

# ONE VIEW TO THE QUALITY SYSTEM ACCORDING TO THE SUBSYSTEM OF PREPARATION OF TECHNICAL ASSETS

Radoljub TOMIĆ<sup>1,2</sup>, Milomir MIJATOVIĆ<sup>2</sup>, Predrag DAŠIĆ<sup>2,3</sup>

<sup>1</sup>Faculty for Operational and Strategic Management, Belgrade, Serbia, tomic\_radoljub@yahoo.com

<sup>2</sup>High Technical Mechanical School of Professional Studies, Trstenik, Serbia, milomirvts54@gmail.com

<sup>3</sup>SaTCIP Publisher Ltd., Vrnjačka Banja, Serbia, dasicp58@gmail.com

**Abstract**— Effective manufacturing, high and stable quality products and services in continual production, only inadequate conditions of planning, systematization and realization corresponding activities in the quality assurance system (QMS-QAS) of the factory (supplier, manufacturer) can be obtained. In this paper, the parameters of quality of development, design, production and service are considered. The complex model of PMAS-CLR (preventive maintenance according to state with a controlled level of reliability), which yields guarantee to target behavior of realized products in operational conditions, is emphasized.

**Keywords**— quality system (QS), quality assurance (QA), research & development (R&D), reliability, maintenance, PMAS-CLR model.

## I. INTRODUCTION

QUALITY system (QS) in our country is now practically set according to ISO standard 9001:2008, assuming the coherent unity of a subsystem in technological and business areas and the corresponding interfaces, with accompanying documentation. Development and product designing, production technology and control, making parts, product assembly and testing are already given corresponding significance (based on the insight into the content of publications dealing with QS). Reliability of technological systems and maintaining the funds are also taken into consideration to a significant extent in the available literature [1], [2] but there is the need to point out that preparation of maintaining systems and funds is not treated on the satisfactory way. Particularly important is the structural and technological connection, preparation, commercial functions (especially the procurement), the system of insurance quality (SIQ) and preparation of maintenance, both for effective planning and productions as well as for effective functioning of QS of a firm in all [3], [4]. The purpose of this paper is to emphasize the effective aspects of preparation for maintenance of technological resources (TR) in domestic production

companies and to point out the obvious possibility of using general provisions relating to personnel, equipment and capacity to the company itself, when dealing with the contribution to the subject function (as a subsystem), insurance of the global target of establishing and functioning effective QS. It is necessary to prescribe adequate suitable methodology and to establish effective technological processes that guarantee the high reliability of preparation, checking, servicing, supplying, intervention, training and putting funds back into function or permanently or temporarily discarding them (until new technical and technological, informatics production assumptions regarding the necessary procedures, the missing materials, tools and spare parts for the complete repair and lifting the experts' qualification status, service and facilities in accordance with the given level of confidence in his work are being provided).

The complete problem can be extrapolated to the global level of corporative managing [5], [6], here directly related to consideration of information system in the preparation and maintenance (as part of the informational surroundings), regarding the contexts of defining suitable educational models (for example, dealing with the avoidance of innocent costs and favoring different levels of investigational maintenance) for establishing a suitable strategy of poverty reduction in Serbia [7]

## II. BASIC ASPECTS DEALING WITH THE ORGANIZATION AND FUNCTIONING OF PREPARATORY MAINTENANCE

Functioning of preparatory maintenance must immediately be related to the business unit of maintenance within the technical sector, in which, manufacturing facilities are usually located with suitable equipment and technical and technological preparation, that should provide systematic and logistic support to the apostrophic preparation of maintenance [3], [4]. For further discussion of the problem, presented in the Fig. 1, wherein the obvious way compatible partial functions of

production company can be connected through the synergy of whose work can be achieved best results

based on the realization of the underlying tasks.

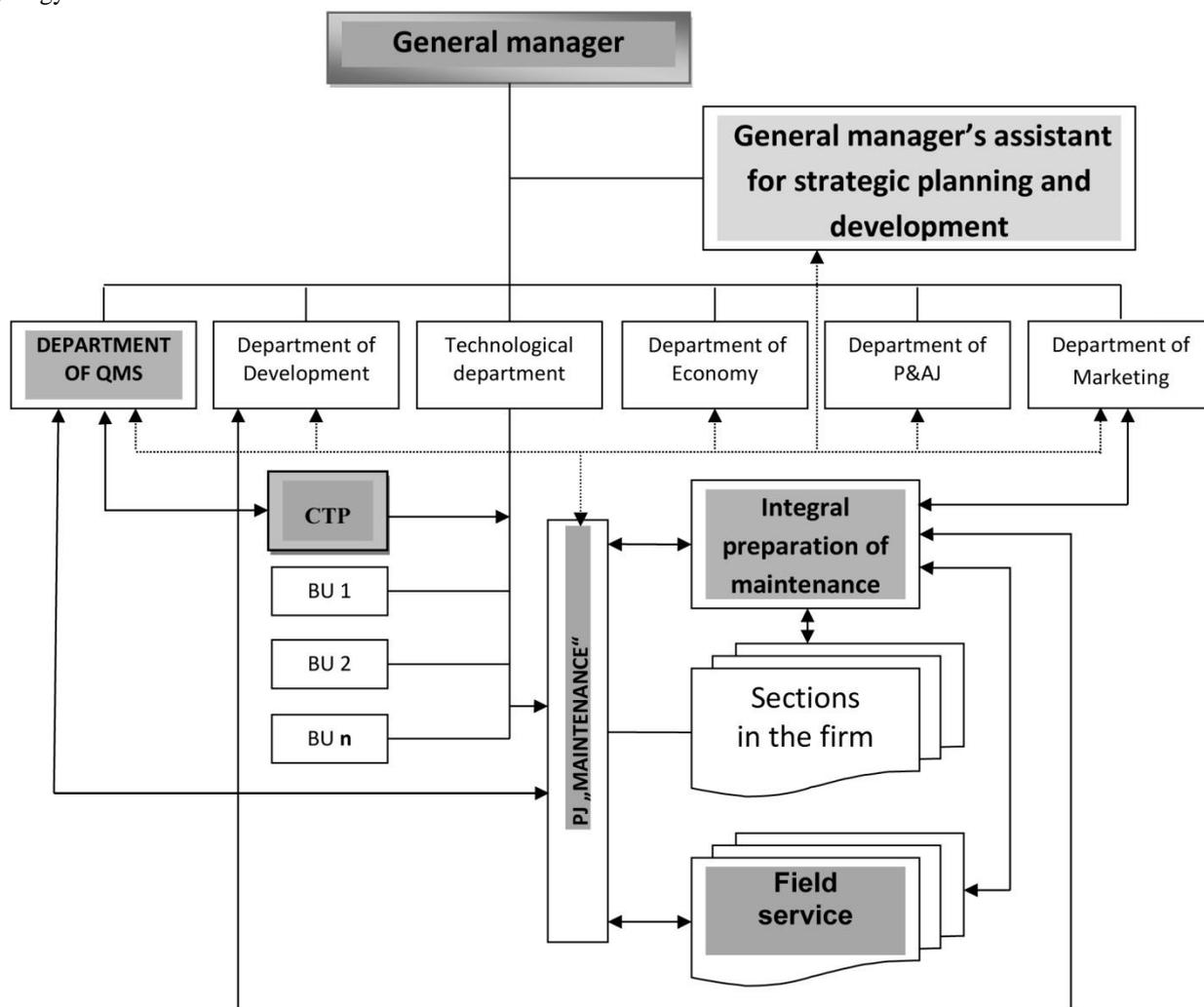


Fig. 1. Basic-possible model of organizational scheme for manufacturing firm

Function of preparation for maintenance, possible under presented model, implies direct communication with the sectors and services in the firm for realization of the following tasks:

- 1) The sector quality insurance (directly with the department for the development of quality) defines the research methodology, program development and production of maintenance process and control systems and facilities; also defines AUDIT programs; perform data processing and analysis of process and implementation of activities in the field of maintenance, through the mixed teamwork too.
- 2) The marketing sector investigates the market in terms of identifying the user of the products and services and supplies of spare parts, cooperation is also taking place in promoting their own facilities, services and training of personnel from among the beneficiaries;
- 3) The personnel and general affairs sector directly with the training Centre, defines

suitable programs and performs basic and specialized training of personnel (internal, external)

- 4) Service of structural and technological preparation, with the sync software with the sector of development, defines the development, operationalization and immediate application of plans and programs of maintenance systems and facilities.
- 5) The rest departments in the BU (Business Unit) "maintenance" directly works on the development of specific documentation and performs procedures at the facility and on the field;
- 6) With other entities in the firm, typically of the higher range, working through the manager of BU "Maintenance" and the technical director.

Preparation for maintenance has to be based on specific requirements and aspects which, are primarily related to:

- 1) *high-quality and competent staff, adequate general and specialized knowledge base, along with the content database, and developed and implemented suitable expert systems;*
- 2) *valid maintenance schedules, with different hierarchical levels regarding the status, terms and level of maintenance funds, it is particularly important that the conceptual solution, still in designing phase, is optimized for a system of maintenance;*
- 3) *statistical analysis of identified values of all significant variables during the exploitation of resources, bringing the model of higher criteria optimization of maintenance to a level that provides an effective system in terms of objective function and constraints dictated by the technological, organizational and market conditions;*
- 4) *planning, programming and practical application of quality maintenance procedures based on the theory of reliability and theory of maintenance;*
- 5) *logistical aspects of the request fulfillment, in connection with a safe reserve [3], special attention must be paid to the issue of safe reserves in connection with the R&D and supplies (level and quality of R&D causes the height of costs which consumer invests into acquisition, storage and controlled storage reserves);*
- 6) *control system prescribed of confidence level means for each real level of the exploitation and maintenance, based on monitoring of specific resources in terms of normal usage (exploitation) the designer must establish different levels of reliability, in an appropriate time period (quarterly, semiannually, annually), depending on the importance of the system in terms of quality and safety;*
- 7) *Program and methodology analysis of causes with undertaking measures to permanently eliminate "in-time" inadequate functioning of the funds and etc.*

### III. SPECIAL ASPECTS REGARDING THE QUALITY SYSTEM

Activities of the process preparation of maintenance functions are determined by the quality system and company's maintainable subsystem on one hand and market conditions in terms of user requirements for services related to maintenance and procurement R&D, materials and etc. Global processes, information flows (input-output), documentation, economic environment, competence and responsibility, should be dealt with at the level of documentary content and procedural nature, type of procedure, by functions associated with the following procedures. They must be formed as a unit, fully compatible with other documents of other subsystems and direct specific links to documents of the QMS. Because of the limited extent of work, there will not be considered standard requirements (exp. ISO

9001:2008 [8]), or total content of defined procedures and practices with the correspondent documentation, but will immediately be pointed out the connection between organizational and program preparation of maintenance functions with other functions and areas of process operation, in relation to rationalize the use of staff, resources and time to ensure the goal - improvement of QS and better business results of the company. Determination and analysis of the reliability of technical systems and components were the topics of research by [9]- [15]. In accordance with the foregoing, in connection with the work domain and appropriate – demanded results of the maintainable preparation can in particular be pointed out the following:

- 1) *The current standard ISO 9001:2008 [8] predicts the fulfillment of the requirements in terms of cost management and production and product quality (as the final element for the market), in order to improve the solvency of the company in the market regarding the competitive prices and satisfactory quality of products and services that company provides;*
- 2) *Suitable organization, articulated informational flows and rational documentation must be the term for the establishment of qualitative maintenance of production assets in the firm and mobile assets on the field;*
- 3) *Preparation of maintenance must be an essential factor in development and improvement of methodology as well as actions of maintainable funds; it is known that the qualitative preparation is the "brain" of maintenance;*
- 4) *Leading personnel must be trained and experienced with multi-disciplinary knowledge (especially when it comes to conceptions, defectors and engineers of repair and maintenance) and the personnel, that is directly involved in solving specialized problems, must have appropriate certification, that has specialized knowledge, and to have adequate software and hardware tools, suitable for realization of tasks in the category;*
- 5) *The personnel must know the theory of reliability and maintenance theory of specific systems and equipment- for correct establishment and realization of maintenance plans;*
- 6) *Principally, preparation must consider different concepts of maintenance (concretely, prevention, combined) for selection of appropriate varieties, both in technical and technological, as well as in economic futures in terms of specific situations; model for example, refers to the preventive maintenance according to state with control level of reliability (PMAS-CLR) (Fig. 2);*
- 7) *Must be precisely determined the operating condition in which the system work, the life cycle,*

- managing and maintenance of the system, the presence of R&D manufacturers in the market and so on;
- 8) Must determine the list of parts whose service life is shorter than the life of the system;
  - 9) Must be made permanent estimate, measures and record of the frequency requirements for servicing and spare parts;
  - 10) Cases must be determined where it is possible to apply the law of probability, as well as cases where it is needed to permanently eliminate specific groups of causes;
  - 11) Suitable techno-economic analysis must be done regarding costs of reserves (internal-safe reserve that provides continuous system function in order to eliminate technical and economic losses and elimination of possible threats to the safety and security, external reserves, the supplier or the Repair Institute, which ensure the inviolability of reserves);
  - 12) A control algorithm and the correction level of reliability with the identification of safety reserve (Fig. 3);
  - 13) Modern technical systems have different sub-systems and it is necessary to focus on different concepts of maintenance (for example, main mechanical sub-systems are being maintained preventively, electronics are maintained correctively and structure is based on fatigue analysis);
  - 14) Process of service-lubrication should be defined correctly, functional testing should be examined, operational and visual inspection, rejection and training, for each system separately;
  - 15) Consumer, as a rule, introduces his own initial maintaining program and tends to already approve, program of his own further develop based on his own experience, methods and terms of exploitation;
  - 16) Systems of renewal reserves must be known ( in practice are commonly used: a system of periodic updates and system updates to the level of reserve quantities);

- 17) At the end of this group of questions should be stated that it is necessary to establish a quality system for reliability monitoring, with special algorithms built-in for deciding on the issue of maintenance of systems and equipment.

Quality assurance system (QAS) in mechanical operations has been discussed in several publications from various aspects: theory for quality assurance [16]-[18], link between quality assurance and machining [19], quality diagnostics and analysis [20], [21], framework machining quality control [22], minimum overall mean quality loss method [23], problem-solving within quality assurance technology [24]- [25].

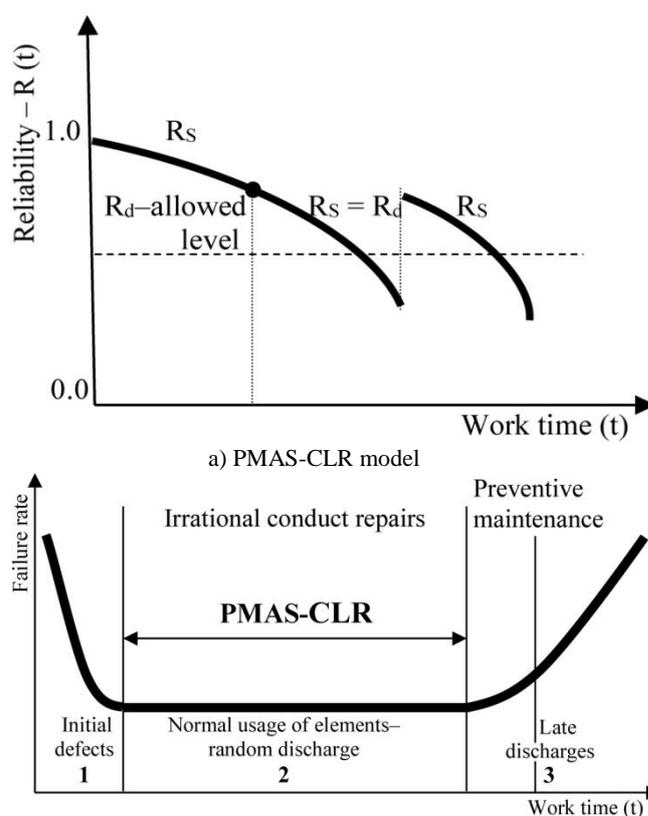


Fig. 2. Model of maintenance PMAS-CLR

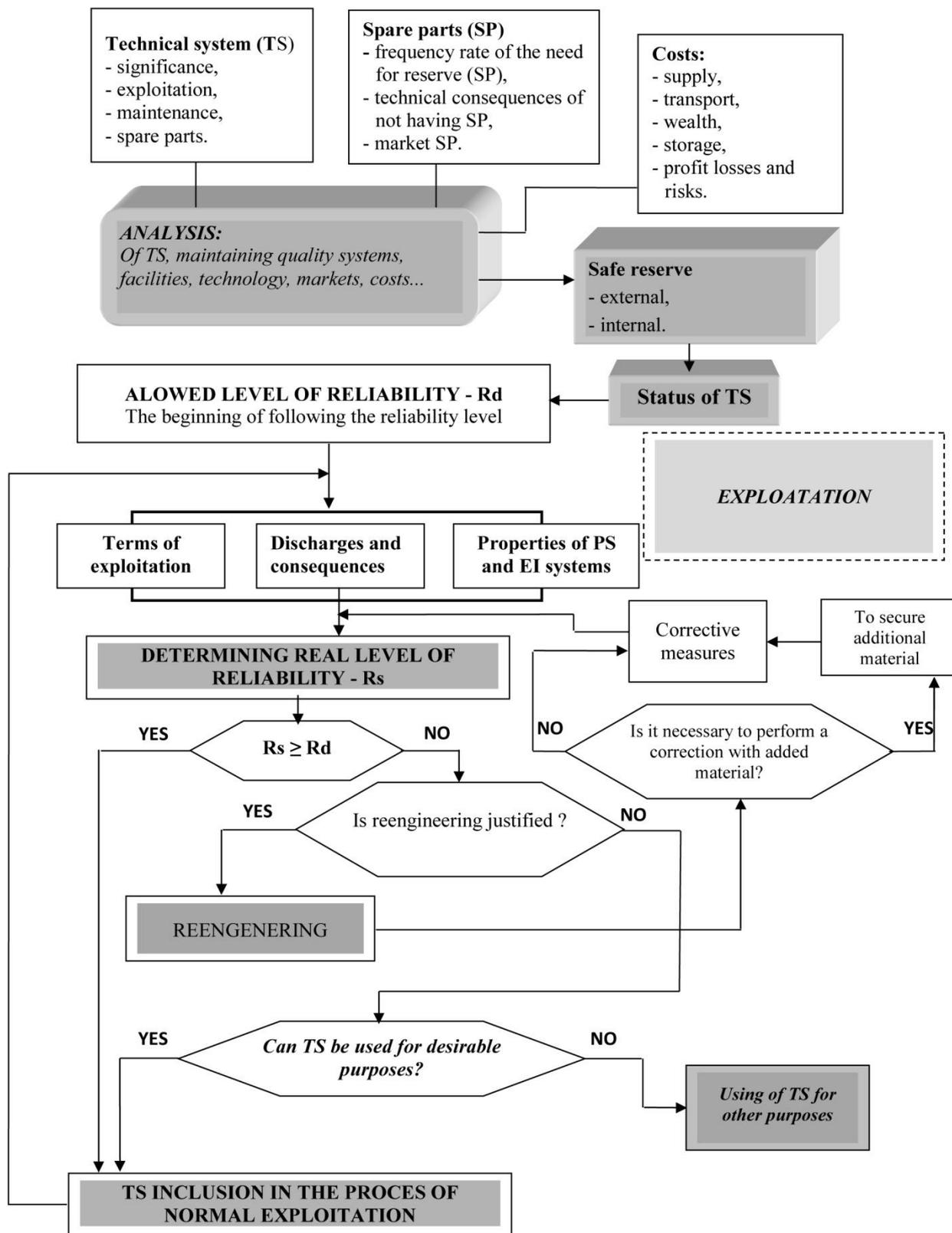


Fig. 3. Flow of control and correction of the reliability level with the safety reserve identification

#### IV. CONCLUSION

The quality system, as indicated, in our country, for so far, is mostly moderated on the ISO 9001:2008 requirements. QS Includes coherent whole of a sub-system by technological areas and adequate interface, with supporting documentation. There is an evident problem of importance and competence for the preparation of maintenance systems and facilities, which are currently treated on the dissatisfactory way. This paper had its purpose of emphasizing the necessity of linking structural and technological preparation, a commercial function, QMS and the preparation of maintenance, both for the efficient planning and production as well as for the effective functioning of the QS of a company as a whole. In this paper aspects of the effective implementation of the maintenance in domestic manufacturing firms were discussed, with identifying the necessary actions (respecting the criteria) and the possibility of using recorded and established general reserves (of all firm's resources not just R&D). In this regard, educating the necessary staff as well as the equipment and facilities inside the company, special attention must be paid and support in documentation must be meticulous and updated.

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