban directly to the digital order-to-invoice process.

? What are the disadvantages of a Kanban system?

Kanban reacts sluggishly to sharp demand peaks and can lead to excess stock when demand declines. It requires stable processes, reliable suppliers and well-maintained master data. For high-value, rare or very long-lead parts, it is frequently unsuitable.

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