Message from the Conference Chair

The International Conference on Production Research – ICPR is being held in Brazil for the first time since it began in 1971.

Over 430 full papers have been submitted from roughly 40 different countries. This is an indication of the relevance of the ICPR in the technical-scientific context and international recognition of the growing interest in Brazil and its importance on the world scene.

The ICPR is a well-established event of major technical importance and quality that provides an extraordinary opportunity for networking and collaborative projects among researchers and other professionals. In addition to all of this, it also has the distinct characteristic of being a pleasant meeting of friends who like Production Research!

The ICPR is an event offered by the International Foundation for Production Research – IFPR, and this year it is being organized by Pontifical Catholic University of Parand – PUCPR, the Brazilian Association of Production Engineering – ABEPRO and the Production Engineering Department of the University of São Paulo (USP).

We couldn’t have chosen a better setting for the 22nd ICPR, for networking, work and friendship. This year it will be in Iguassu Falls, one of nature’s Wonders, located on the border between Brazil and Argentina at the Iguassu National Park - the world largest subtropical river forest reserve – listed by UNESCO as a World Heritage Site.

The main theme of the 22nd ICPR – Challenges for Sustainable Operations – is appropriately symbolized by Iguassu Falls and the Itaipu Hydroelectric Plant, an engineering marvel, and to this date the largest energy-producing hydroelectric plant in the world.

The Conference offers three Plenary Sessions on the theme: Sustainable Business Performance in the New World Order, by Prof. Chris O’Brien (UK), Advances in Planning and Control Models for Sustainable Production, by Prof. Shimon Noé (USA), and City of the Future - Urban Production, by Prof. Dr.-Ing. Dr.-Ing. E.h. Dieter Spath (Germany). Also, Dr. Glaucio Arbix, President of the Brazilian Agency for Innovation – FINAP, will talk about Brazil: Institutional Building for Innovation-based Development.

To open the event, Mr. João Mocelin, the Industrial Director of Natura, will present the company’s innovative initiatives in the area of sustainability.

For the scientific arm of the ICPR there will be technical sessions where approximately 400 papers on the various themes in Production Research will be presented, in addition to Special Sessions: Methodology and Research Design, Meet the Editors with the Editors of the International Journal of Production Research (the Official Journal of IFPR), International Journal of Production Economics and Journal of Manufacturing Technology Management, and the Panel on Future Trends in Production Research, with a representative from Brazil, and from the United States, Germany and the Philippines, representing each of the three regions of the IFPR (Americas Region, Africa, Europe and Middle East Region and Asia-Pacific Region).

Before the start of the event, Dr. Rob Dekkens will coordinate the Doctoral Training and Early Career Researchers Program where board members of the IFPR will help young researchers to formulate their research profiles. Three promising early career researchers will receive the Early Career Researchers Mentoring Award and will be mentored for two years by board members of the IFPR, and invited to present a keynote speech during the next Conference. This year, Dr. Kamil Erkan Kabak (Beykent University, Istanbul, Turkey), the winner at the 21st ICPR, will deliver the speech Simulation Models in Operations Management: Reaching Beyond Post-positivism?

In addition to the quality of the event and its incomparable Room, we are pleased to offer special programing for Spouses, along with good music, food and Brazilian hospitality for all to have an enjoyable time.

Welcome!

Dr. Sergio E. Gouveia da Costa
Conference Chair
Secretary-General IFPR
Message from the IFPR President

On behalf of the International Foundation for Production Research: IFPR, we would like to welcome all participants to the 22nd International Conference on Production Research: ICPR in Iguassu Falls, Brazil. This is the second time the ICPR is being held in South America.

Our work at IFPR has led to new business opportunities for younger researchers in the field of production research with this conference, including a doctoral training program, an early career research program and the early career researcher's mentoring award. The development and management of these programs has depended on the great contribution of Dr. Rob Dekkers.

The main theme of this conference is Challenges for Sustainable Operations. We know Brazil is the country that organized the United Nations Conference on Environment and Development in 1992, called the 1st Earth Summit. That conference started many international operations in environmental management.

Brazil is one of the most economically successful developing countries in the world in recent years. Moreover, Brazil will be hosting the 2014 FIFA World Cup and the 2016 Summer Olympics that will provide many opportunities to create value in this country.

We are delighted that you have chosen to join us and hope that you are excited about the Conference in Iguassu Falls. We also wish you a personally satisfying and professionally rewarding stay in Iguassu Falls. Enjoy the conference and the beautiful and rich natural environment of Brazil. Por favor desfrute o ICPR.

Professor Dr. Kazuyoshi Ishii
President of IFPR

ICPR 22 - Challenges for Sustainable Operations

Conference Chair:
Prof. Dr. Sergio E. Gouveia da Costa, PUCPR (Brazil)

Conference Co-Chair:
Prof. Dr. Afonso Fleury, USP (Brazil)

International Scientific Committee Chair:
Prof. Dr. Edson Pinheiro de Lima, PUCPR (Brazil)

Members:
Mirym Barad, Israel | David Bennett, England and Sweden | Bopaya Bidanda, USA | Hans-Jörg Bullinger, Germany | Jose A. Ceroni, Chile | Antony Chui, Philippines | Cihan H. Daqlî, USA | Rob Dekkers, Scotland | Michael P. Deisenroth, USA | Alexandre Dolgui, France | Toni Dooleen, USA | Robert D. Dryden, USA | Marek Fertsch, Poland | Jennifer Farris, USA | Barbara Flynn, USA | Afonso Fleury, Brazil | Boaz Golany, Israel | Sergio E. Gouveia da Costa, Brazil | Robert W. Grubbsstrom, Sweden | Chin-Yin Huang, Taiwan | Takaya Ichimura, Japan | Kazuyoshi Ishii, Japan | Moshe Kaspi, Israel | Athakorn Kengpol, Thailand | Geert Letens, Belgium | Ming Li, China | Bart McCarthy, England | Masayuki Matsui, Japan | Gonzalo Mejia, Colombia | Ricardo Naveiro, Brazil | Shimon Y. Nof, USA | Toyokazu Nose, Japan | Christopher O’Brien, England | Jan Olhager, Sweden | Veikko Orpana, Finland | Eui H. Park, USA | Jinwoo J. Park, Korea | Raimondo Pasquinio, Italy | Ken W. Platts, England | Edson Pinheiro de Lima, Brazil | Luis E. Quezada, Chile | Jens Schütze, Alemanha | Wilfried Sihn, Austria | Amrik Sohal, Australia | Dieter Spath, Germany | Kim Hua Tan, England | Agostino Villa, Italy | Eileen Van Aken, USA | Veli-Matti Virolainen, Finland | Robert Young, USA

Local Organizing Committee:
ICPR 22 - Program - Sessions

INTF 2: International Production 2
- Building an Analytical Framework for the Study of Emerging Country Multinationals' Operations Management
  - Flauray, Alejandro; Faria, Halse; Cordas, Jose Henrique; Shi, Yongkang
- Modelling and Simulation of Context-Dependent Behavioural Aspects in Global Supply Chains
  - Franzosa, Enzo; Montanari, Alberti; Andrei Lima, Antonio; Alipasii
- Agility in Production Networks - Classification, Definition and Configuration
  - Magnani, Maor; Sisonchi, Stefano
- Optimizing Models for Value-Added Networks of Globally Operating Companies
  - Lazar, Gheorghe; Ruhmenn, Stefan; Stricker, Nicole; Koll, Matthias

SCML 1: Supply Chain and Logistics 1
- On the Storage Space
  - Tapia, Francisco, Cervantes, Rodrigo; Miranda, Pablo; Gonzalez-Ramirez, Rosa
- Implementation of Pull Logic of Flow in Job Shop Condition - Case Study
  - Hadi, Lukasz; Pinheiro, Pawel; Forsch, Markus; Czyk, Piotr; Seweryn
- Machine-Specific Increase of Process Capability in Additive Manufacturing
  - Esch, Christian
- TRANSFORMATION OF THE PRODUCTION SYSTEM IN A MULTIDEPARTMENTAL ENTERPRISE WITH A WIDE RANGE OF PRODUCTS
  - Hadi, Lukasz; Czyk, Piotr; Seweryn
- The Effect of Buffers and Work-Sharing on Line Performance When Producing Small Batches Under Learning Effects
  - Butkiewicz, Tomasz; Wroblewski, Ehter

PSM 1: Production Systems and Management 1
- Greening the Supply Chain: A Model for Green Performance Assessment
  - Seltik, Miguel; Aroso, Brachard; Miura, Pinheiro, Gonzalo
- Connections Between Lean Supply Chain and Green Supply Chain Literature Review
  - Environmental; Ercan, Tolga; Rodrigues de Oliveira Neves, Tiberius; Gouveia, Sergio
- EFFECTS OF ORGANIZATIONAL DECISIONS LOCUS, TASKS STRUCTURES, RULES, IT DEPARTMENT'S VALUE, AND RESOURCE ON ERP SUCCESS
  - Medina, Public
- NEW APPROACHES FOR FACTORY PLANNING - INTEGRATION OF PLANNING PROCEDURE, PROJECT EXECUTION AND PROJECT DOCUMENTATION
  - Wagner, Ulf; Müller, Egon; Oefner, Daniel; Kiel, Ralph
- STATIC AND DYNAMIC FACILITY LAYOUT METHODS USING EVOLUTION STRATEGIES IN CASE OF DIFFERENT SHAPES AND AREAS OF FACILITIES
  - Hidalgo-Pacheco, Natividad; Martinez, Rosalba

QUES 1: Quality, Environmental and Social Issues 1
  - Bas, Cihan; Zaheer; Alves, Robert; Gouveia, Sergio
- Sustainability Scenario in the Fashion Apparel Manufacturing in Brazil
  - Garcia, Salome, M. N. de Almeida, A.; Benn, T.; Smolarek, M.; Sack, Anna; Silva, Beatriz; de Souza, Carla
- INTEGRATION OF ENVIRONMENTAL VARIABLES INTO THE SIX SIGMA TECHNIQUE
  - Lucats, Wargnier; Cezar; Veiga, J.; Millo; Santos, J., Carlos, A.; Silva

PHER 1: Production Education and Research 1
- Professionals' Demands for Production Engineering: Analysing Areas of Professional Practice and Transversal Competencies
  - Lima, Rafael; Mequita, Diana; Rocha, Carla
- Management System of Educational Programs for Production Manager
  - Jha, K. Rajesh; Makoto, K.
- An Engineering Modelling Approach to Teaching Sustainability
  - Young, Robert; E.; Kwon, Karen; Allen

QRE 1: Quality and Reliability Engineering 1
- Monitoring the Process Mean with a Side-Sensitive Synthetic Xbar Chart
  - Mahdavi, Marzio; Aparicio-Guerrero; Gouveia, Carlos; Ferrando-Branco
- Quality Control Tools in Customized Systems: A Comparative Study
  - Rzepa, Andrzej; A.; Schwerger, Tom; C, Carla
- Performance of a Combined Cusum-See-Haworth Chart for Binary Data in the Process Mean
  - Heranz, Sis帛; Sabin; Robert; Wayne; W, Olga; Maria

EEEN 1: Enterprise Engineering 1
- Correlation Process in Content Analysis for a BPM Modeling Project
  - Kluza, Andrei; Anaya, Pinheiro de Lima; Edson; Gouveia, Sergio
- Information and Project Management System for Factory Planning Processes
  - Milhazes, Marco; Robert
- Cross-Enterprise Collaboration as Flexibility Strategy for Small and Medium-Sized Enterprises
  - Baum, Heiko; Zech, J.; Gond; Jund; Martina; Ivanova, Raffa
- Toward an Effort Estimation Model for Software Projects Integrating Risk
  - Lapich, Safdie; Gourc, Didier; Marmier, Francois

SCML 3: Supply Chain and Logistics 3
- Greening the Supply Chain: A Model for Green Performance Assessment
  - Seltik, Miguel; Aroso, Brachard; Miura, Pinheiro, Gonzalo
- Connections Between Lean Supply Chain and Green Supply Chain Literature Review
  - Environmental; Ercan, Tolga; Rodrigues de Oliveira Neves, Tiberius; Gouveia, Sergio
- EFFECTS OF ORGANIZATIONAL DECISIONS LOCUS, TASKS STRUCTURES, RULES, IT DEPARTMENT'S VALUE, AND RESOURCE ON ERP SUCCESS
  - Medina, Public
- NEW APPROACHES FOR FACTORY PLANNING - INTEGRATION OF PLANNING PROCEDURE, PROJECT EXECUTION AND PROJECT DOCUMENTATION
  - Wagner, Ulf; Müller, Egon; Oefner, Daniel; Kiel, Ralph
- STATIC AND DYNAMIC FACILITY LAYOUT METHODS USING EVOLUTION STRATEGIES IN CASE OF DIFFERENT SHAPES AND AREAS OF FACILITIES
  - Hidalgo-Pacheco, Natividad; Martinez, Rosalba

TIRM 4: Technology, Innovation and Knowledge Management 4
- Proprietary of a Structural Model of Audit for Sustainable Production Intelligences
  - Ferreira, Evandro; Antonio; Ristuccia, Ristuccia, Edson; Lima, Gouveia, Sergio
- Industrial Cluster Development: Examining the Impact of CSR in Indonesia
  - Gunawan, Jorl
- TELEWORK AND MANAGEMENT: TECHNOLOGY FOR A MORE SUSTAINABLE ENVIRONMENT
  - Issac, Ricardo; Fonte; Battistelli, W.; Aparicio-Guerrero; Cavenghe, Wagner
- Efficiency Resource Management to Ensure Sustainability
  - Bosphor, Ruben; Franciscos

QRE 5: Quality, Environmental and Social Issues 5
- Application of Led Luminaries in Combination with Telecommunication Control for Urban Lighting Efficiency
  - Campos, Silvio; Jose Fernandes de Freitas, Aparecido dos Reis
- Fertibrasil: An Innovative Network for the Development of Tropical Soils Fertilizers
  - Jesus, Igor; Rosi Dia, Delires; Miotto, Vicente; Mele, Flordelis; Carafa, Joao
- Knowledge Management Applied to Exploration & Production Projects at Petrobras
  - Toledo, Ana Cristina; Barcia, Nascimento, Ricardo; Manfredi

ITME 3: Internet of Things, Networking, Systems and Security 3
- Pasture Intensification, Agropastoral and Agroecological Systems: Economic Viability - Brazilian Cattle Farming
  - Veiga, Marcelo; Osaki, Osako; Miranda; Ivo; Pascoal, Marco
- The Problems of Food Economy: Ecological and Ethical Dimension of Innovation
  - Zakrzewski, Sylwia; Osako, Georgszczak, Wirogluck, Leszek
- Economic and Environmental Aspects of Cattle Production: Legal Reserve Reconstitution
  - Santos, Marcelo; Silva, Silvio; Salomão, Silvio; de Veiga, Marcelo; de Zem, Sergio
- Social Technologies on Small Farms: A Case Study in Brazil
  - Scialli, Andrea; Rosi; Restoli, Juliana De Andrade
FIRST STEPS TO CONSTRUCT A LIFECYCLE FRAMEWORK FOR EPS. Hernich Beavers, Fernando Cachcar-Miguel, Paulo A.
USE OF ICA IN PROCESS DEVELOPMENT FOR THE PRODUCTION OF MARKET ORGANIC FOOD. Tamoskis, Rosario; Bhargavi
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A METHOD FOR MANAGING THE REQUIREMENT SPACE. Schulte, Guenter; Hecker; Holger
AN INTERRELATION COMPONENT OF ECONOMIC AND SOCIAL SECURITY BALANCE. Soares, Adriana Mendonca; Serrao, Edmundo dos; Rocha, Ricardo; Mendonca, Jairi
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RESEARCH ON CORRELATION ANALYSIS IN THE USE OF SOCIAL MEDIA IN OPERATIONAL MEASUREMENT SYSTEMS. Morata, Juliana; Branco, Maria; Plot, Giovanni; Gouve, Vitor
HOW CAN CAPACITY PLANNING AFFECTS PRODUCTION COSTS IN OPTIMIZING PRODUCTION MODELS OF PLANNING WHICH USE MATHEMATICAL TECHNIQUES TO SOLVE THE MODEL. Sampayo, Raimundo; Benge, Wolfgang; Rodriguez, Juan; Zerba, Roberto; Gouve, Giovanni; Carvalho, Jair
A MODIFIED BAYES ALGORITHM FOR THE DEPARTMENTALIZATION IN THE CAPITAL GOODS INDUSTRY. Gahid, M.; Huleyn; Muscat; Banu, Panagis; Pappalad, Hagi; Pernig, Christian
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NEW PRESENTATIONS

AN ANALYSIS OF INDUSTRIAL NETWORKS FOR REMANUFACTURING IN BRAZIL
Guidat, Thomas; Barquet, Ana Paula; Zorzel dos Santos, Julio Augusto; de Oliveira Gomes, Jefferson; Rozenfeld, Henrique; Seliger, Günther; Taís, Hamamoto
ST SCML 13

A DYNAMIC INVENTORY MODEL WITH SUPPLIER SELECTION IN A SERIAL SUPPLY CHAIN STRUCTURE
Golany, Boaz; Ventura, José A.; Valdebenito, Victor A.
ST SCML 13

MANUFACTURING SYSTEMS FOR AUTOLOGOUS REGENERATIVE MEDICINE PRODUCTS
Cohen, Paul H.; Persur, Molly; Prim, Peter; Carr, Sean; Wysk, Richard; Shirwaiker, Rohan; Atala, Anthony; Yoo, James
ST PTEC 1

PRESENTATIONS REPLACED

IMPROVING PROCESSES ON THE BASIS OF A SHORT CYCLIC IMPROVEMENT ROUTINE, VALUE STREAM MAPPING AND A PROCESS MANAGEMENT SYSTEM
Kuhlang, Peter; Hempen, Sabine; Sihn, Wilfried; Deuse, Jochen
FROM PSMG 19 TO PSMG 14

MANAGEMENT SYSTEMS AND GOOD PRACTICES IN THE SUSTAINABLE SUPPLY CHAIN MANAGEMENT
Ching, Hong Yuh; Anderson, Mayco
FROM SCML 6 TO SCML 4

USING DISCRETE EVENT SYSTEM CONCEPTS IN SUPPLY CHAIN MANAGEMENT COMPOSED BY THREE PRODUCTION LEVELS SUBJECT TO UNCERTAINTY
Pacheco, Eduardo De Oliveira; Lüders, Ricardo Lüders; Delgado, Myriam Regattieri
FROM SCML 12 TO SCML 15

APPLICATION OF BAYESIAN NETWORKS TO PREDICT APPLIANCES’ NPD TIME TO MARKET
Barros, Marcos Vinicius; Possamai, Osmar; Oliveira Dalla Valentina, Luiz Veriano; Oliveira, Marco Aurelio
FROM QREN 3 TO QREN 1
NO-SHOWS

- **July 29th**

TELEWORK AND MANAGEMENT: TECHNOLOGY FOR A MORE SUSTAINABLE ENVIRONMENT
Basso, Ricardo Fonte; Battistelli, Rosane Aparecida Gomes; Cavenaghi, Vagner
ST QUES 3

- **July 30th**

RATIONAL USE OF IDLENESS IN MANUFACTURING CELLS
Coppini, Nivaldo Lemos; Lourenço, Wilson da Silva; de Souza, Edson Melo; Hassui, Amauri; Carvalho, Alexandre Augusto Martins
ST PSMG 2

LEVERAGING RADIO FREQUENCY IDENTIFICATION (RFID) TECHNOLOGY IN A CLASSROOM ENVIRONMENT
Uzochukwu, Benedict Madu; Eyob, Ephrem; Twine, Eric; James, Travon; Simpson, Jessica
ST TIKM 2

A FUNDAMENTAL STUDY ON POLICY DEVELOPMENT FRAMEWORK IN AUTO INDUSTRY CLOSED LOOP SUPPLY CHAIN
Eryuruk, Sulė; Sun, Jing; Kato, Tomoyuki; Tokumaru, Norio; Koshijima, Ichiro
ST SCML 13

FUNDAMENTAL STUDY OF TECHNOLOGY-PRODUCT-BUSINESS INNOVATION CHAIN USING EVOLUTIONARY GAME THEORY
Kato, Tomoyuki; Nishida, Ayako; Koshijima, Ichiro
ST TIKM 6

- **July 31th**

REORGANIZATION AND LEAN IN A KANBAN INVENTORY: A CASE STUDY
Siqueira Martins Domingos, Bianca; Batista Ribeiro, Rosinei; Medeiros de Barros, José Glênio; Henriques Araújo, Antônio; Tavares Matias, Nelson; Gonzaga, Marcelo
ST SCML 15

AN OVERVIEW OF THE GENERIC PRODUCT DATA MODEL - GENPDM
Paulo Martins, Rui Sousa
ST PDEN 8

**SESSION RESCHEDULED**

Session Technic OSPF 9 rescheduled from Tuesday, July 30th - 8:30am - 10:00am at Atlantico room to Monday, July 29th - 2:00pm - 3:30pm at Pacifico room
Abstract
A Process Management System in general represents is a suitable approach to improve processes in the broadest sense. For this improvement a lot of established concepts and methods are applied practically and are depicted in literature. In most cases these improvement attempts between the different levels are not linked methodically. This paper presents and combines three – broadly practically applied and theoretically well described - approaches out of the broad variety of concepts and methods to improve value streams. Within this framework value stream mapping and the short-cyclic improvement routine are integrated into the organisational framework of process management in order to enable a methodically fostered improvement of value streams in different levels of detail. Therefore an advanced and sustainable continuous improvement process is enabled. Hence the objective of this paper is to link these industrially applied concepts for managing and improving value streams usefully, and to depict this linkage in an extended model and a practical assembly example.

Keywords: continuous improvement, value stream mapping, process management

1 INTRODUCTION
Enterprises face the task of managing, designing and improving their processes in the broadest sense – so from the main processes down to the operative (work-) methods – on a daily base. For this purpose a lot of established concepts and methods are applied practically and are depicted in literature. In most cases these improvement attempts between the different levels are not linked methodically. For example, a consistent exchange of information and data between different improvement attempts does not take place.

Out of this the following questions respectively presentations of the problem are derived. How can different improvement attempts within different levels of a value stream be combined usefully? How can value streams be managed, designed and improved in a structured and repeatedly recurring way?

A Process Management System in general represents a suitable approach to improve processes in the broadest sense. This paper presents and combines three – broadly practically applied and theoretically well described - approaches (Process Management, Value Stream Mapping and a systematic routine to manage and improve processes) out of the broad variety of concepts and methods to improve value streams.

Hence the objective of this paper is to link these industrially applied concepts for managing and improving value streams usefully, and to depict this linkage in an extended model.

2 FUNDAMENTAL PRINCIPLES TO CHANGE PROCESSES
A process, that has once reached a certain level of performance, is likely to lose that level in a natural way. Improvements to push processes to a higher performance level can be achieved by innovation (volatile changes) and continuous improvement (short-cyclic changes) [1], [2].

Innovation usually means a radical improvement with crucial changes. Innovation leaps are discontinuous, often initiated by strategic decisions and are usually highly complex and interdisciplinary. Continuous improvement from a current-condition to a target-condition is characterised by a lot of small, short-cyclic (univariat) improvement steps in the specific processes. Both principles need a different amount of time and both should be utilised in organisations.

3 DEFINITIONS AND CONFINEMENT OF PROCESS AND VALUE STREAM
Processes have inputs and outputs that confine a process to the contiguous processes (upstream and downstream) and they fulfill the process purpose. The input (to be considered as an activated incident), the actual process flow and the required resources as well as the output (outcome) are basic parameters to define a process. Processes are defined as timely and, with regard to content, completed sequence of activities [3] [4].

From a process-oriented point of view there is no fundamental difference in understanding of what a “process” or what a “value stream” is. In terms of this paper a value stream is in most cases a product-oriented flow or extract of processes on a higher level of detail. A value stream may contain different processes from the Process Map or main- as well as sub- processes from “deeper” levels of detail which affect the production of a product. The value stream itself consists of operative processes and the appertaining material and information flows. A value stream includes all activities, i.e. value adding, non-value adding and supporting activities that are necessary to create a product (or to render a service) and to make it available to the customer. This includes the operational processes, the flow of material between the processes, all control and steering activities and also the flow of information. [5]

4 STANDARDISATION
A lot of companies are interpreting standards related to production processes often in a way to stabilise process conditions on the achieved level of performance, or to harmonise different processes. Based on this “best
practice” definition standards remain static and they should last as long as possible [6]. This interpretation of a standard prevents a target-oriented advancement of processes [7] [9] Lenzian, Schneider and Deuse, 2009). On the contrary innovative approaches are interpreting a standard as a target-condition to differ intentionally from the current-condition. This differentiation causes the fundament for target-oriented process improvements by reducing the difference between the current-condition and the particular standard (target-condition) [9].

5 TARGET-CONDITIONS AND ROUTINES TO SYSTEMATISE IMPROVEMENTS OF PROCESSES

The short-cyclic improvement routine proposes, starting from a current-condition, the specification of a target-condition, which should be achieved and is oriented to an ideal-state. The target-condition describes “how” a process should be performed in the future. It also can be considered as a milestone along the way to the ideal-state. The ideal-state is like a navigation point (“true north”) or like an aid to orientation for the definition or specification of the several different target-conditions for the processes. [1], [7], [10]

The management is responsible either for defining the ideal-state as well as the several target-conditions as well as for coaching the operatives employees during aspiring and accomplishing the target-conditions. Examples for parameters describing an ideal-state are 100% added value, one piece flow, zero-defects, lack of impairment for the workers.

A particular target-condition is specified in detail by targets and parameters describing the process. Targets are for e.g. productivity (in terms of “performance/time unit”) or quality (“failure-free parts/total parts”). The actual- and the target-condition of the process are specified for example by parameters or indicators like cycle times (customer takt), deviation, applied (work-) method, work in progress in the particular work system, or specifications considering the layout or organisational aspects. In order to formulate motivating target-conditions, for all engaged workers, they have to be realistically attainable and demanding. [11]

Against the background of these principles Rother formulated ideas and procedures of the improvement- and the coaching-kata. [12] (Rother, 2009)

“Kata” describes a specified routine, a pattern or a habitual thinking and acting. These very often repeated routines of the improvement and the coaching kata are fundamental for the systematisation of improving processes.

Figure 1 shows the routine to support process improvements and consists of the following steps:
1. Orientate towards the ideal-state and definition of target-conditions.
2. Compare current to target-condition.
3. Identify problems and obstacles systematically.
4. Formulate and try one action to solve the main problem (hypothesis and experiment).
5. Interpret and evaluate the results.

6 VALUE STREAM MAPPING

VSM was originally developed as a method within the Toyota Production System. [13] [14]. It was first introduced as an independent methodology by Mike Rother and John Shook. VSM is a simple, yet very effective, method to gain a holistic overview of the condition of the value streams within an organisation. Based on the analysis of the current-condition, flow-oriented target value streams are planned and implemented. [5] [15] [16]

By defining target-conditions, VSM uses a 4-Step-Method consisting of the steps “choose a product family”, “draw a current-condition map”, “develop a target-condition” and “implementation of target-condition” as well as an “action plan” to monitor the implementation, to describe necessary actions and activities (what, by whom, until when) to improve the value stream.

7 PROCESS MANAGEMENT

Process Management (PcM) causes a sustainable improvement of working procedures in the organisational structure. Process Management is the combination of activities which include the planning and monitoring of a process. It also is the application of knowledge, skills, tools, techniques and systems to define, visualise, measure, control, report and improve processes with the goal to meet customer requirements. The core concept in the PcM concept is the Process Life Cycle (PLC) (see Figure 2).

The Process Life Cycle indicates and determines each stage of the life cycle of a process within a Process Management System. It starts with the incorporation of the process into the process map and it ends with the shutting
down of the process. The Process Life Cycle defines steps in the cycle of a process in the Process Management System in form of phases and phase transitions and is named the “large control-circuit” in PcM. Phase 1 “Recording and Integration in the Process Map” and phase 2 “Process Definition” represent the design and conception of processes. Phases 3 “Operating, Controlling and Optimising” as well as phase 4 “Reporting and Monitoring” specify the recurring (“daily”) work of performing and improving processes.

In phase 2 the 4-Step-Method is a vital procedure to define new processes and to change and improve already existing processes. The 4-Step-Method of PcM is applied if a new process has to be defined based on identified improvement potentials. The 4-Step-Method (see Figure 2) is a general approach in PcM and it consists of the four steps “identification and scope”, “analyse actual process”, “design target process” and “implementation of improvements” [4]. The four steps are implemented by a series of at least four so-called Process Team Meetings (PTM). Each PTM represents a milestone during a step to ensure the systematic execution of the 4-Step-Method.

The so-called Process Jour Fixe (PJF) meetings are instruments for a continuous control of a process in phase 3 and during the transition to reporting and monitoring in phase 4. During phase 3 – representing the so-called “daily life of a process” – the focus is set on meeting the requirements and on identifying and realizing improvement actions, short-cyclically, towards a target-condition. The reporting and monitoring of different processes and several process goals occur in phase 4. Thus, the information available in phase 2 and phase 3 is broadened by relevant, respectively strategic parameters and aspects. All relevant information and performance indicators as well as actual problems in the daily life of the process are conditioned prior to a Process Management Review (PMR). Therefore they are also available for the PJF and the PTM in order to accomplish successful decision making and to provide the basis for the deduction of necessary improvement actions. [4]

8 VALUE STREAM ORIENTED PROCESS MANAGEMENT – THE SYSTEMATISATION OF VSM

Process Management provides the organisational framework for the systematisation of VSM. This is based on embedding and integrating a values stream into phases 2 to 4 of the PLC (see Figure 3).

The general approach in solving the systematisation of VSM is the conjunction of volatile and short-cyclic improvements of a value stream. This conjunction of continuous improvement and innovation can be found in the PcM-System, in phase 2 and 3 of the Process Life Cycle. The determination of target-conditions during phases 2 to 3 utilising information from phase 4 endorses the PLC by setting clearly defined intermediate target-condition along the way to the ideal-state. The following sections describes how a particular value stream is systematically comprehended, analysed, changed in great and short steps, operated and controlled in this changeover of the phases (see Figure 4).

8.1 Volatile changes

Referring to the level of the value stream in phase 2, where the two 4-Step-Methods in PcM or VSM are applied, the current-condition at point in time to is recorded and a challenging target-condition is determined along the way to the ideal-state. This target-condition “target 1” is defined during step 3 of PcM’s 4-Step-Method and is afterwards implemented and aspired in step 4.

The implementation is accomplished by realising improvement actions summarized in the LIP or the action plan taking economic, organisational and time-related constraints into consideration. In phase 2 of the PcM volatile and conceptual changes occur on the level of the whole value stream. From a theoretical point of view the target-condition “target 1” of the now changed value stream is accomplished at point in time t1 at the end of step 4. This attained condition at point in time t1 becomes automatically the new current-condition at point in time t1 – independent of whether the desired level has been reached or not – for the following phase of continuous improvement (phase 3).

8.2 Continuous, short-cyclic changes

The most noted and practically applied method is the PDCA (Plan-Do-Check-Act)-method. The PDCA-method formalises an experimental procedure as a scientific method. Due to the complexity and variability of a system it is eminently important to establish systematic and steady elapsing procedures for improvement. In order to establish and to maintain a short-cyclic improvement process in phase 3, it is necessary to implement a structured procedure within the business organisational structure. The short-cyclic improvement has to take place with a high frequency to implement and settle changes in the processes. Concerning this, the applied methodical approach of univariate experiments is therefore anchored as an integrated routine in the daily operation of the business. Due to the fact that the kata is an appropriate method of improving and coaching activities, this systematic routine for improving processes is introduced here as the basis for continuous improvement, and enlarges and consolidates the already applied approaches and concepts (e.g. LIP, PJF, PMR) in phase 3 of the PLC. The coaching routine aims to guide and to enhance the particular workers in applying the improvement routine
PDCA-cycles). Here, the person has to be asked, guided and encouraged repeatedly to identify obstacles within the borders of the process and to remove them by univariate PDCA cycles (rapid PDCA’s) instead of trying to search for solutions at the processes’ interfaces, or outside of the process as it is common practice. On the one hand, the accompanying coaching ensures the compliance of the prescribed (work-) methods in the work systems by different workers, and on the other hand, it ensures that all possible actions for improvement within a process are actually taken into consideration.

8.3 Stabilisation after volatile changes
Ideally and typically, the performance of a process respectively a value stream stabilises after reaching a new performance level. Nevertheless, a decline from this performance level is the reality. As a result, it is more or less impossible to attain both a target-condition and a sustainable stabilization at the end of phase 2.

Figure 4: Systematic improvement of a value stream in the Process Life Cycle

8.4 Renewed volatile changes
A long-lasting continuous improvement usually leads to diminishing changing steps. Despite the coaching procedure and all the improvement endeavours, it may occur that the target-conditions cannot be accomplished within the scope of the process borders. On the one hand, this may be a reason for determining a too short a time frame for accomplishing “target n”. In this case, the frame may be extended and the improvement efforts in phase 3 within the process borders will continue. On the other hand, in particular the non-attainment of the target-condition in phase 3 mainly occurs if the major, still existing, obstacle cannot be found between the processes or if it is beyond scope of action of the shift leaders. Hence, it is imperative to initiate another innovation leap in order to improve the value stream in phase 2 across its process borders and to determine a new, challenging target-condition “target n+1” at point in time t_{n+1}.

8.5 Ongoing Monitoring
Phase 4 of the Process Life Cycle is crucial for the development of a value stream – no matter if there are small steps or innovation leaps. The actual performance data of the value streams and current information concerning the organization (e.g. key performance
Indicators) and the external influences are collected for the PMR. In this way the information is available for the PTM and PJF as well.

Process Management Reviews help to make the performance level of value streams assessable and controllable. They provide the basis to decide if a re-design of a value stream is necessary and to set certain targets for the improvement projects. This swinging back and forth between different conditions of a Process Life Cycle also represents the connection between volatile changes and continuous improvement steps.

9 PRACTICAL EXAMPLE

A pump manufacturer with a high variant model-mix production is improving value streams and their operative processes covering a large part of the production using the improvement and coaching kata. Within the scope of the improvement routine the shift leaders in the production are responsible to improve the processes “pre-production”, “pre-assembly” and “final assembly” within the determined borders of the processes. The processes have to be stabilised referring to customer takt (Cycle time) and the productivity has to be increased. An entire synchronisation of pre- and final assembly is not possible in the given situation due to technological framework conditions and cannot be realised based on a short-cyclic improvement procedure. This is why inventory is required between the processes in order to ensure delivery reliability.

Within the processes the volatile change is keen on synchronisation of the cycle times (see Figure 6). Within the value stream the volatile change is keen on implementing a new material and information flow.

Figure 5. Target value stream focussing the interface between pre- and final-assembly

Figure 6. Short-cyclic and innovation leaps from current-condition to target-condition and ideal-state
10 SUMMARY AND OUTLOOK
This paper presents the linkage of these industrially applied concepts for managing and improving value streams in an extended model and equally it points out, that target-conditions for processes have to be derived from the target value stream. The short-cyclic improvement routines ensure an ongoing improvement of processes towards the ideal-state due to the determination and attainment of intermediate target-conditions. This determination and attainment of target-conditions based on short-cyclic improvement steps is recommended for the recurring (“daily”) work of performing and improving processes in order to enhance phase 3 of the PLC. These “one-factor-experiments” develop processes towards their targets based on formulating hypothesis and performing experiments. Further research activities considering these issues are currently running. First practical experiences in applying the model show clear evidence to transfer the functions of real organisation precisely to those of the model.

11 REFERENCES