UNIVERSITÀ DEGLI STUDI DI TRIESTE

Prof. Ing. Raffaele Campanella

E-mail: raffaele.campanella@yahoo.it

335 211609

INDUSTRIAL PLANTS II

Chapter two ï part 4

Maintenance of Industrial Plants

Organization

DOUBLE DEGREE MASTER IN

ñPRODUCTION ENGINEERING AND MANAGEMENTò

CAMPUS OF PORDENONE

UNIVERSITY OF TRIESTE

UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE ORGANIZATION

Some data:

The average maintenance dept. experiences about 1/3 percent of wastes every year. It means that budgets are spent on poor maintenance practices.

About 2/3 percent of the maintenance activities are self-induced. It means they are done just because there are resources available

About 25% of a typical engineerôs day is spent walking to and from te job site. Another 20% looking for parts.

About 60% of spare parts inventory is not used at all in at least 3 years. The consequence is the obsolescence of those parts

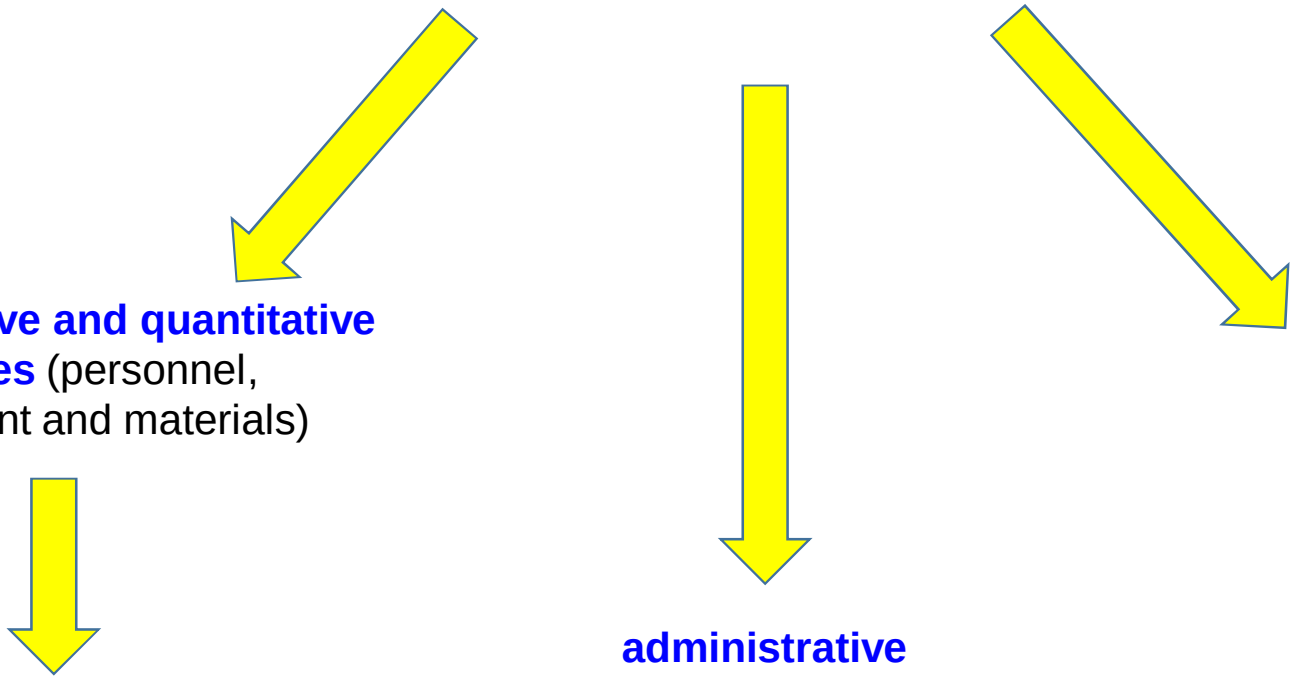
As far as the remaining 40 % of the used inventory, about 60% of this is considered excessive.

An average spareparts inventory has about 10 % of exact same part with different codes

UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE MANAGEMENT

Management of maintenance service involves following three decision areas:



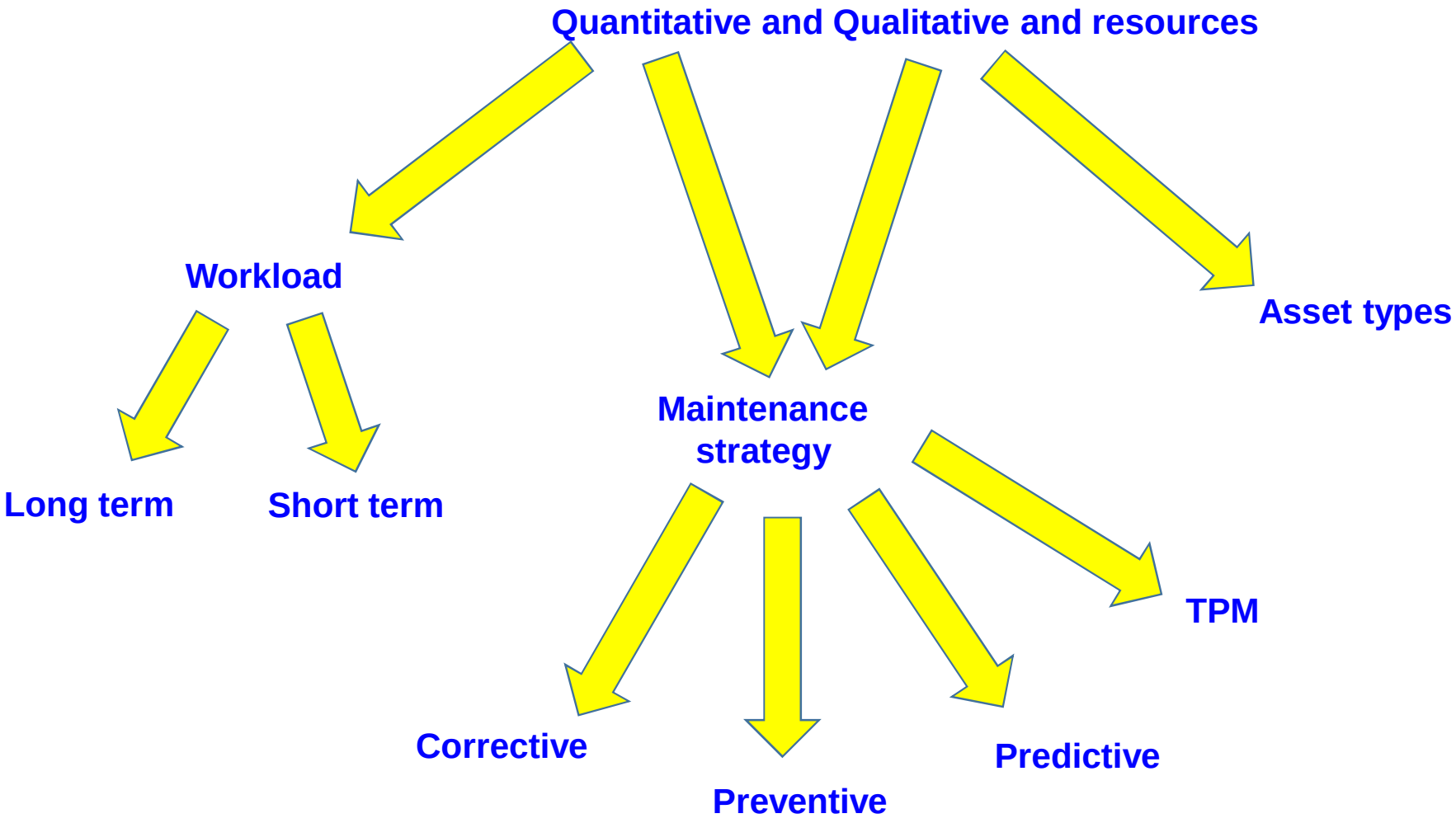
qualitative and quantitative resources (personnel, equipment and materials)

administrative procedures

work planning system interacting within the management system

UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE MANAGEMENT



UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE MANAGEMENT

workload defined by a probabilistic model

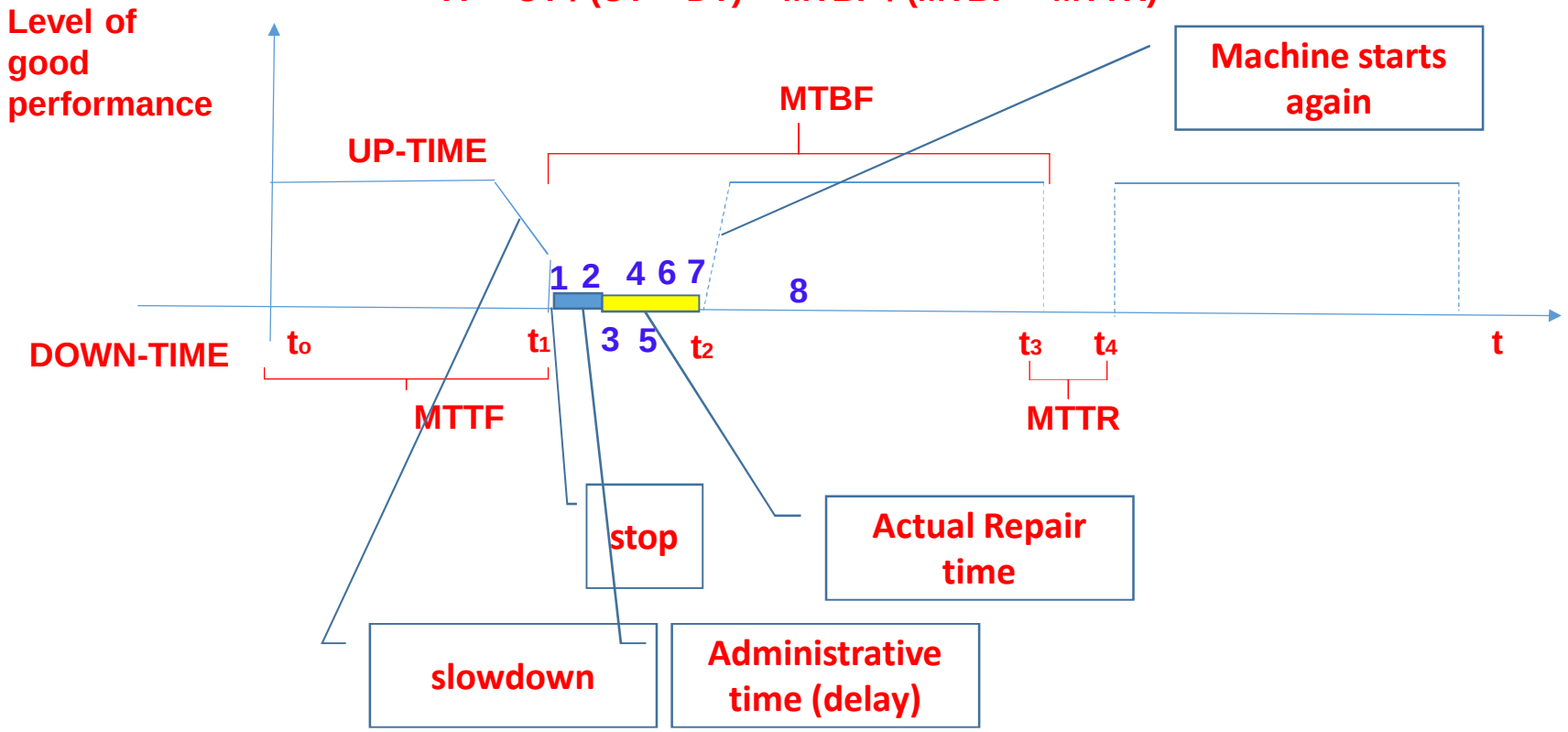
phases:

1. **fault identification; skills**
2. **fault diagnosis; skills**
3. **prescription of necessary actions to restore the production unit; organization**
4. **planning the necessary resources; organization**
5. **scheduling of intervention to be performed; organization**
6. **issue of work orders and operating instructions; procedures**
7. **repair time skills, materials, tools**
8. **control of intervention performed. Skills, procedures**

UNIVERSITÀ DEGLI STUDI DI TRIESTE

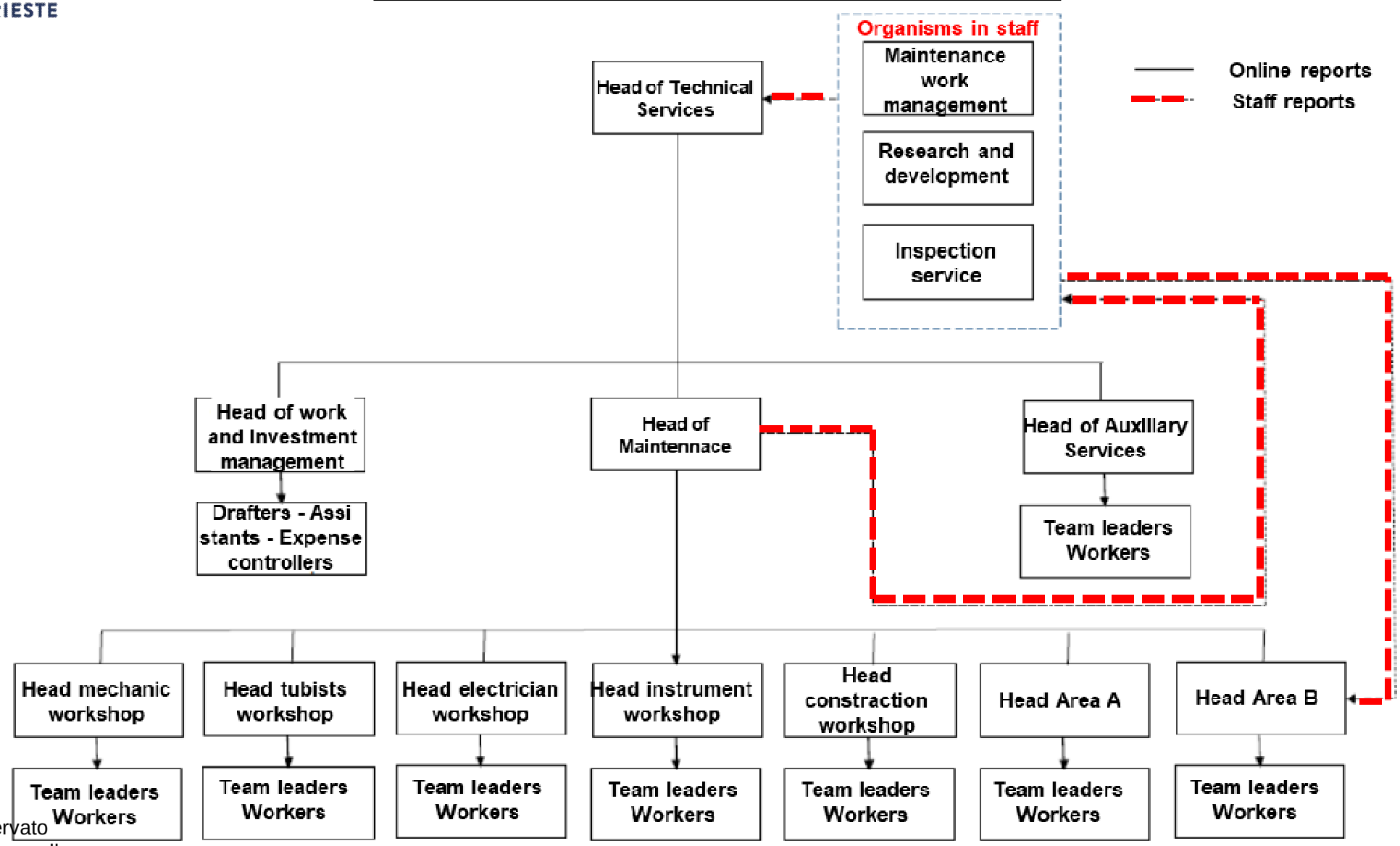
MAINTENANCE MANAGEMENT

A = UT / (UT + DT) = MTBF / (MTBF + MTTR)



UNIVERSITÀ DEGLI STUDI DI TRIESTE

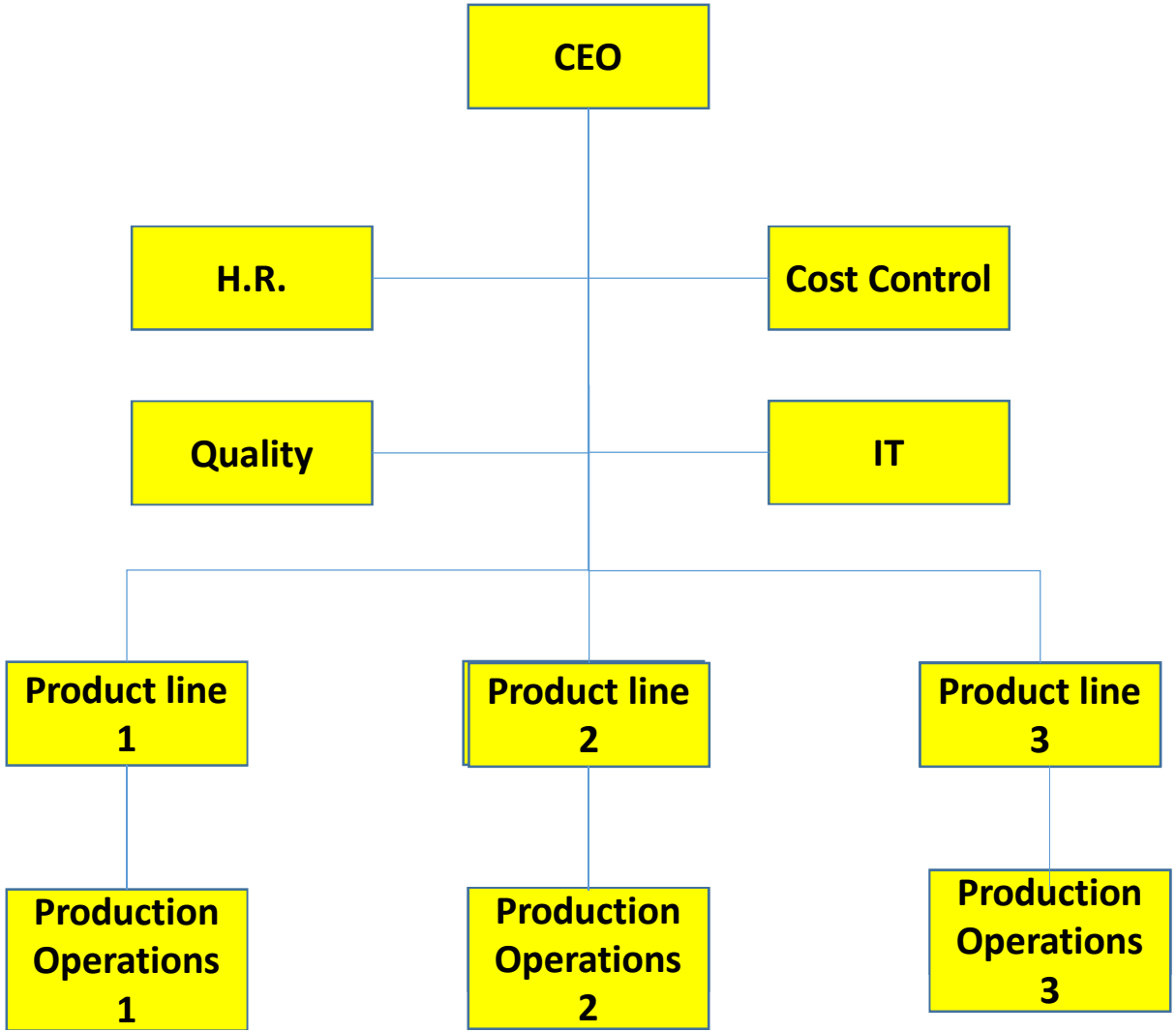
Organization of maintenance service resources



UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE MANAGEMENT

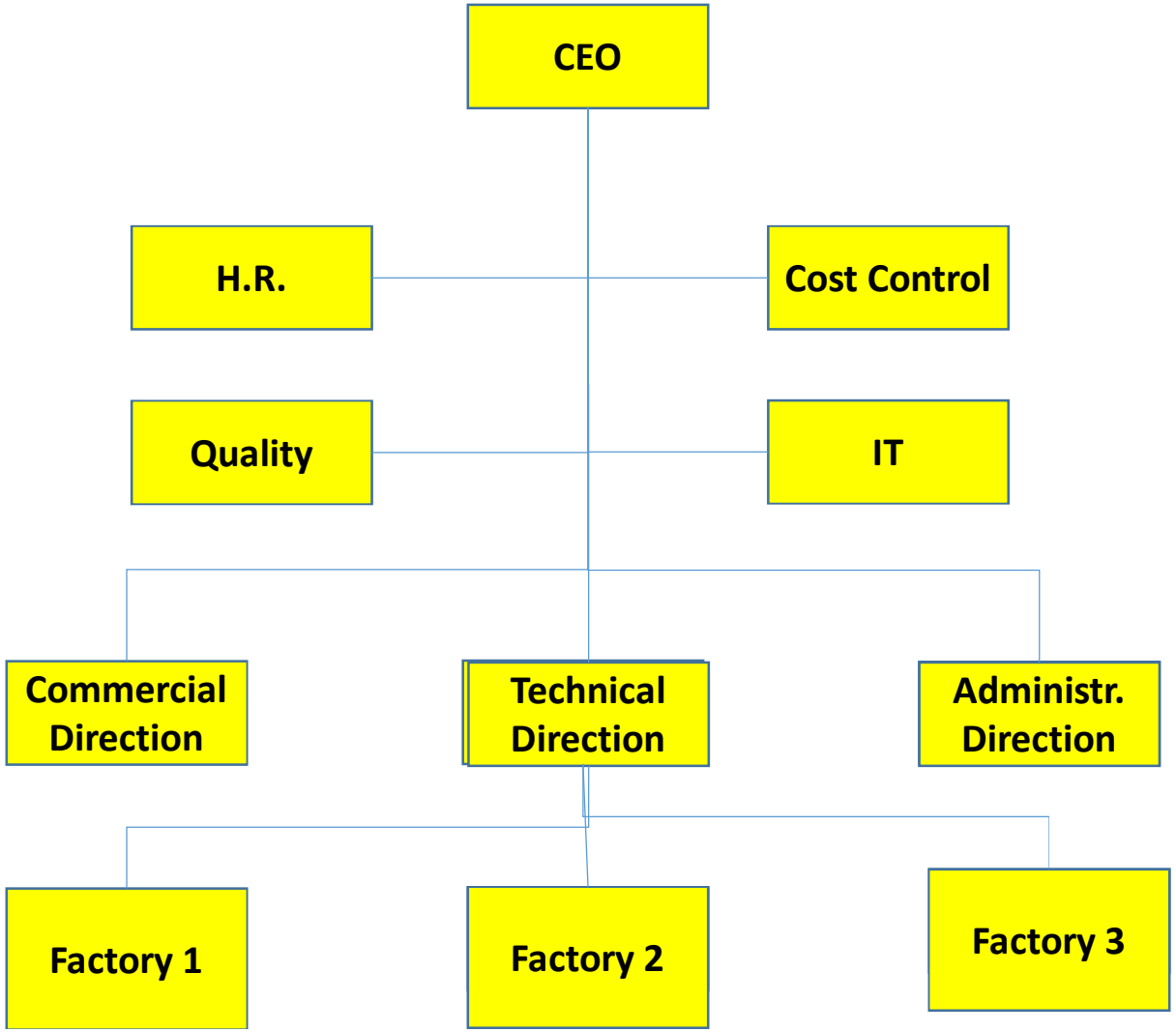
Organization chart



UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE MANAGEMENT

Organization chart



UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE MANAGEMENT

Success factors

- **Safety first of all:** Reduction/elimination of **emergency work**.
- **Availability of fact-finding data and Analysis capacity** about causes of failure of the various components, statistics on repairs and replacements times and costs, etc
- **Managing and controlling costs** by continuous improvement
- **Optimization of the Maintenance process** by the deep knowledge of the operation processes and the ñcustomerôs needs and the use of Information Technology
- **Strategy definition and implementation**
- **Use of Maintenance engineerôs toolbox** 

UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE MANAGEMENT

Engineerôs toolbox

- **RELIABILITY BLOCK DIAGRAM** 
- **FAULT TREE DIAGRAM**
- **ROOT CAUSE ANALYSIS**
  - **5 WHYS**
- **5 W ï 2 H**
- **7 TOOLS OF QUALITY**
  - **DATA COLLECTION**
  - **DATA STRATIFICATION**
  - **HYSTOGRAMS**
  - **PARETO DIAGRAM**
  - **CONTROL CHARTS**
  - **CORRELATION DIAGRAMS**
  - **CAUSE-EFFECT ANALYSIS (ISHIKAWA DIAGRAM)**

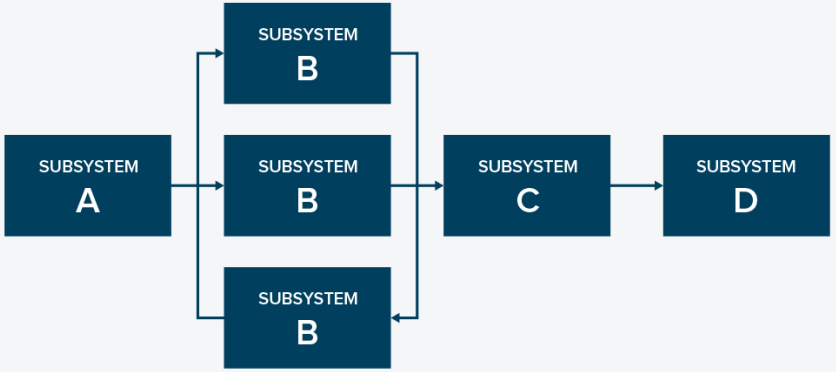
UNIVERSITÀ DEGLI STUDI DI TRIESTE

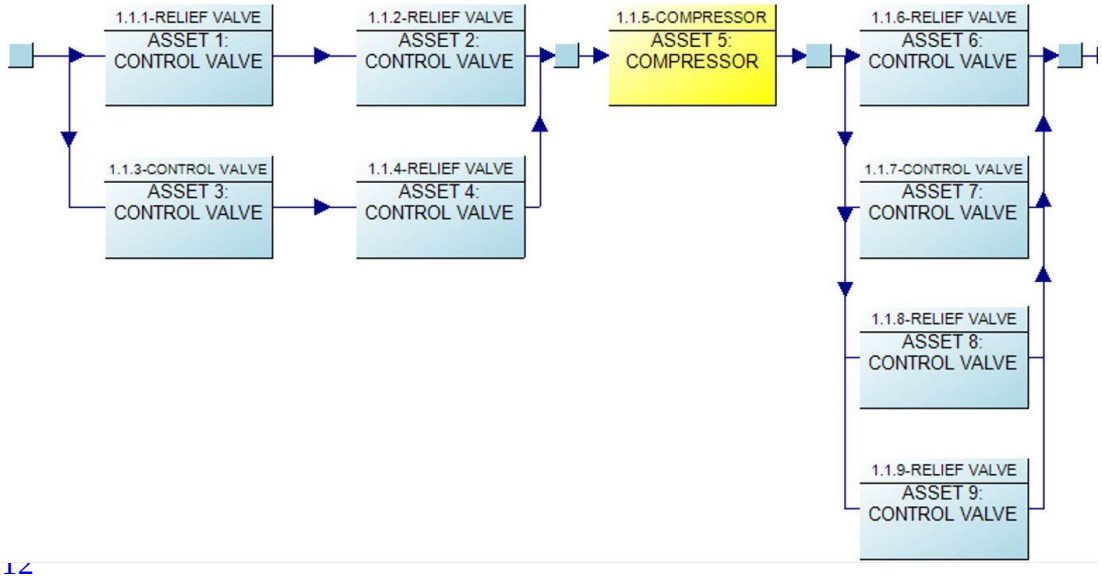
MAINTENANCE MANAGEMENT

Engineerôs toolbox

RELIABILITY BLOCK DIAGRAM

Reliability Block Diagrams (RBDs) are a way of representing a system, including its subsystems and components, as a series of blocks in such a way that equipment failure rates, operating philosophies, and maintenance strategies can be quantitatively assessed in terms of the impact they are expected to have on system performance.





UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE MANAGEMENT

Engineerôs toolbox

RELIABILITY BLOCK DIAGRAM

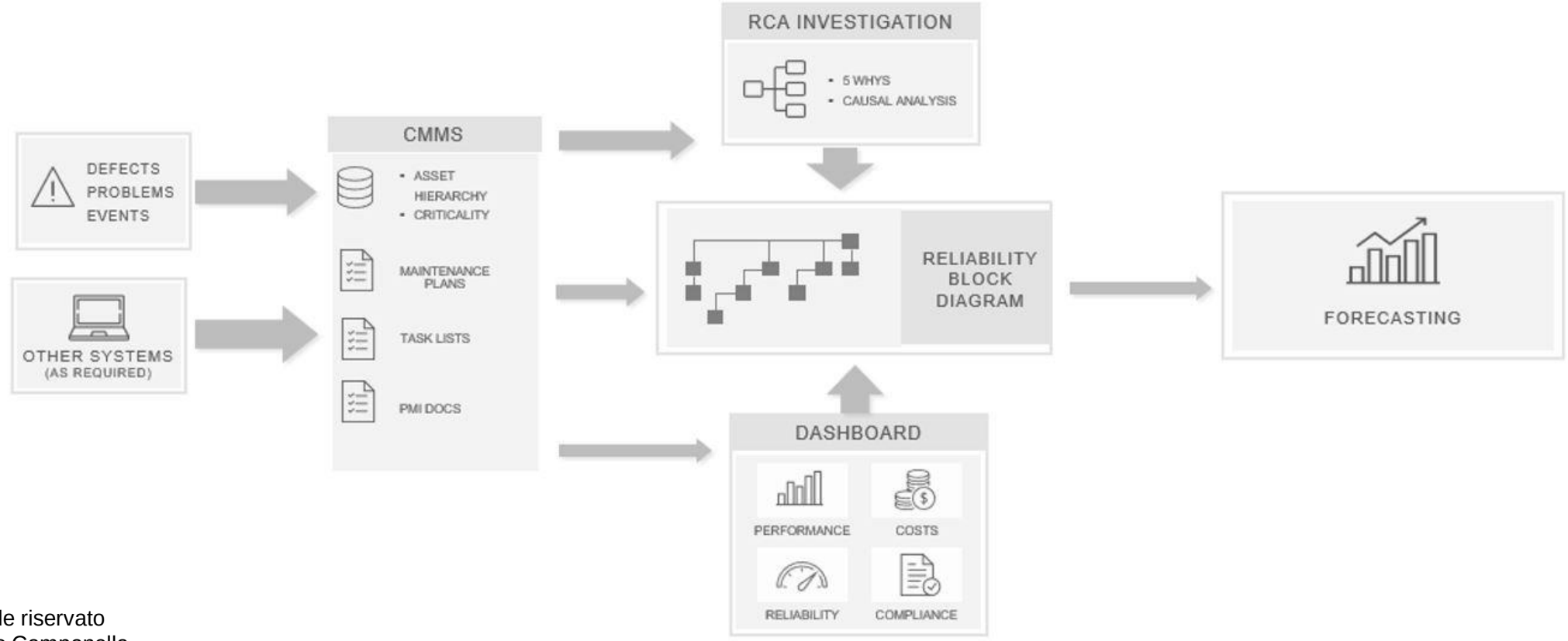
1. **The primary output** of a Reliability Block Diagram is a **forecasted performance level** of a system and all constituent subsystems and assets for a given period of time under specific operating conditions.
2. **The secondary output** of a Reliability Block Diagram is a **quantitative indication** of which assets are the biggest **risk** to the sub-system they are located in, and the system in its entirety, for the period under consideration given the assumptions of the model. This means, not only do you know which areas of your plant are likely to be the most problematic, but also which assets are causing these issues, and how the frequency and duration of issues created by each asset compares to all others in the model.
3. **One of the great strengths** of Reliability Block Diagrams is their **ability to simplify incredibly complex systems** into more digestible segments. The model can be constructed with the level of granularity required of the results and structured to capture the asset redundancies and dependencies that impact the successful operation of the system.

UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE MANAGEMENT

Engineerôs toolbox

RELIABILITY BLOCK DIAGRAM



UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE MANAGEMENT

Engineerôs advanced toolbox

- **FMEA OR SIMPLIFIED FMEA**
- **RISK ASSESSMENT**
- **QUALITY FUNCTION DEPLOYEMENT**
- **SEQUENCE OF EVENTS ANALYSIS**
- **ARCHIVE OF INFORMATION**

UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE ARCHIVE OF INFORMATION

As an initial support for this work, a summary sheet called "**description for positioning plan**" can be used on which, in addition to identifying the department or production center, there is a summary description of each machine, its positioning code and its serial number.

POSITIONING DESCRIPTION SHEET		PLANT
CODES	DESCRIPTION OF THE MACHINE	BADGE NUMBER

UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE ARCHIVE OF INFORMATION

Summary card of the machine: It reports the technical references and the list of components making up the unit, with the relevant code and summary sheet.

DESCRIPTION OF THE MACHINE					
TECHNICAL DATA AND REFERENCES					
Unit number	Manufacturer	Flow		Voltage	V
		Prevalence		Current	A
Title of the plant	Suplier	Power		Power	
	Model	Pressure		Speed	c/min
	Type	Temperature		Phase	
	N. Series	Speed		Report	
	N. Order	Capacity		Comment	
	Instruction book	Weight	kg	Weight	kg
	N. Collector				
	N. Drawings				
CONSTITUENT COMPONENTS					

COMPONENT	CODE	COMPONENT CARD	COMPONENT	CODE	COMPONENT CARD

UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE ARCHIVE OF INFORMATION

This information, common to all machines of the same type, is supplemented by the specific data for each machine (**serial number, corresponding positioning code, purchase date, description of the function performed**) shown on the back of the **machine card** according to the model shown in the figure

MACHINE CARD				
SERIAL NUMBER	PURCHASE DATE	PURCHASE COST		FUNCTION

UNIVERSITÀ DEGLI STUDI DI TRIESTE

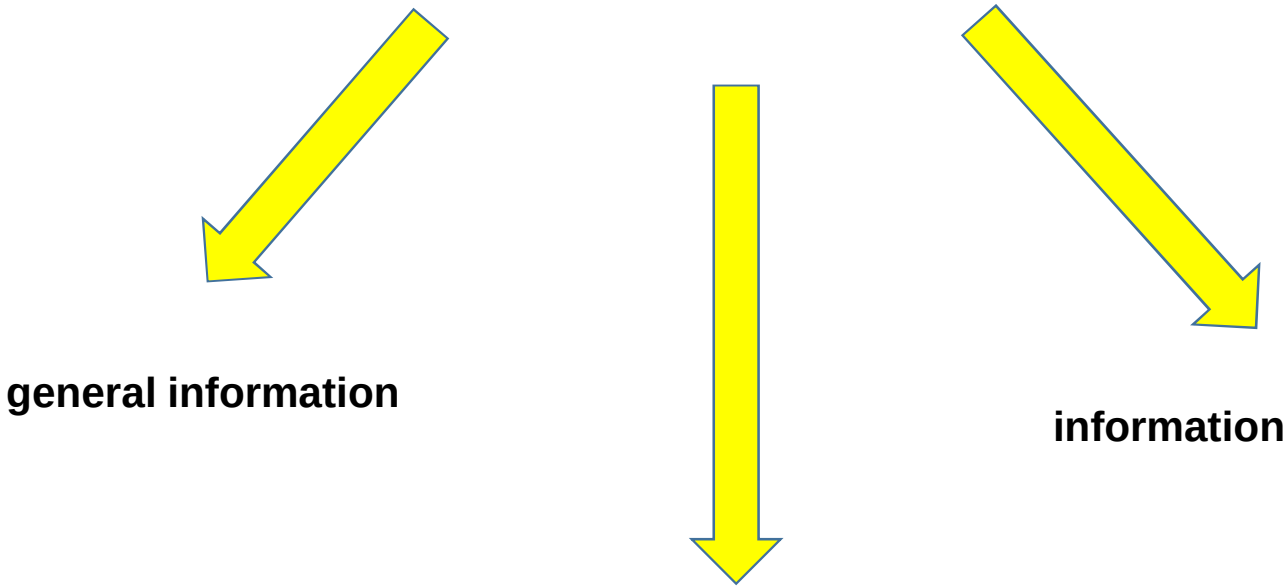
MAINTENANCE ARCHIVE OF INFORMATION

Component card" containing a brief description of the most important component, its data included any technical references, and the related code, in order to identify that particular type of component and the indication of the machine on which it is installed

COMPONENT	COMPONENT DESCRIPTION	COMPONENT CODE
TECHNICAL DATA AND REFERENCES		
Manufacturer		
Supplier		
Model		
Type		
Purchase cost		
Standard time for replacement, cleaning, design etc.		
MACHINES ON WHICH THIS COMPONENT IS INSTALLED		
BADGE NUMBER	POSITIONING CODE	COMPONENTS NUMBER

MAINTENANCE ARCHIVE OF INFORMATION

maintenance intervention feedback



general information

information relating to failure

return information of maintenance operations

UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE ARCHIVE OF INFORMATION

maintenance intervention feedback: general information

They can be distinguished at the machine and component level, but must contain:

- **initial date of the service** (in the case of the component, detectable by the work notes, it does not necessarily mean that it coincides with those of the machine);
- **general conditions at the time of installation** (new machine or component, overhauled, etc.);
- **Availability of technical information, troubleshooting, technical support**;
- **standard times for the execution of some maintenance operations** (replacement, disassembly, overhaul, etc.);

UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE ARCHIVE OF INFORMATION

maintenance intervention feedback: failure information

They are very useful for determining the **reliability of the machine or component** over time and the consequent average time between failures (MTBF).

It will be appropriate to store information regarding the **functional modes of the fault,** the alleged causes and the effects on the performance of the system, in order to intervene appropriately during the design phase.

administrative and accounting implications

The information needed to draw up a "**fault report**" is therefore:

- **fault location code;**
- **date and time of the occurrence of the fault;**
- **functional mode of the fault;**
- **causes of failure (where possible);**
- **effects of the failure on the performance of the machine;**
- **administrative and accounting implications**

UNIVERSITÀ DEGLI STUDI DI TRIESTE

Fault report

ACTIVITIES	FAULT REPORT	N.
1) POSITIONING CODE (1st part of the code)		□□□□
2) COMPONENT CODE (2nd part of the code)		□□□□
3) DATE OF FAILURE		___ --/--/----
4) FAULT FUNCTIONAL MODES ----------		
----------.		
5) EXPECTED CAUSE OF FAILURE ----------		
----------.		
6) EFFECT OF THE FAULT ON THE MACHINE PERFORMANCE ----------		
----------.		
---------- CODE----------.		
7) WORK BILL NUMBER ----------		DATE --/--/-----
OBSERVATIONS		
----------.		
----------.		
----------.		
COMPLETED BY ----------		DATE --/--/-----

UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE ARCHIVE OF INFORMATION

maintenance intervention feedback: return information of maintenance operations

They are carried out online or in the workshop and are collected in the **ñMachine records"** in which the following data are highlighted:

- **positioning code of the machine and its component;**
- **type of intervention carried out (accidental maintenance, scheduled emergencies,**
- **Modifications (eg. out of service for tests, etc.);**
- **date and time of the occurrence of the machine failure;**
- **date and time when the machine is again available for operation;**
- **worktime spent (normal and overtime hours) and qualification of the staff employed (mechanics, electricians, electronics, etc.);**
- **operations performed (cleaning, adjustments, repairs, replacements, etc.);**
- **used materials and equipment;**
- **intervention time foreseen in the estimation.**

Machine records

SOCIETY MAINTENANCE SERVICE	WORK BUBBLE	N.

Applicant: ………………………………………………...	Date of issue: ../../…..
Description of the machine: …………………………...	Positioning code: ……………..…………………………...
Description of the works: ………………………………... …………………………………………………………………	Machine available for operation: Yes ☐ No ☐
Head of Service Comments: …………………………... …………………………………………………………………	Confirm urgency Normal ☐ Urgent ☐

Description of the work to be carried out: ………………………………………………………………………… ………... ………... ………... ………...
Special equipment and means: …………………………………………………………………………………… ………... ………... ………... ……………………………………………………………… Work assignment date: ../../….

TYPE OF MAINTENANCE	PERFORMER		PRICE QUOTATION			
Accidental ☐ Preventive ☐ Modifications ☐	DEPARTMENT	CODE	Work period		N. hours of activity	N. hours total
			from	to		

UNIVERSITÀ DEGLI STUDI DI TRIESTE

Machine records

DESCRIPTION OF WORKS PERFORMED											
							Part	Component	Operation		
Used materials and spare parts; description							Code				
EMPLOYMENT USE							TOTAL HOURS	N. MATERIALS WITHDRAWALS			
NAME	CATEGORY	DATE AND NUMBER OF HOURS									
								N. BUONI RITORNO MATERIALI			
Team Leader Signature					Head of Department Signature						

UNIVERSITÀ DEGLI STUDI DI TRIESTE

Machine diary

the "**machine diary**", which is a summary of the entire history of maintenance work carried out on the machine since its installation.

MACHINE DIARY								BUDGE NUMBER
MACHINE DESCRIPTION		MACHINE COST		SERVICE START DATE		INSTALLATION CONDITION		FAILURE NUMBER
Work date	Done works	Activity hours	Total hours	Types of intervention	Used materials and spare parts	MDO cost	Material cost	B.d.L. number

UNIVERSITÀ DEGLI STUDI DI TRIESTE

Component diary

In the machine diary it is possible to extract the information useful for filling in the ñ**component diary**ñ which shows a chronological list of data relating to the interventions carried out on the individual components of the machine (conditions of use, intervention date, type of intervention, duration of the intervention, inconvenience found, etc.).

COMPONENT DESCRIPTION				COMPONENT CODE		
INSTALLATION DATE					POSITIONING CODE	
Employment condition	Intervention date	Intervention carried out	Duration of intervention (h)	Problem eucontered	Corresponding age	Hours of operation

UNIVERSITÀ DEGLI STUDI DI TRIESTE

historical summary sheet of the component

The most interesting information contained in the diary of the component is reported in the "**historical summary sheet of the component**", which codifies, at the time of operation, the inconveniences encountered and the duration of the intervention from which it is possible to draw useful information for reliability and other maintenance parameters.

COMPONENT DESCRIPTION			COMPONENT CODE		
CONDITION OF USE	TYPE OF INTERVENTION CARRIED OUT		AGE OF THE COMPONENT	INCONVENIENT RECEIVED	INTERVENTION DURATION

UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE ARCHIVE OF INFORMATION

maintenance intervention feedback: return information of maintenance operations

Additional documents considered useful for maintenance management can be filled as:

- "**accounting report by cost centers**ñ : It is issued weekly or monthly and constitutes a list of costs related to the maintenance service (preventive, accidental maintenance, provided by external contractors and possibly differentiated into costs for labor and for the use of materials);
- "**periodic unavailability report**ñ It calculates the passive time due to the maintenance action with respect to the production time (estimate or final balance);
- "**labor utilization ratio**ñ: It defines the use of available human resources.

UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE ORGANIZATION

Maintenance planning and scheduling

When it comes to managing dozens or even hundreds assets, Maintenance planning and scheduling management is crucial. That it is necessary to optimize the quality and utilization of assets throughout their lifecycle, increase productive uptime and reduce operational costs.

A common saying states that 1 hour of planning will save 3 hours of work. Maintenance planning saves more.

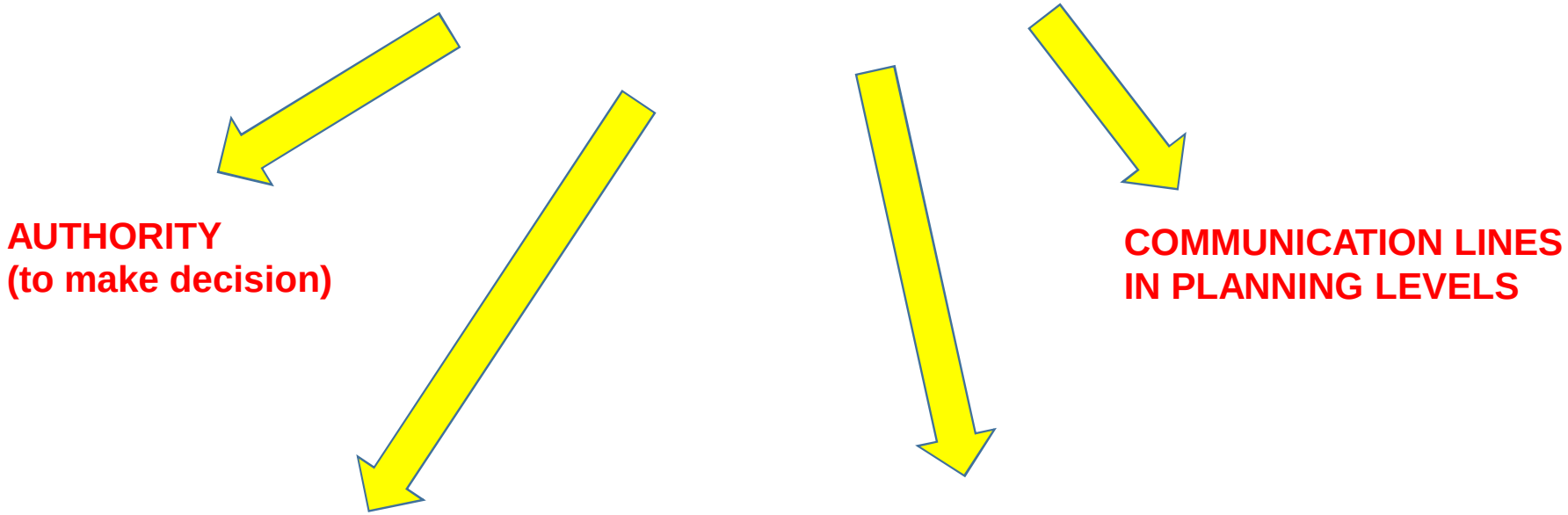
Probably maintenance planning has remained an undeveloped area of tremendous leverage for maintenance productivity.

Planning optimization is the biggest improvement one can make to a maintenance program, because the preparatory work, when properly done, greatly increases maintenance productivity.

UNIVERSITÀ DEGLI STUDI DI TRIESTE

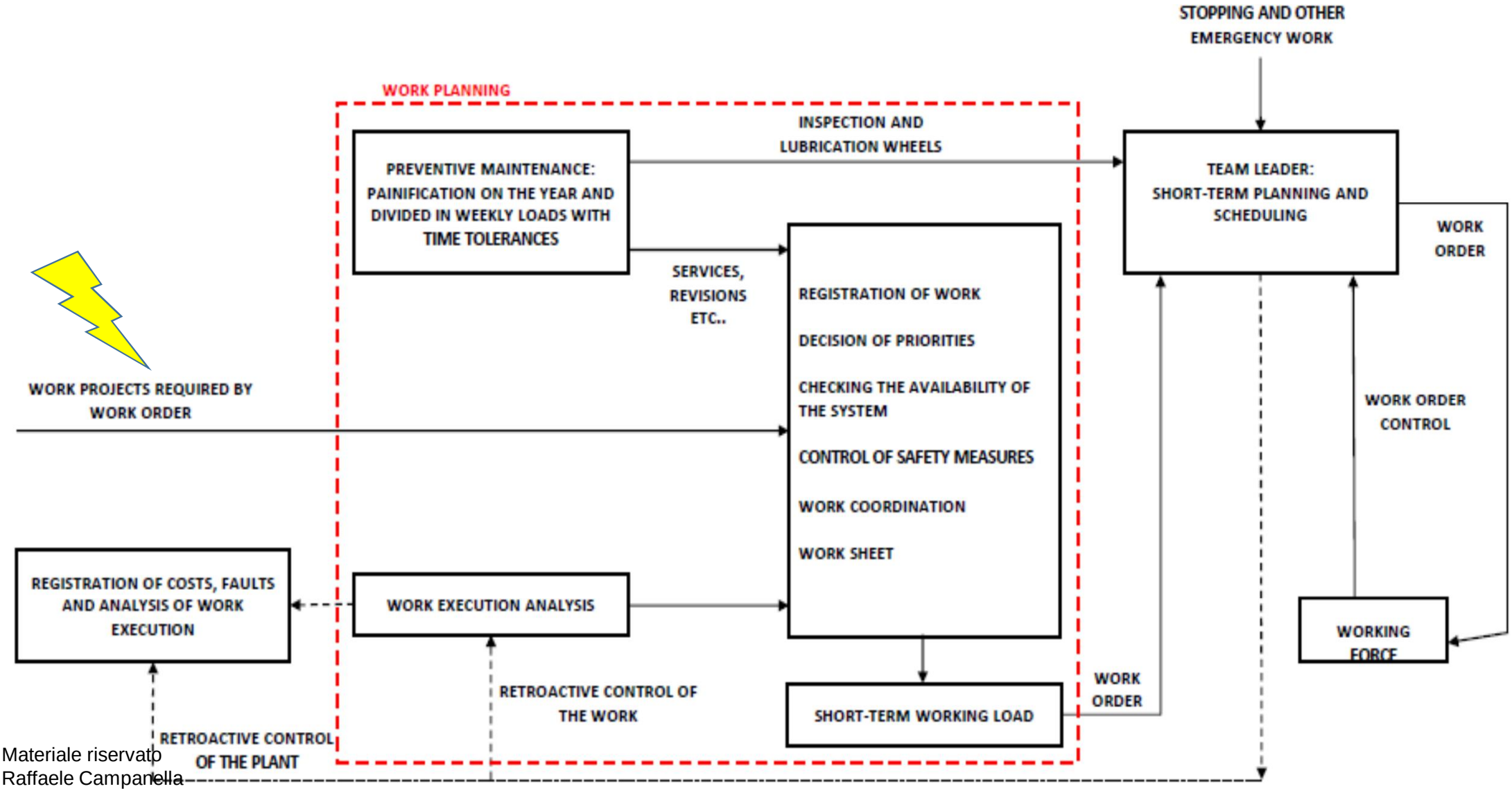
ORGANIZATION OF MAINTENANCE SERVICE RESOURCES

WORK PLANNING



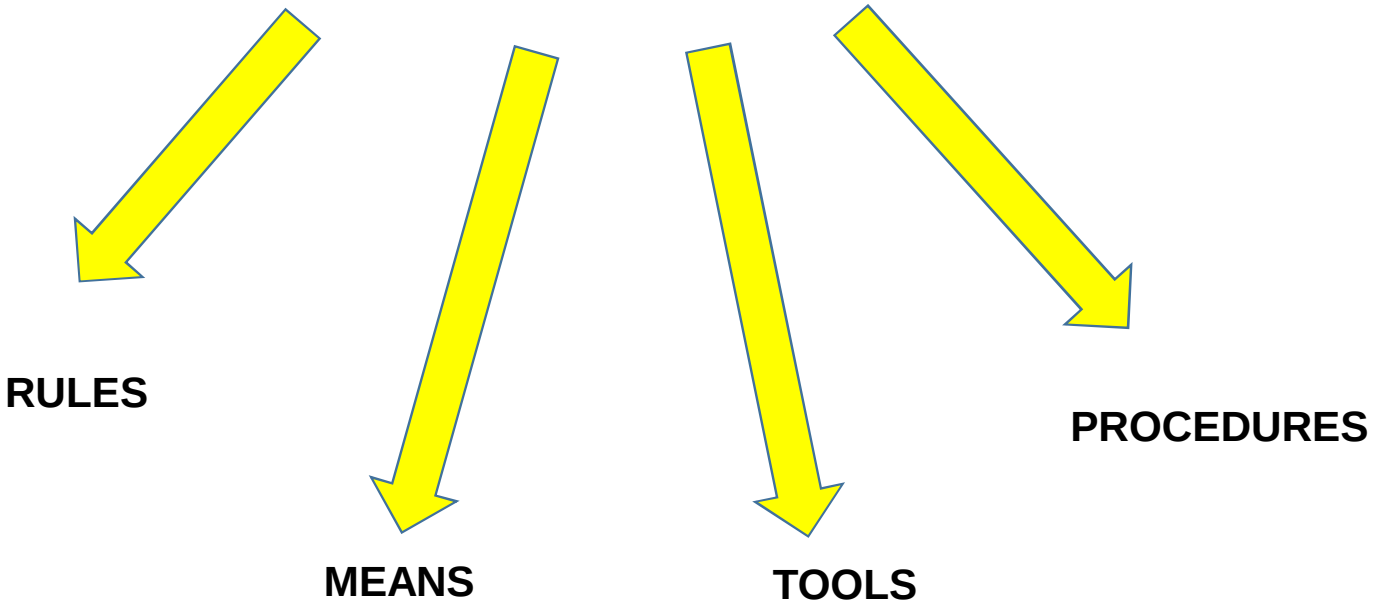
UNIVERSITÀ DEGLI STUDI DI TRIESTE

Maintenance service planning activities



MAINTENANCE MANAGEMENT

Maintenance information system

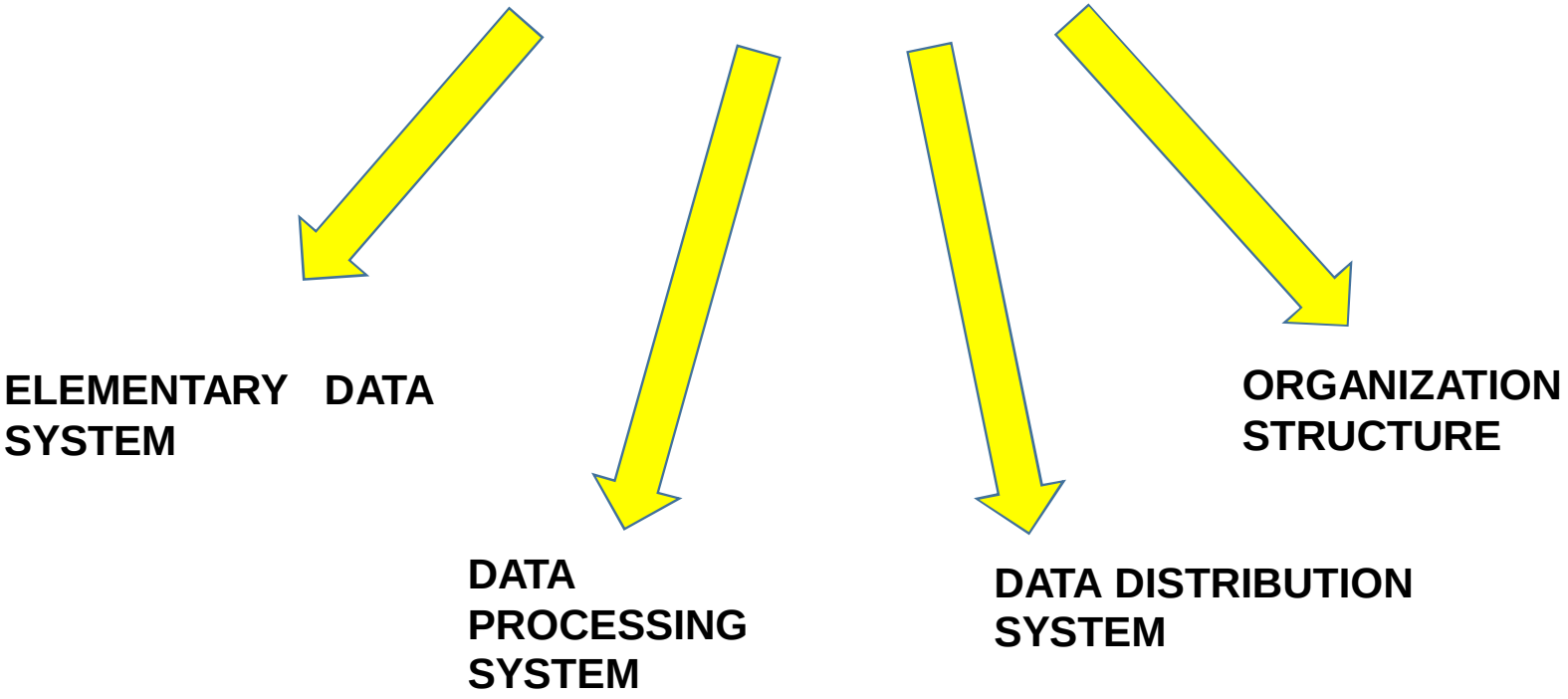


designed to acquire, store, transform and issue corporate information related to the Companyôs assets

UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE MANAGEMENT

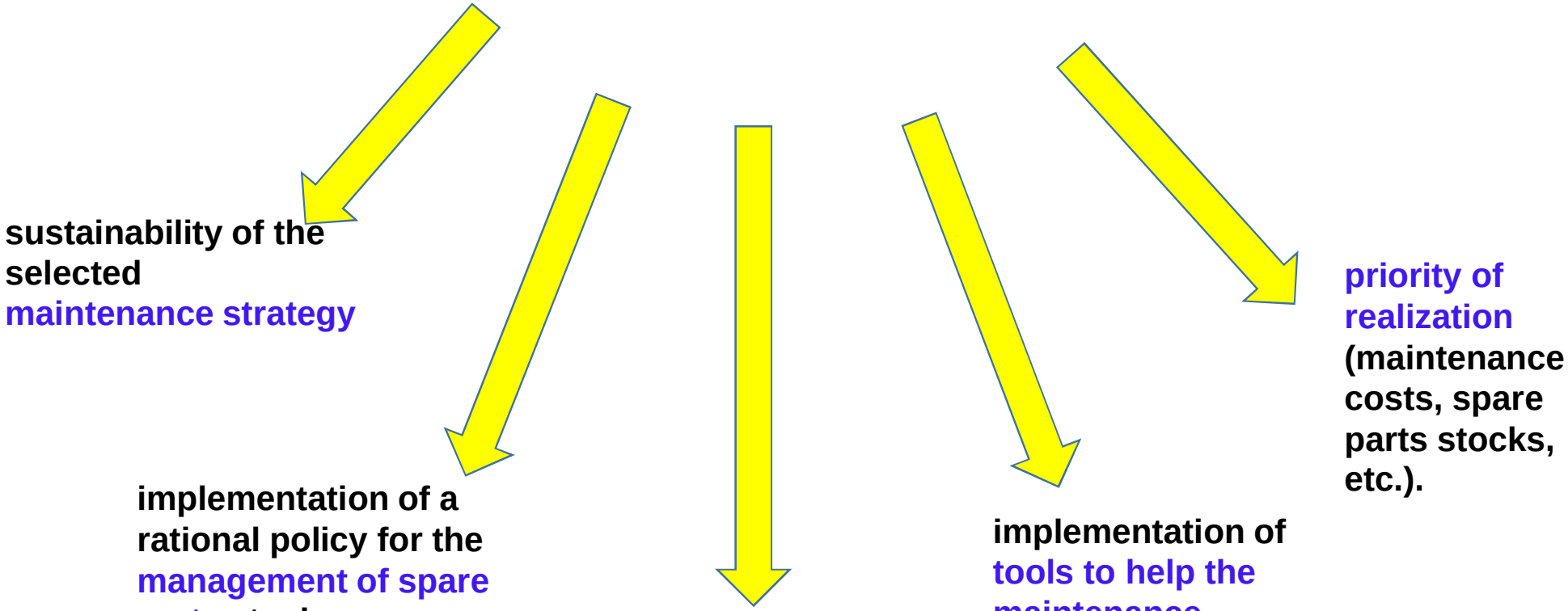
Maintenance information system



UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE INFORMATION SYSTEM

OBJECTIVES



UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE INFORMATION SYSTEM

OBJECTIVES

a) Sustainability of the selected maintenance strategy which consists of:
- data collection of accidental maintenance interventions and their organization in a historical archive;
- analysis of all the interventions in order to identify the possible repeatability of the same ones;
- gradual introduction of scheduled maintenance on as many devices as possible;
- construction of an archive of standard scheduled maintenance interventions;
- management of maintenance programs through the use of network programming techniques;
- identification and implementation of an optimal periodic maintenance plan;
- identification in real time of an optimal maintenance plan in the event of forced plant shutdown;
- extension of short-term planning for inspections, checks and repairs of lesser economic and technical interest;
- leveling of the periodic workloads of the various maintenance departments;
- planning of materials (preventive control of material availability and booking);

MAINTENANCE INFORMATION SYSTEM

OBJECTIVES

b) **implementation of a rational policy for the management of spare parts stocks which includes:**
   - **creation and continuous updating of a catalog of available materials and their location in the warehouse;**
   - **identification of management policies for each material;**
   - **determination of the management parameters for each material;**
   - **recording of movements in the warehouse, valuation of inventories or stocks;**
   - **calculation of the management parameters (economic quantity of reordering, safety level, reorganization level, etc.);**
   - **analysis of the characteristics of the suppliers (quality, price, security of supply, supply time);**
   - **issue of supply orders;**

UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE INFORMATION SYSTEM

OBJECTIVES

c) creation of effective control over the maintenance service activities divided into:
- control of the relative costs that can be attribute to each unit;
- comparison between the estimated and final costs;
- evaluation of the service management (for example labor) and comparison with previous periods;
- statistical analysis on unavailability, reliability and failure analysis for each individual unit;

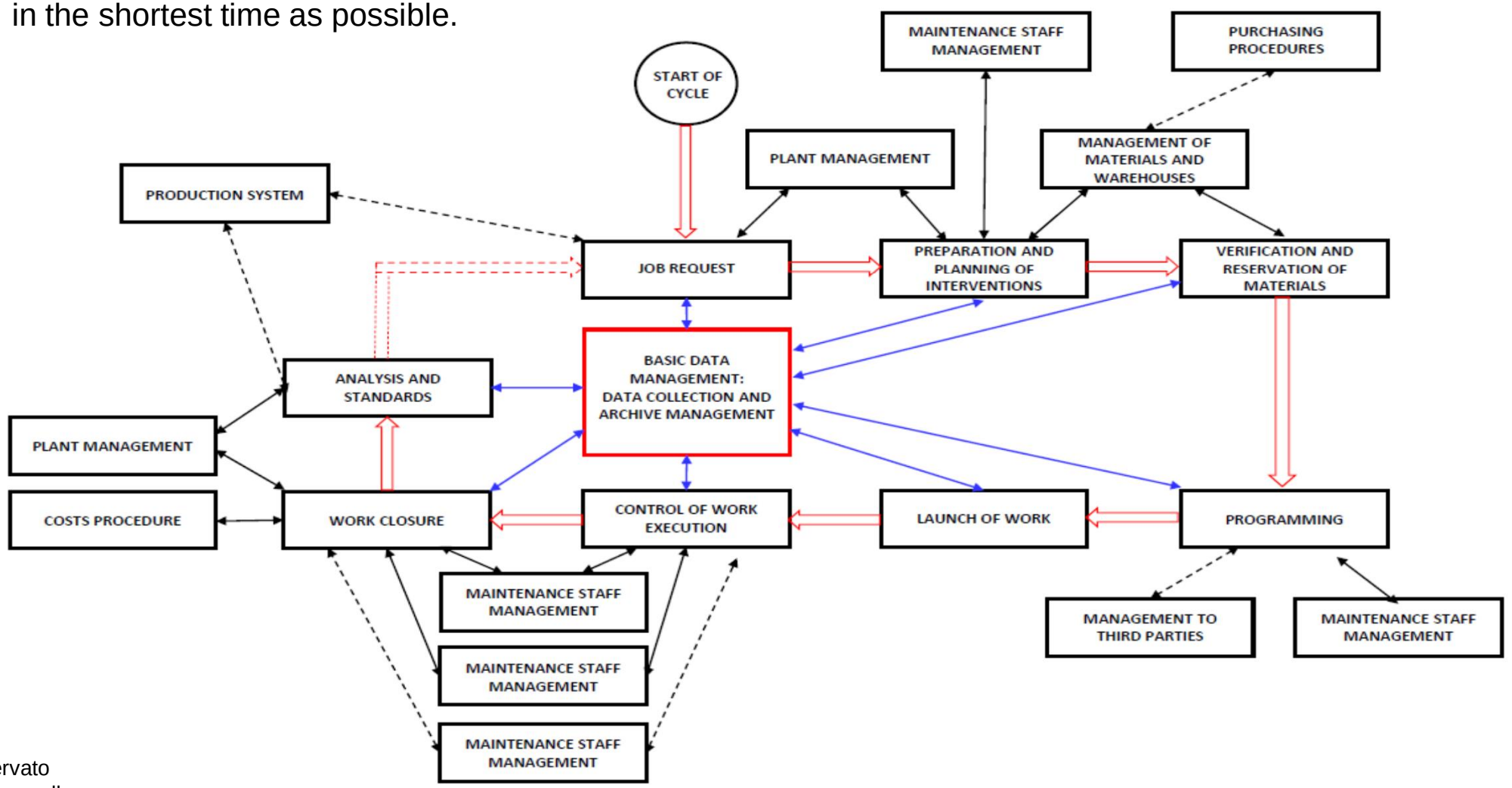
d) implementation of help tools for the maintenance operations by:
- continuous control of the execution of the works;
- obtaining documents (withdrawal vouchers, machine journals, troubleshooting etc.) in real time;
- knowledge of the warehouse archive (inventory, pending orders, etc.);
- maintenance work planning;

e) priority of realization (maintenance costs, spare parts stocks, etc.).

UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE INFORMATION SYSTEM

The **Maintenance information system** is designed to capture, store, research and to provide information in the shortest time as possible.



MAINTENANCE ORGANIZATION
MAINTENANCE INFORMATION SYSTEM

a) job request:

The main purpose of this area is to **collect, check and approve** requests for normal or emergency interventions due to several cases (unforecasted breakdowns, preventive maintenance operations as well as to modify existing plants).

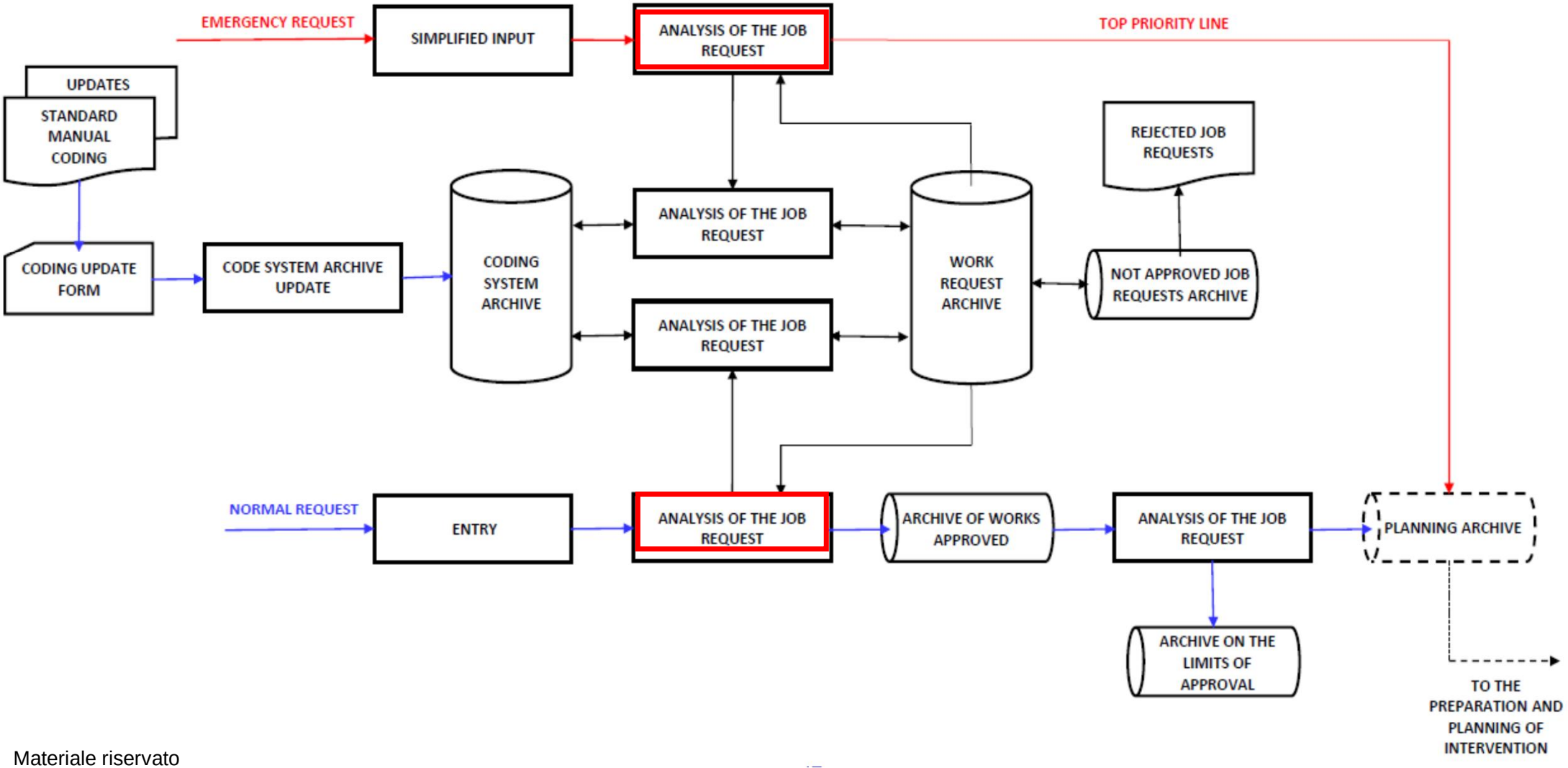
Sometimes there are different procedures for preventive maintenance or for interventions related to "large stops". The latter are programmed separately using reticular programming systems (**PERT - Program Evaluation and Review Technique**), which generate work orders that are entered in the sector of preparation and work planning.

The main **objectives** to be achieved, are:

a) identification of a single collection and storage point of job requests (normal or emergency);
b) assessment of the consistency and precision of the description of the work requested and of the plant involved;
c) ensuring that only real problems are sent to planning dept.;
d) identification of the uniqueness of the job request
e) review of the request: If a request is rejected, the reasons for the disapproval are specified and the same information is permanently stored in the appropriate archive.

UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE ORGANIZATION



MAINTENANCE ORGANIZATION

MAINTENANCE INFORMATION SYSTEM

b) work preparation and planning

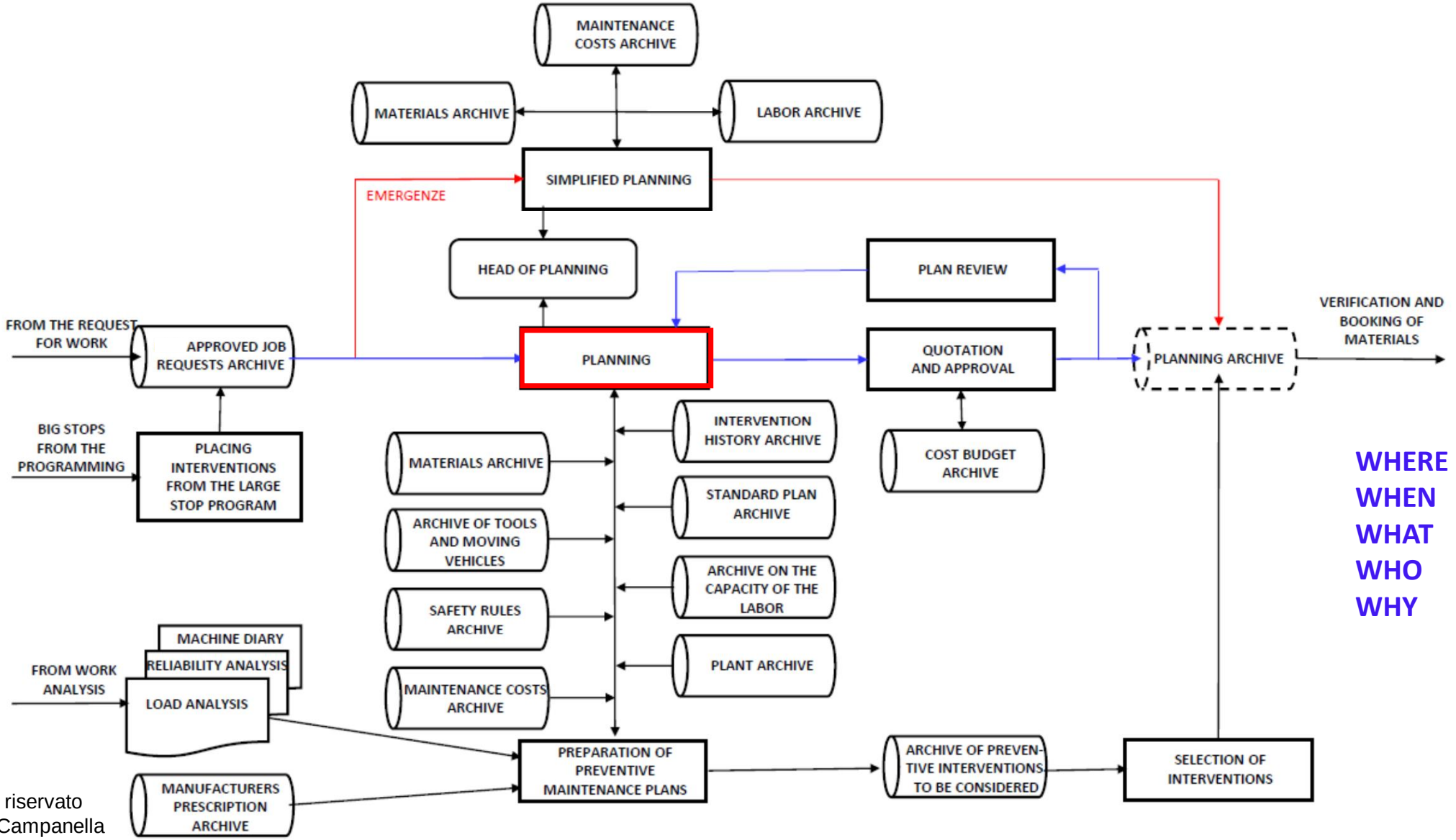
After the acceptance phase, the job request is transformed into a job order and passes through the sector of preparation and planning of the interventions.

Orders with emergency request, having the highest priority, can avoid the approval phase, and follow the normal planning line, or, for the sake of brevity, they can follow a privileged and concise preparation route (prompt intervention), in order to get an immediate work execution launch.

Work orders, related to preventive maintenance and those corresponding to large stops, are managed in this sector. Planning experts must both coordinate the different phases of the work, the consequent duration, the existing interconnections and the corresponding sequences, and identify the necessary resources (workforce based on professional skills, materials, tools, transportation, work prescriptions such as permits safety and cleaning activities of plants etc.) in order to achieve maximum service efficiency at the lowest possible cost

UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE INFORMATION SYSTEM



WHERE
WHEN
WHAT
WHO
WHY

MAINTENANCE ORGANIZATION

MAINTENANCE INFORMATION SYSTEM

b) work preparation and planning

The main objectives linked to these activities are:

- **detailed definition of the activities to be performed (profession and specialty);**
- **estimation of working time divided by profession and specialty;**
- **list of necessary equipment;**
- **list of necessary materials and spare parts;**
- **list of prescriptions and work methods;**
- **sequence of work to be carried out;**
- **estimation of pertinent costs.**
- **formal approval of the intervention plan on the basis of predetermined cost limits;**
- **review of unapproved work plans;**
- **detailed preparation of the preventive maintenance plan showing the interventions to be carried out and their execution frequency;**
- **select the preventive and major stops to be considered in the planning budget of the subsequent financial period**

MAINTENANCE ORGANIZATION

MAINTENANCE INFORMATION SYSTEM

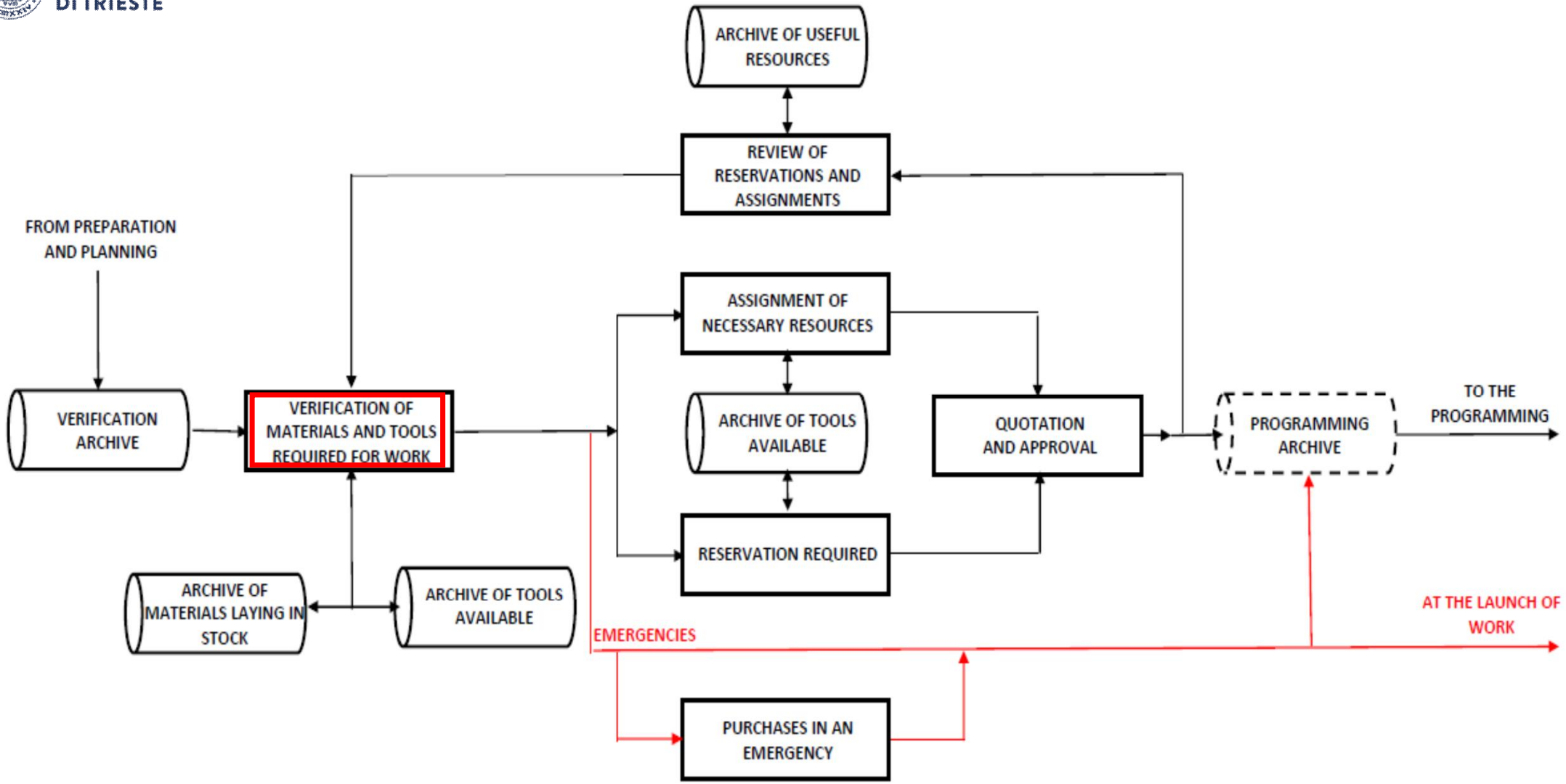
c) verification and booking of materials

As far as the materials are concerned one of the main objectives is to minimize the stocks of materials used for replacement. A useful policy is to approach the verification and planning phases of the works as much as possible, in order to avoid booking the materials long before they are used.

After the verification, if there is an out-of-stock situation the IT system allow the immediate purchase requests or the cancellation of the reservation in the presence of other orders. The system will provide the material booking at the moment of arrival, in order to minimize their storage time in the warehouse.

Therefore, the main objectives are:

- **assigning the necessary materials for the planned job, checking the material availability;**
- **ensuring the availability of materials on time;**
- **priority of interventions in the assignment of materials.**
- **assigning the quantity of material required for the intervention;**
- **booking of the materials necessary for the intervention, in order to be purchased and available on time;**
- **review of services and allocations.**


ARCHIVE OF USEFUL RESOURCES
REVIEW OF RESERVATIONS AND ASSIGNMENTS
FROM PREPARATION AND PLANNING
ASSIGNMENT OF NECESSARY RESOURCES
VERIFICATION ARCHIVE
VERIFICATION OF MATERIALS AND TOOLS REQUIRED FOR WORK
ARCHIVE OF TOOLS AVAILABLE
QUOTATION AND APPROVAL
PROGRAMMING ARCHIVE
TO THE PROGRAMMING
RESERVATION REQUIRED
ARCHIVE OF MATERIALS LAYING IN STOCK
ARCHIVE OF TOOLS AVAILABLE
AT THE LAUNCH OF WORK
EMERGENCIES
PURCHASES IN AN EMERGENCY

UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE ORGANIZATION

MAINTENANCE INFORMATION SYSTEM

d) programming

After the phases of work planning, verification and booking of the resources (materials, tools, labour, skills and right date) for the intervention, the target is to recover work orders selectively and to prepare a weekly maintenance program. The programming of work orders and their subsequent release, based on the availability of the necessary resources, is one of the most important aspects in the management of maintenance activities.

All types of intervention must be considered together, including those of preventive maintenance and major stops, minus emergency actions that do not affect this sector.

Therefore:

An order is programmable only when the following requirements are satisfied:

- **materials and spare parts, special tools and systems are available;**
- **Safety is assured (including interventions by the National Health Service);**
- **it is possible coordinating several interventions on the same plant, taking into account the production status, priorities, preventive maintenance programs, shutdown programs, etc.**

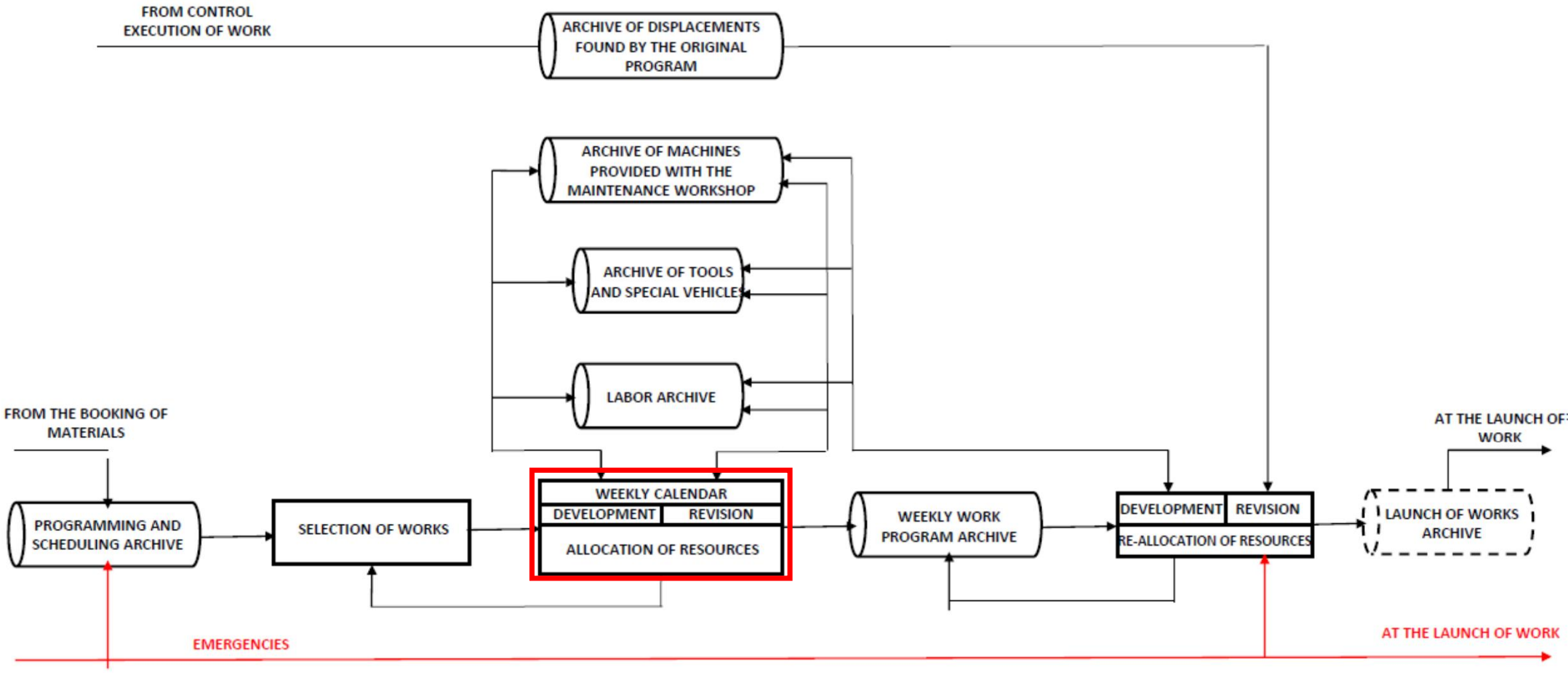
MAINTENANCE ORGANIZATION

MAINTENANCE INFORMATION SYSTEM

d) programming

The main tasks of this function within the maintenance organization are:

- **choice of work orders scheduled for the following week;**
- **definition of the weekly work program taking into account both the interventions already launched and not completed, and the availability of the necessary resources (labor, tools, etc.);**
- **review of the weekly program if there are delays and deviations from the scheduled program;**
- **daily review and update of the work program due to sudden emergencies or to a different availability of resources or to changes in the duration of ongoing interventions.**


FROM CONTROL EXECUTION OF WORK
ARCHIVE OF DISPLACEMENTS FOUND BY THE ORIGINAL PROGRAM
ARCHIVE OF MACHINES PROVIDED WITH THE MAINTENANCE WORKSHOP
ARCHIVE OF TOOLS AND SPECIAL VEHICLES
LABOR ARCHIVE
FROM THE BOOKING OF MATERIALS
PROGRAMMING AND SCHEDULING ARCHIVE
SELECTION OF WORKS
WEEKLY CALENDAR
DEVELOPMENT
REVISION
ALLOCATION OF RESOURCES
WEEKLY WORK PROGRAM ARCHIVE
DEVELOPMENT
REVISION
RE-ALLOCATION OF RESOURCES
LAUNCH OF WORKS ARCHIVE
AT THE LAUNCH OF WORK
EMERGENCIES
AT THE LAUNCH OF WORK

MAINTENANCE ORGANIZATION

MAINTENANCE INFORMATION SYSTEM

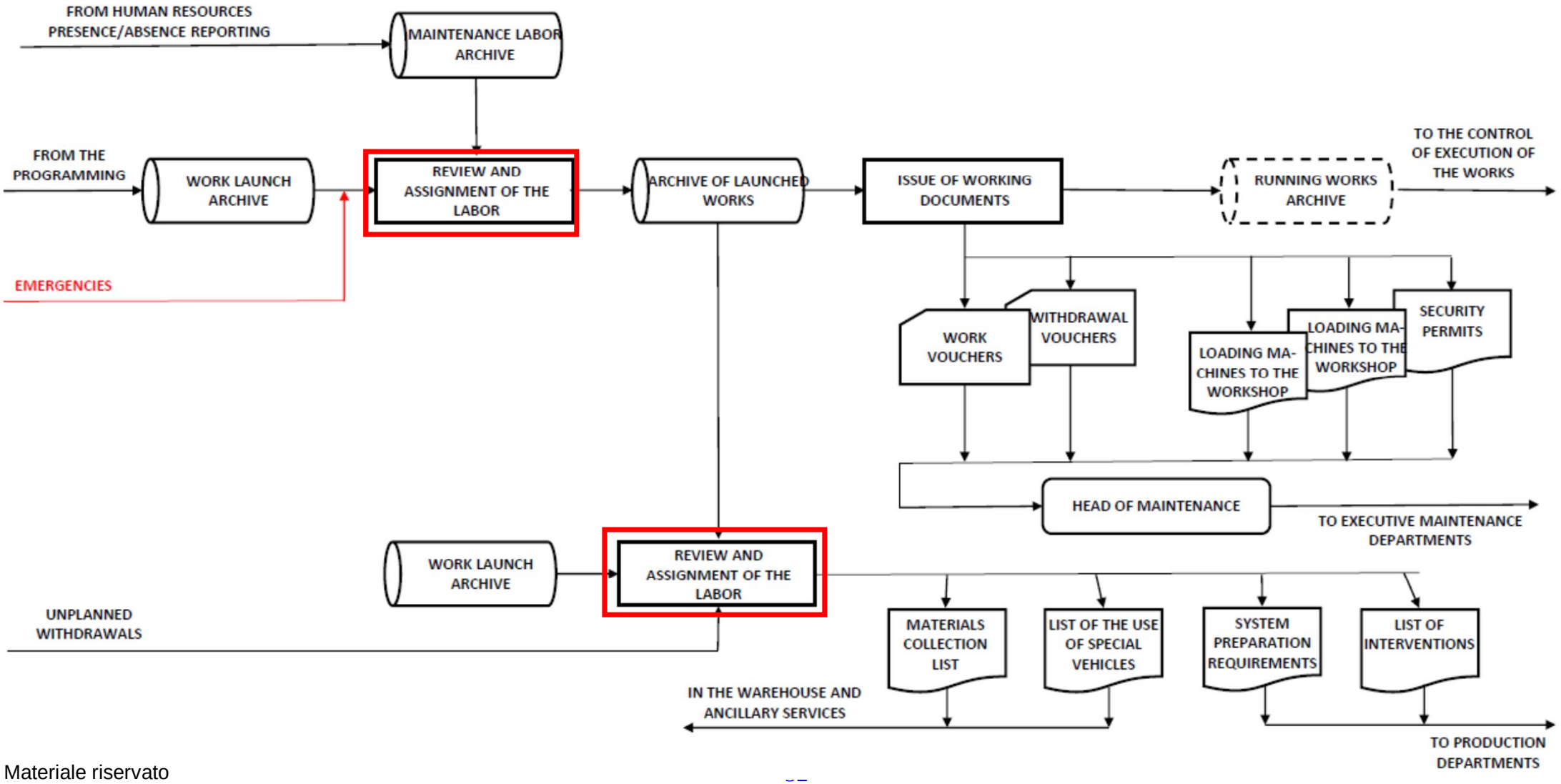
e) job launch

Once the daily maintenance program has been established, it is time to launch the works, that means to assign the tasks in an appropriate sequence and with the complete technical documentation to the individual engineer or to labour teams.

The main tasks of this function within the maintenance organization are:

- **daily assignment of labor to specific work orders;**
- **issue of executive work orders including the work notes, vouchers for materials pick-up and tools and, if necessary, work permissions;**
- **issue of support documentation (picking lists of materials and tools at the storage warehouses, use plans of the vehicles at the movement service, notices of forthcoming intervention and prescriptions for the preparation of the plants at the departments).**

UNIVERSITÀ DEGLI STUDI DI TRIESTE



MAINTENANCE ORGANIZATION

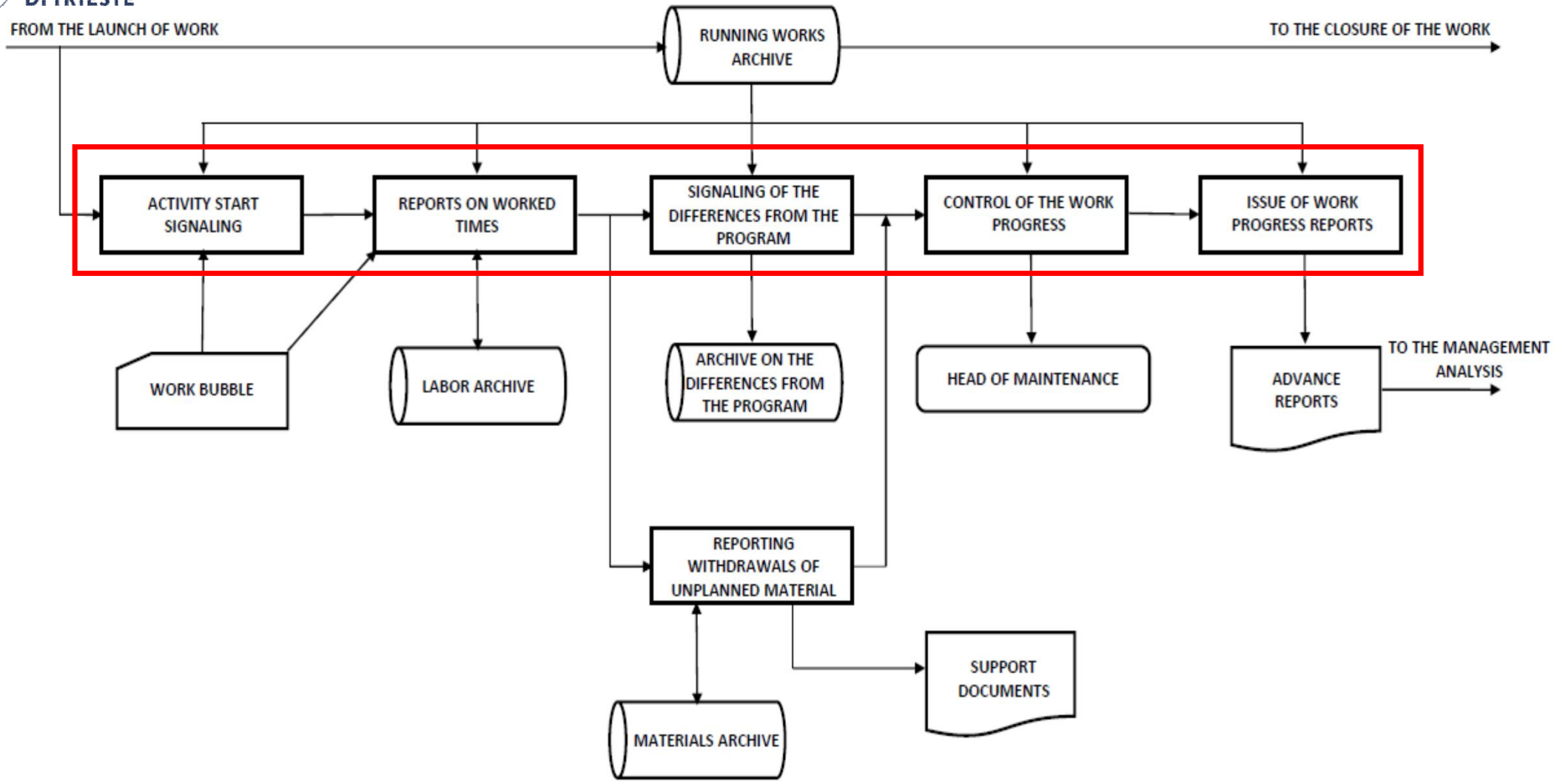
MAINTENANCE INFORMATION SYSTEM

f) monitoring the progress of the work

This function collects information on the actual performance of maintenance work and provides the documents reporting any deviations from the initial program.

The **main tasks of this function** within the maintenance organization are:

- **reporting** of the start of the activity for each work bill and the times worked by the workforce for each work order in progress;
- **storage, search and display** of the progress of each intervention;
- collection of information relating to orders for **emergency interventions** that are not planned or scheduled;
- collection of data on the **use of resources** (materials, labour, general costs, etc.);
- reporting of **any deviations (time, methods, materialsé)** in order to allow the review of the program;
- supply of **reports useful for management analysis**;


FROM THE LAUNCH OF WORK
RUNNING WORKS ARCHIVE
TO THE CLOSURE OF THE WORK
ACTIVITY START SIGNALING
REPORTS ON WORKED TIMES
SIGNALING OF THE DIFFERENCES FROM THE PROGRAM
CONTROL OF THE WORK PROGRESS
ISSUE OF WORK PROGRESS REPORTS
WORK BUBBLE
LABOR ARCHIVE
ARCHIVE ON THE DIFFERENCES FROM THE PROGRAM
HEAD OF MAINTENANCE
ADVANCE REPORTS
TO THE MANAGEMENT ANALYSIS
REPORTING WITHDRAWALS OF UNPLANNED MATERIAL
SUPPORT DOCUMENTS
MATERIALS ARCHIVE

MAINTENANCE ORGANIZATION

MAINTENANCE INFORMATION SYSTEM

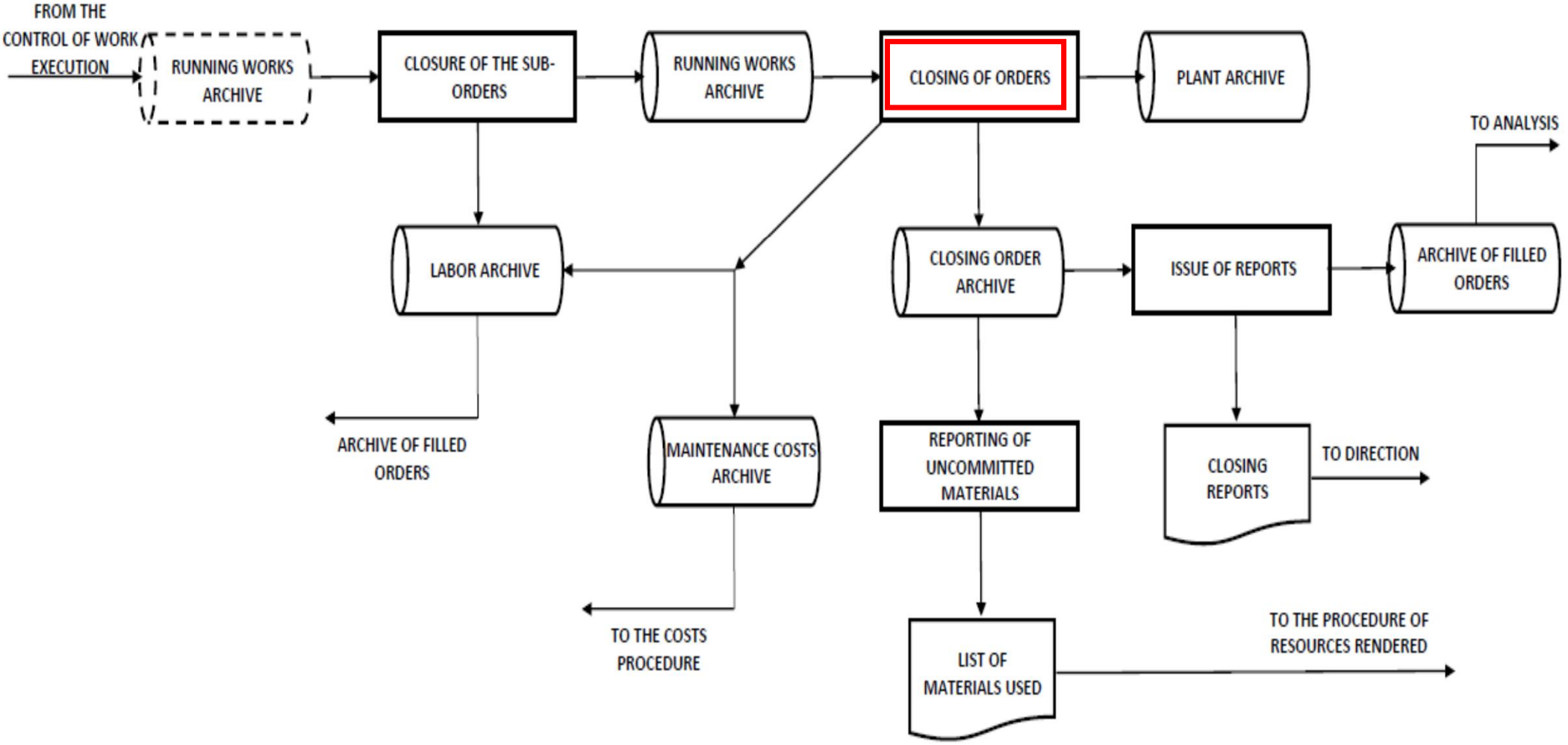
g) closing of the works

The Information system provides the means to process work orders, check their real completeness and collect data for their subsequent analysis, especially of costs.

The **main tasks of this function** within the maintenance organization are:

- evidence of the **end of the activities** related to the work orders and sub-orders and their closure;
- **check of the completeness and correctness** of the maintenance intervention;
- **report of unused materials**, returned to the warehouse and correctly loaded in the information system
- **reports for the directional analysis,** with the deviations from the original plan
- accurate **analysis of cost data** and trends of maintenance costs.

.


FROM THE CONTROL OF WORK EXECUTION
RUNNING WORKS ARCHIVE
CLOSURE OF THE SUB-ORDERS
RUNNING WORKS ARCHIVE
CLOSING OF ORDERS
PLANT ARCHIVE
TO ANALYSIS
LABOR ARCHIVE
CLOSING ORDER ARCHIVE
ISSUE OF REPORTS
ARCHIVE OF FILLED ORDERS
ARCHIVE OF FILLED ORDERS
MAINTENANCE COSTS ARCHIVE
REPORTING OF UNCOMMITTED MATERIALS
CLOSING REPORTS
TO DIRECTION
TO THE COSTS PROCEDURE
LIST OF MATERIALS USED
TO THE PROCEDURE OF RESOURCES RENDERED

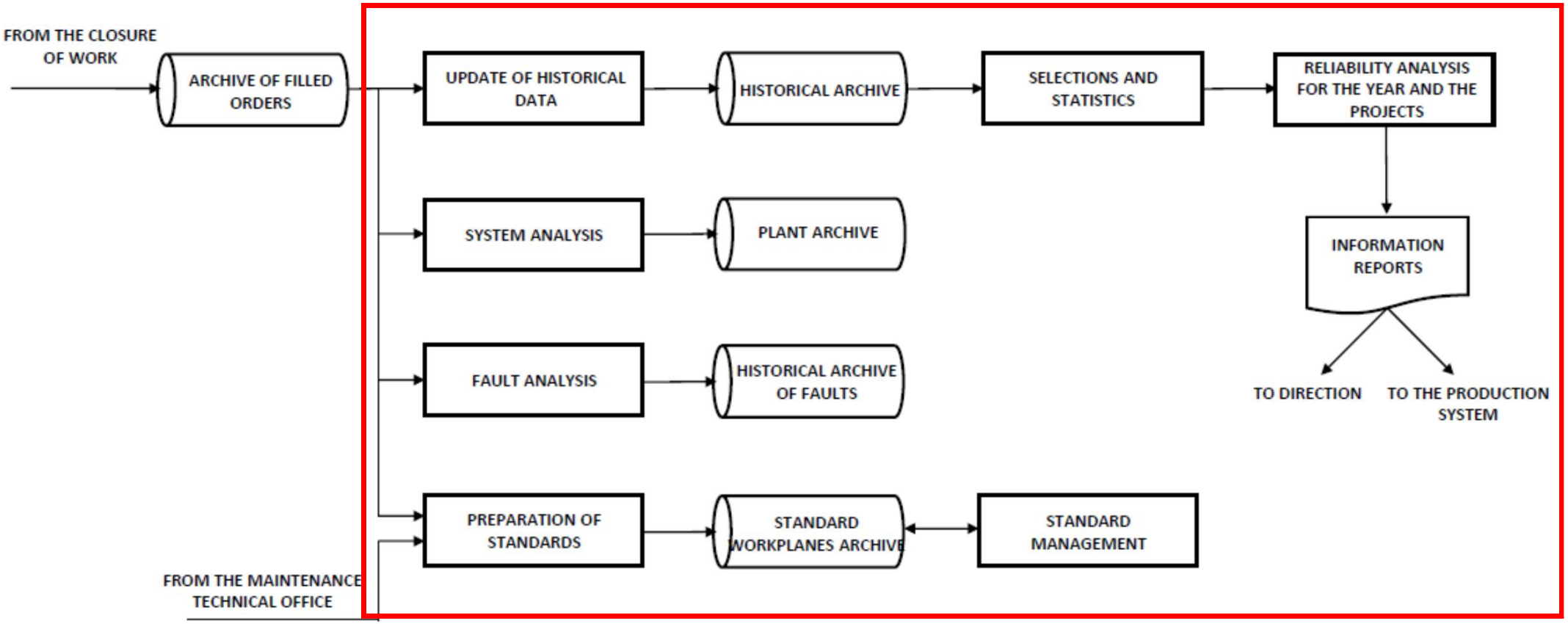
MAINTENANCE ORGANIZATION

h) analysis and standards

In this area, the historical data of the maintenance jobs are used to perform a series of analysis that allow future improvement.

The **main tasks of this function** within the maintenance organization are:

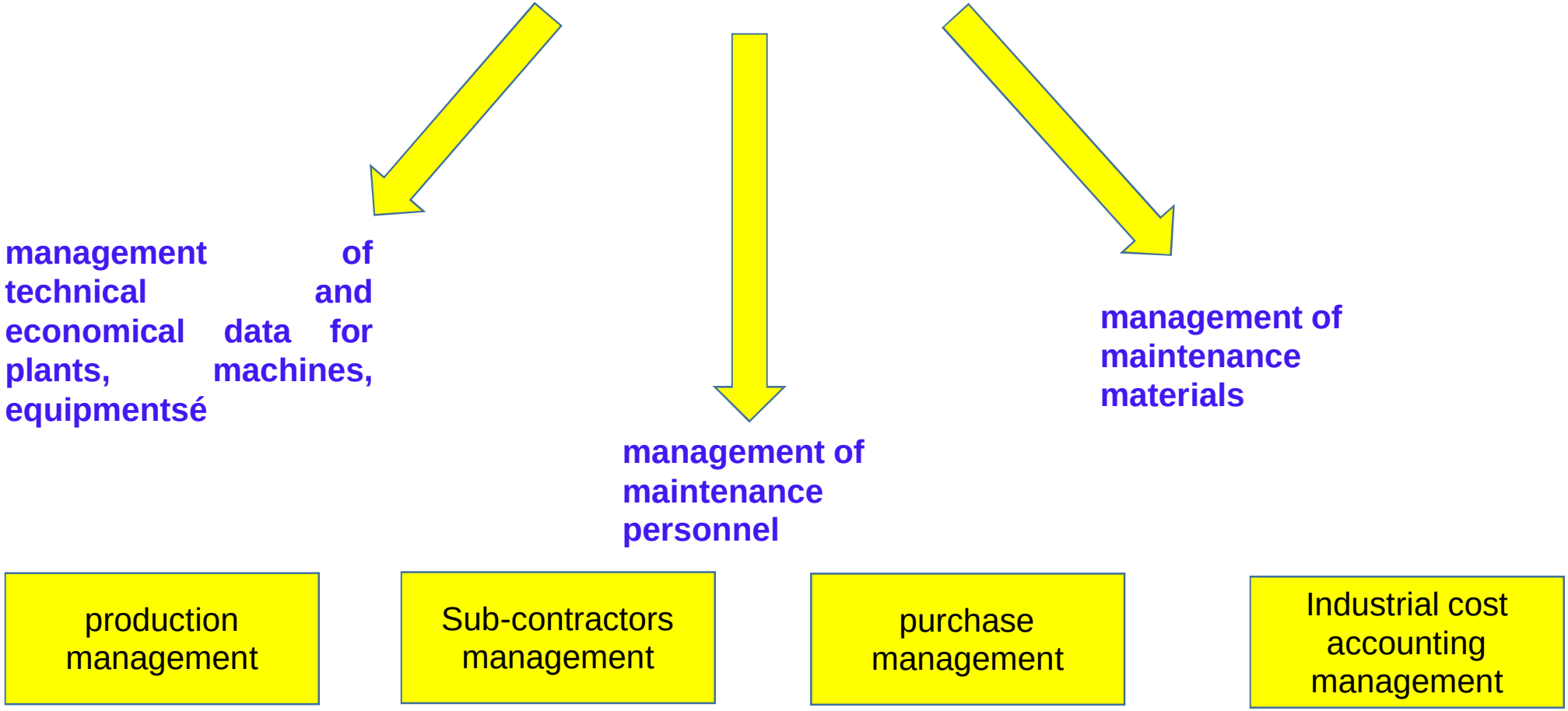
- study the results of preventive and predictive maintenance programs by analysis of the faults statistical trends (MTTF, MTTR, etc.);
- analysis of the pertinent failure rates by machine or production line and plant;
- assessment of the need for future improvement;
- comparison between forecasts and actual data;
- evaluation of used resources adequacy;
- evaluation of the performances (materials and labor) included the external suppliers and subcontractors;
- updating of intervention standards.
- preparation of new maintenance standards


FROM THE CLOSURE OF WORK
ARCHIVE OF FILLED ORDERS
UPDATE OF HISTORICAL DATA
HISTORICAL ARCHIVE
SELECTIONS AND STATISTICS
RELIABILITY ANALYSIS FOR THE YEAR AND THE PROJECTS
INFORMATION REPORTS
TO DIRECTION
TO THE PRODUCTION SYSTEM
SYSTEM ANALYSIS
PLANT ARCHIVE
FAULT ANALYSIS
HISTORICAL ARCHIVE OF FAULTS
PREPARATION OF STANDARDS
STANDARD WORKPLANES ARCHIVE
STANDARD MANAGEMENT
FROM THE MAINTENANCE TECHNICAL OFFICE

UNIVERSITÀ DEGLI STUDI DI TRIESTE

MAINTENANCE ORGANIZATION

MAINTENANCE INFORMATION SYSTEM



UNIVERSITÀ DEGLI STUDI DI TRIESTE

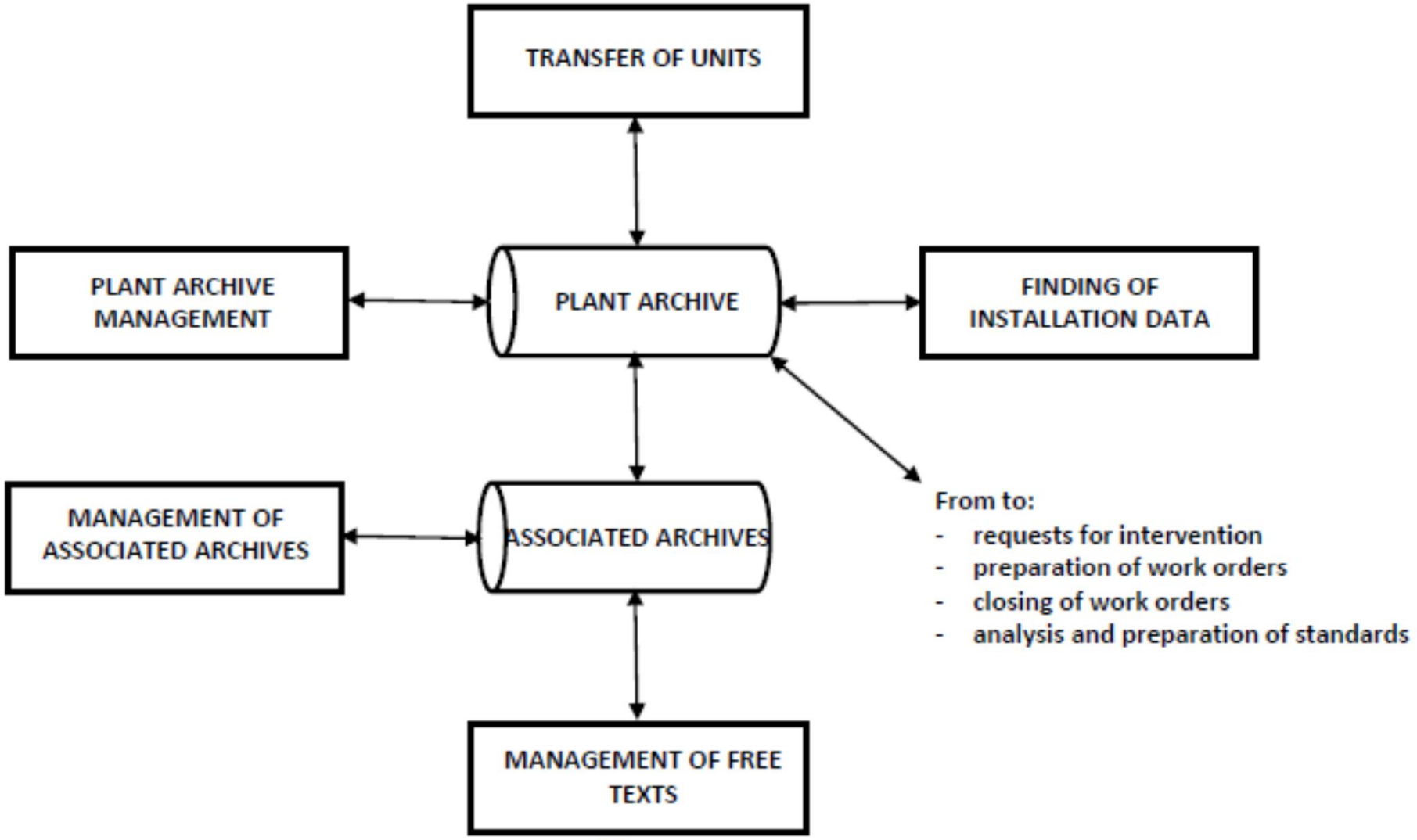
MAINTENANCE ORGANIZATION

MAINTENANCE INFORMATION SYSTEM

i1) management of plant, equipment, machinesé data

The main tasks of this function within the maintenance organization are:

- **creation of a data archive with the precise description of the plantsé , both from a technological and a production point of view.**
- **creation, insertion, modification of the characteristics of plants or parts thereof;**
- **update within the archive of information relating to the transfer of machines or operating units;**
- **retrieval of plant data at any time, even if its code is not known;**
- **creation and retrieval of data associated with the various levels of detail for the various plants;**
- **processing of technical information as descriptive texts contained in specific associated libraries**



MAINTENANCE ORGANIZATION

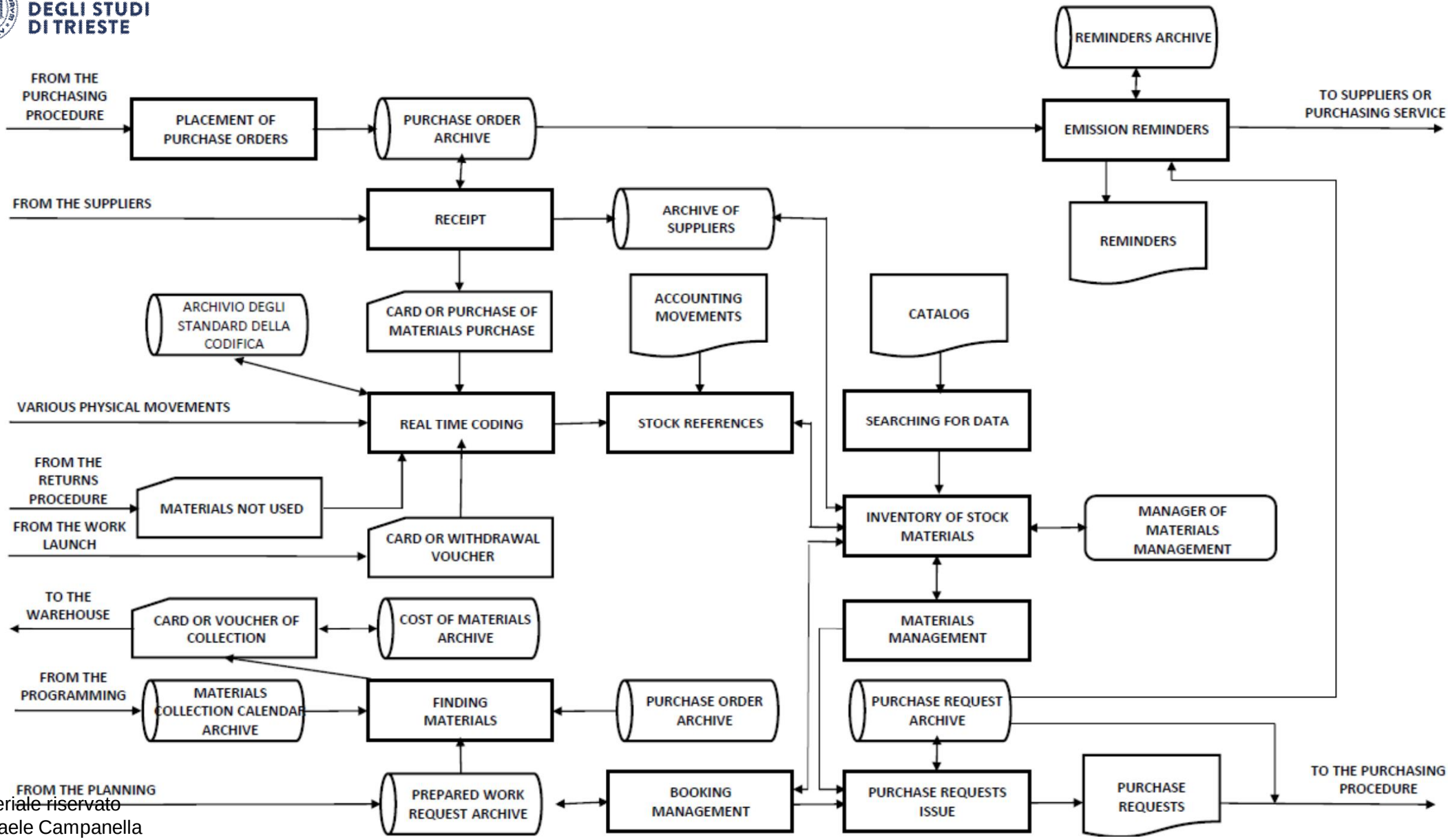
MAINTENANCE INFORMATION SYSTEM

i2) management of materials and maintenance warehouses

The main tasks of this function within the maintenance organization are:

- **planning of incoming material and continuous control and monitoring materials inventories,**
- **creation, insertion, modification and possible destruction of the descriptive data of the materials and the related management parameters;**
- **availability of the data for each material code at any time;**
- **association to the same material of several bookings linked to different work orders;**
- **real-time management of all material movements (warehouse upload, download, returns, transfers, etc.);**
- **updating of stock data following physical inventory procedures, breakages, reworking of materials;**
- **issue of purchase requests, call-off, incoming quality and quantity inspections**
- **supply to the interested engineers of all information about materials (descriptive data, management parameters, availability, status of purchase documents);**
- **on time updating on purchase requests, on issued orders and of the probable delivery dates;**

UNIVERSITÀ DEGLI STUDI DI TRIESTE



UNIVERSITÀ DEGLI STUDI DI TRIESTE

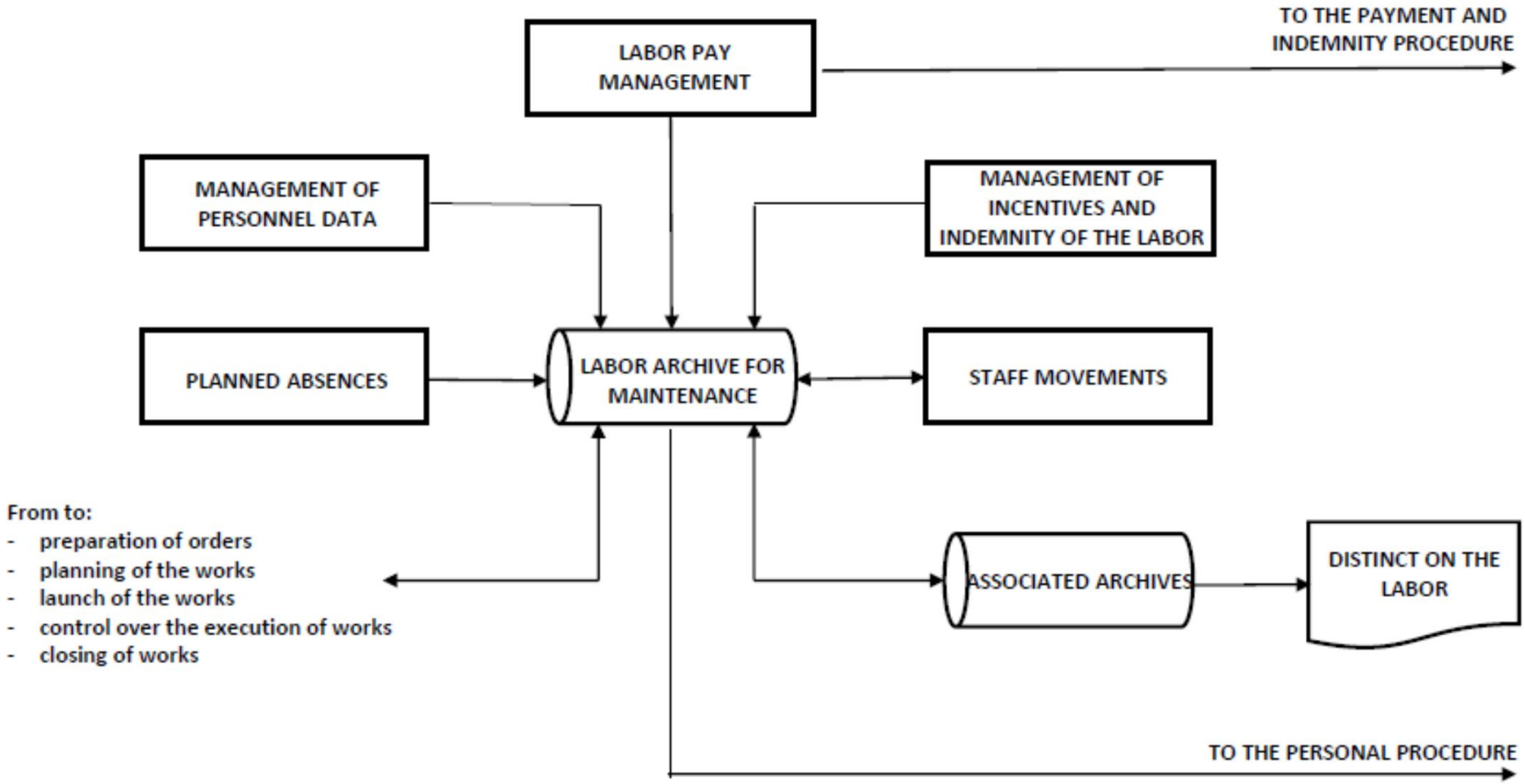
MAINTENANCE ORGANIZATION

MAINTENANCE INFORMATION SYSTEM

i3) maintenance staff management

The main tasks of this function within the maintenance organization are:

- supply the job preparation and programming depts. with updated and consistent data on the availability of manpower according the relevant professional skills;
- updating of manpower presence and absence data, useful to the operations responsible in order to know the real availability.
- management of personnel personal data, with particular reference to qualification and professional skills, training needs;
- management of temporary or permanent staff transfers;
- updating of data related to salaries, incentives and allowances that contribute to the total labour cost;
- input and storage in the pertinent archive of data related to planned staff absences;


LABOR PAY MANAGEMENT
TO THE PAYMENT AND INDEMNITY PROCEDURE
MANAGEMENT OF PERSONNEL DATA
MANAGEMENT OF INCENTIVES AND INDEMNITY OF THE LABOR
PLANNED ABSENCES
LABOR ARCHIVE FOR MAINTENANCE
STAFF MOVEMENTS
From to:
- preparation of orders
- planning of the works
- launch of the works
- control over the execution of works
- closing of works
ASSOCIATED ARCHIVES
DISTINCT ON THE LABOR
TO THE PERSONAL PROCEDURE