

Maturity Level 7 in implementing PortCDM - Continuous improvement of PortCDM Principles

by¹

Mikael Lind,^{1,2} Niels Bjørn-Andersen,¹ Michael Bergmann,¹ Robert Ward,¹
Sandra Haraldson,¹ Michalis Michaelides³, Almir Zerem¹, Vaklin Angelov,⁴ Mathias Karlsson,¹
Trond Andersen,⁵ José Gimenez,⁶ Gabriel Ferrus,⁶

¹RISE Viktoria, Sweden, ²Chalmers University of Technology, Sweden,

³Cyprus University of Technology, Cyprus, ⁴Satakunta University of Applied Sciences, Finland,

⁵Port of Stavanger, Norway, ⁶Valenciaport Foundation, Spain,

On behalf of the International PortCDM Council

Introduction

This is the fifth and final implementation note regarding Port Collaborative Decision Making (PortCDM), providing guidance for how to reach the different PortCDM maturity levels. This particular implementation note deals with how to establish structures and processes for continuous improvement once Level 6 of the PortCDM maturity model has been achieved.

PortCDM is a concept to support those engaged in or associated with port call operations. It aims to improve the efficiency and effectiveness of activities in any port by providing a framework for data sharing and enhanced collaboration. The PortCDM maturity model in Figure 1 shows the incremental steps required to establish successfully PortCDM as part of a port’s operations and summarises the capabilities achieved at each level.

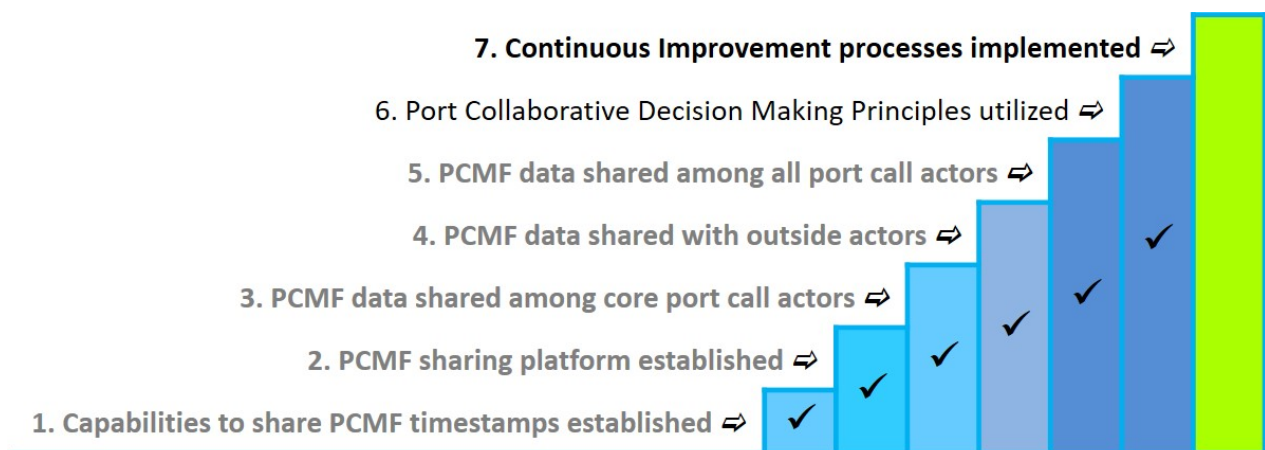


Figure 1 PortCDM maturity scale focusing on Level 7

Building upon the previously published concept note introducing the PortCDM maturity level framework², four implementation notes from the International PortCDM Council have already been published:

- Implementation note 1 identifies the four collaboration areas, introduces the seven-level maturity

¹ Participating authors are all belonging to organizations that are participants in the International PortCDM Council (IPCDMC)

² Lind M., Andersen T., Bergmann M., Watson R.T., Haraldson S., Karlsson M., Michaelides M., Gimenez J., Ward R., Andersen N-B., Gonzales A., Holmgren B., Zerem A., Rauer F., Sahlberg H., Lindberg J. (2018) The maturity level framework for PortCDM, Concept Note #13, STM Validation Project

(Implementation Note #5)

framework, and sets out the path for how a port might use PortCDM in order to achieve compliance in collaboration and data sharing³

- Implementation note 2 provides guidance on how a port might achieve Levels 1 and 2 in the maturity framework by providing the necessary timestamps using the S-211 standard and establishing a Port Collaborative Message Format (PCMF) sharing platform.⁴
- Implementation note 3 provides guidance on how a port can migrate towards Levels 3, 4 and 5 by achieving transparency through the sharing of data among all port actors.⁵
- Implementation note 4 provides practical advice on how a port can fully implement the collaborative decision making of the PortCDM and achieve maturity Level 6.⁶

This fifth implementation note deals with the last step in the PortCDM maturity model, where the objective is for a port and its actors to continuously monitor their individual and collective operational performance, identify shortcomings and collectively and collaboratively address and overcome them. It is based on the practical experience gained in implementing PortCDM in the ports of Barcelona, Brofjorden, Gothenburg, Limassol, Sagunto, Stavanger, Valencia, Umeå, and Waasa. These implementations were part of the recently completed PortCDM testbed activity, which again was part of the wider STM validation project.

The concept of the Continuous Improvement Process (CIP)

The highest PortCDM maturity level is inspired by the Kaizen⁷ or the Continuous Improvement Process (CIP)⁸ practices implemented with great success in many industries, especially within production and services.

Kaizen in Japanese means ‘improvement’, and in business, it refers to activities that continuously improve processes and functions. It refers to all types of improvements from small improvements to be implemented in a day, to large-scale reorganizations taking years to accomplish. An excellent example of the latter are the improvements in Toyota, which has resulted in huge competitive advantages for Toyota (and other Japanese automobile manufacturers) over their European and US competitors, especially when it comes to the higher quality of products.

Traditionally, two different approaches may be distinguished,

- Flow Kaizen, refers to the flow of materials and information, and it is often used in connection with the reorganization of entire production lines, like the Toyota assembly line.
- Process Kaizen, refers to the small-scale improvement of the workplace of individual workers. This

³ Lind M., Bergmann M., Andersen T., Haraldson S., Ward R., Bjørn-Andersen N., Michaelides M., Watson R.T., Ferrus Clari G., Zerem A., Rylander R., Gimenez J., Karlsson M. (2019) Achieving compliance in collaboration and data sharing with PortCDM, Implementation note #1, International PortCDM Council (IPCDMC)

⁴ Lind M., Bergmann M., Andersen T., Haraldson S., Ward R., Bjørn-Andersen N., Michaelides M., Watson R., Ferrus G., Zerem A., Rylander R., Gimenez J., Karlsson M., (2019) First Steps in implementing PortCDM - Establishing a data sharing environment, Implementation note #2, International PortCDM Council (IPCDMC)

⁵ Lind M., Bergmann M., Andersen T., Haraldson S., Ward R., Andersen N-B., Michaelides M., Andersen T., Karlsson M., Gerosavvas N., Watson R.T., Zerem A., Olsson E., Gimenez J., Ferrus Clari G., Angelov A. (2019) Maturity Levels 3 to 5 in implementing PortCDM - increasing data sharing and situational awareness, Implementation note #3, International PortCDM Council (IPCDMC)

⁶ Lind M., Bergmann M., Ward R., Haraldson S., Andersen N-B., Michaelides M., Watson R.T., Zerem A., Angelov V., Karlsson M., Andersen T., Gimenez J., Ferrus G., (2019) Maturity Level 6 in Implementing PortCDM - Full Adoption of PortCDM Principles, Implementation note #4, International PortCDM Council (www.ipcdmc.org)

⁷ Mauer, Robert (2015) One Small Step Can Change Your Life: The Kaizen Way

⁸ "Continual improvement process". Retrieved 20 May 2019. ASQ: Learn About Quality — <http://asq.org/learn-about-quality/continuous-improvement/overview/overview.html>

(Implementation Note #5)

is particularly a method for improving the workplaces by eliminating overly hard work. This is done by teaching workers to eliminate waste and slack, to use scientific methods for humanizing work, and to improve business processes in general.

Common to both of these approaches is the notion of a continuous improvement process governed by agreed objectives against which performance is measured. Whatever achievement is obtained, there is always the possibility of making the situation better. The idea of continuous improvement is not to adopt the traditional change model of unfreezing a situation, changing it and then refreezing it again. The idea is to strive continuously for improvements. It is a constant drive for improvement that will provide a better and better situation.

CIP in relation to PortCDM

In many ways, the situation in ports is similar to production processes within a single organization, where an effective organization requires that all processes are aligned and optimized in order to produce the highest quality at the lowest unit costs. The main difference is that a port does not function as one organizational entity. A port can best be described as an eco-system with a double-digit number of independent actors, all dependent on each other in different ways, each striving to optimize their own utilization of resources, and if possible, increase their part of the overall revenue generated from a port call.

As described in earlier Implementation Notes, the goal for PortCDM is to enable a port and all its different and independent contributing actors to function as if they were one single organization with the obvious advantages of improved efficiency and effectiveness in the utilization of resources. Therefore, in the PortCDM context, continuous improvement relates both to the performance of the whole port-call (sub) ecosystem of maritime transport as well as to each of the actors in the port-call ecosystem.

A performance monitoring framework for PortCDM has been defined, based on six Key Performance Indicators (KPIs). The KPIs are: *duration time*, *waiting time*, *berth productivity*, *capacity utilisation*, *predictability*, and *punctuality*.⁹ These KPIs are purposely based on output performance. There are not based on the size or the complexity of the infrastructure that supports PortCDM in any particular port. Using these KPIs, or similar KPIs agreed by all the port call actors, allows a port and its actors to easily identify if performance is being maintained or is improving or deteriorating, using data that is readily available as part of the PortCDM data sharing process. When undesirable or unexplained changes in performance are detected, this should then trigger specific investigations to determine the causes and devise appropriate solutions.

A summary of the baseline PortCDM KPIs are:

- *duration time* (ship turnaround time) - the elapsed time between the arrival to the port (area) and the departure from the port (area). Duration time can be sub-divided into movement time, berth time, waiting time, and so on. Duration time is calculated as the difference in time between arrival to the port / traffic area and departure from the port /

⁹ Lind M., Haraldson S., Ward R., Bergmann M., Andersen N-B., Karlsson M., Zerem A., Olsson E., Watson R., Holm H., Michaelides M., Evmides N., Gerosavva N., Andersen T., Rygh T., Arjona Arcona J., Ferrus Clari G., Gimenez Maldonado J., Marquez M., Gonzalez A. (2018) Final PortCDM concept description incl. generic specification of identified services - Improving port operations using PortCDM, STMVal_D1.3 (www.stmvalidation.eu/documents)

traffic area.

- *waiting time* - the period when one or more parties (such as the ship) is waiting for an already requested action or service to occur because a particular resource or infrastructure is not available. Waiting times are calculated based on when one (or several) party (actor(s)) is waiting for other(s) to serve / being served.
- *berth productivity (berth utilization rate)* - a measure for the efficiency of a berth visit in relation to the purpose of a port call. Berth productivity is calculated as the relationship between the cargo operations time (from cargo operations commenced to cargo operations completed) divided by the ship's berth time (from ship's arrival at the berth to ship's departure from the berth).
- *capacity utilisation* - a measure of how much a particular resource/ infrastructure is used. Capacity utilization is calculated based on the relationship between the time when a particular capacity/resource is utilized divided by the total available time of the capacity / resource.
- *predictability (predicted event accuracy)* - the degree to which a time prediction made at a certain moment matches the actual time an event occurs. For example, for ETA's, this KPI is a measure of the difference between ships' ETAs calculated and declared at various stages of their approach to a port and the actual arrival times for the same ships. It is a measure of the likelihood of a predicted event time being correct.
- *punctuality* - the deviation between when a particular state eventually occurs and the previously agreed time for its occurrence. Punctuality is a measure of the difference between when something was planned to happen and when it actually happened. Punctuality is not the same as predictability. Punctuality is a measure of how well an event matched its planned time.

In addition to supporting the KPIs, the various timestamps providing the arrival and the departure times of ships and/or the duration of the services provided to ships during their port calls are also very valuable contributors to the data set needed to measure the capacity efficiency of resources.

Wherever possible, the data required to evaluate the KPIs and to provide data for other useful efficiency analyses should be shared by machine-to-machine interaction using a standard data format such as the S-211 port call message format and the timestamps that underpin PortCDM and data sharing.

Monitoring performance through the KPI's and associated analysis enables the different actors to improve their operations and utilisation of physical infrastructure and variable resources.

In the context of PortCDM, the establishment of regular process review meetings is recommended to collaboratively analyse the results of the KPIs, the intended or implemented improvements within each actor's arena as they effect the others and to discuss how overall system improvements could be achieved.

The collaborative approach and data sharing established in the earlier levels of the PortCDM maturity model are key assets at Level 7, particularly where collective changes may be required based on the monitoring of the KPIs. Even when the KPIs indicate that a particular actor or a sub-group of actors need to make changes, those changes could affect others – so, these need to be communicated and discussed

(Implementation Note #5)

as part of the PortCDM collaboration to enable improvement of the holistic process.

Maintaining an open and constructive discussion forum is key to ensuring that improvements are made to the overall performance of a port as well as to the performance of individual actors. This refers back to the note made above on establishing regular process review meetings. The idea is not to minimize costs/efforts of one actor at the expense of other actors. Total flexibility of one actor could mean idle resources for the next actor in the eco-system. The idea is to obtain a higher level of overall efficiency and effectiveness.

We strongly believe that the Living Lab or similar processes used earlier to establish PortCDM and foster the collaborative, data sharing environment upon which PortCDM depends, is an ideal way to ensure that the ongoing discussion and understanding for continuous improvements required at Level 7 are successful. The Living Labs process is explained first in Implementation Note 2¹⁰ and in consecutive Concept Notes on the implementation of PortCDM.

Formulation of a common object of interest and its goals as guidance for continuous improvement

The setting of physical collaboration and a digital data-sharing environment forms the basis for the actors to ensure that improvement actions are oriented towards their desired common object of interest. As earlier elaborated upon, the common object of interest is the port call process where maritime and hinterland transports are brought together, thereby enabling improved performance in the supply chain. By gathering the actors in the same arena of collaboration, the conditions are created that enable the actors to collectively perform together. This requires that the actors can agree on the same value basis and agree on appropriate performance measures. In this effort, three aspects of performance measurement are particularly relevant:

- The optimization of expected performance for forthcoming port calls, based on the plans made by the different actors. As the relationships between the timing of different operations are synchronized, waiting times can be forecast and collaborative decision-making actions taken that deliver better performance. This dimension has been elaborated in Implementation Note #4.¹¹
- The measurement of performance in relation to the agreed goals of performance as well as identifying the trends of performance outcome based on the analysis of the PortCDM KPIs over time. By visualising such trends, possibly divided into different segments such as type of trade, the port and its actors can gain confidence that they are performing well enough that they need to take action to improve or counter-act negative trends.
- Benchmarking against the average performance of port call operations.¹² Benchmarking against other ports, both at a particular point in time and over time, can provide a valuable input for identifying areas for improvement.

¹⁰ Lind M., Bergmann M., Andersen T., Haraldson S., Ward R., Bjørn-Andersen N., Michaelides M., Watson R., Ferrus G., Zerem A., Rylander R., Gimenez J., Karlsson M., (2019) First Steps in implementing PortCDM - Establishing a data sharing environment, Implementation note #2, International PortCDM Council (IPCDMC)

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¹² Note that PortCDM would not favor the comparison between two particular ports. It rather tries to highlight the average performance among a number of ports that would be used as the basis to guide a particular port in its improvement efforts

Performance monitoring and processes for introducing improvement actions

As discussed above, the realization of the port call processes provides opportunities to gather timestamp data associated with the performance of the port call processes. This is then the basis for identifying improvement actions that subsequently can be implemented. In Figure 2, performance monitoring is shown as part of the process of continual performance review and governance, leading to the introduction of improvement actions.

The improvement process depicted in the figure indicates a continual need for continuous performance review in a collaborative way, such as, through regular process review meetings or workshops. This is a continual process to capture and review the performance of the port. By using the collaborative arena established as part of the introduction of PortCDM in the port, it is recommended that the actors jointly review the performance, based on trends and possibly in relation to other ports, as discussed above. This may result in a decision to develop an improvement action, which should specifically identify the improvement outcome required. This would then be followed by piloting the improvement and conducting an evaluation of the improvement before introducing it widely. Between each of these steps (review, development, piloting, introduction), it is recommended that the actors should jointly decide on whether each next step is feasible. The goal is that the collective nature of the improvement process will bring the actors together to join forces in the continuous improvement of the common object of interest to which all are both participants and potential beneficiaries if success is to be achieved.

Last but not least it is worth mentioning the need for an effective feedback system. The implementation of a working feedback system will allow not only the suggestions and the innovative ideas to be detected and introduced in due time, but also the handling of complaints and constructive criticism. It is of paramount importance to allow every participant regardless of their role and position in the port ecosystem to have access and ability to submit comments and input.

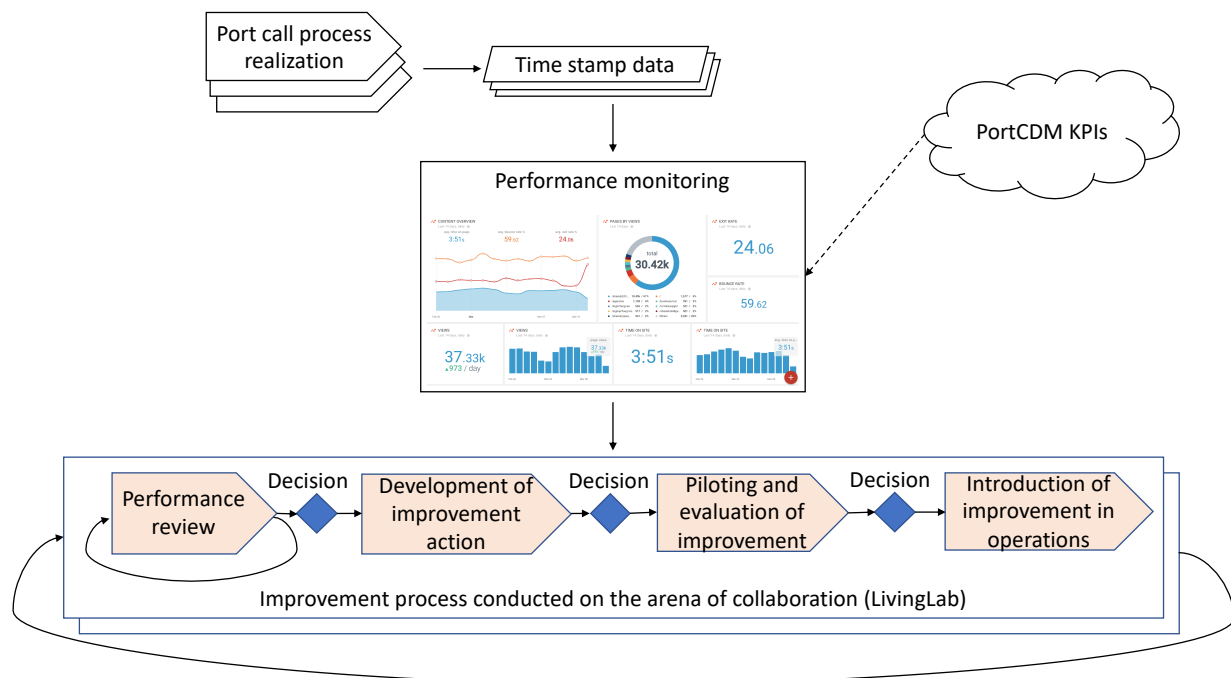


Figure 2: Performance monitoring in relation to improvement process

Final words

Continuous improvement is obviously a never-ending story. Benchmarks and KPIs help identify the need for new improvements, dynamic businesses will develop new processes and new technologies will offer new technological solutions. All of these will provide opportunities potentially enhancing the coordination of activities in the individual port.

More information

In addition to providing global governance for the PortCDM concept, the PortCDM Council continues to disseminate information about new breakthroughs in processes and in structures. We strongly suggest that you follow the latest output of the council – so stay tuned.

Guidelines and advice on all PortCDM concepts, practices, processes and infrastructures are available at IPCDMC¹³.

For more information, contact:

Trond Andersen, Harbour Master at Port of Stavanger and Chairman of the International PortCDM Council, (+47) 932 23 123 or trond.andersen@stavanger.havn.no

Michael Bergmann, Secretary of the International PortCDM Council (IPCDMC), +49 172 743 63 79 or Michael.bergmann@bergmann-marine.com

José Andrés Giménez Maldonado, Port Logistics Director at Fundación Valenciaport and Operational Working Group Leader of the International PortCDM Council (IPCDMC), +34 687 399 216 or JAGimenez@fundacion.valenciaport.com

Dr. Phanthian Zuesongdham, Head of Digital and Business Transformation and Head of smartPORT Programme Management at Hamburg Port Authority and Technical Working Group Leader of the International PortCDM Council (IPCDMC), +49 151 5849 0429 or Phanthian.Zuesongdham@hpa.hamburg.de

Ass. Prof. Mikael Lind, Senior Strategic Research Advisor at RISE Viktoria and Dissemination Working Group Leader of the International PortCDM Council (IPCDMC), +46 705 66 40 97 or Mikael.Lind@ri.se

Sandra Haraldson, Senior Researcher, RISE Viktoria, +46 707 61 88 14 or Sandra.Haraldson@ri.se

www.ipcdmc.org

PortCDM brings sea transports to become an integrated part of the global transport chain by providing means for ports to enhance their capabilities in collaboration and data sharing. The International PortCDM Council (IPCDMC) is an independent association with global reach providing international standards and guidelines for regional and local implementations of PortCDM.

Detailed information on various aspects of the PortCDM concept can be found in the series of previously published concept notes posted at www.stmvalidation.eu and/or www.ipcdmc.org.

¹³ <https://www.ipcdmc.org/>