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USE OF FIXED PRODUCTIVE CAPITAL AT A SHIPBUILDING ENTERPRISE

By

V. I. GLADUN, N. I. SAVIN

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INTRODUCTION

Shipbuilding comprises a significant proportional amount in the economy of Khabarovskiy Kray. On the basis of introducing the modern achievements of technical progress and employing the new methods of planning and economic incentive, there has been a substantial rise in the effectiveness of shipbuilding, the growth rate of labor productivity has accelerated, and enterprise profitability has risen. However, proper attention is not given to these questions at all the shipbuilding enterprises.

The Directives of the 24th CPSU Congress on the Five-Year Plan for the Development of the USSR National Economy in 1971-1975 have posed the task of a maximum intensification of social production in all national economic sectors on the basis of the more efficient use of production capacity and fixed capital. A solution to this problem can be achieved by increasing product output per unit of fixed productive capital through the fuller utilization of machinery and equipment, by raising the shift factor, eliminating stoppages, reducing the time required to put capacity into full operation, and by further intensification of the production processes. The actual realization of these ways for raising the efficiency of social production in shipbuilding will provide an opportunity to substantially reduce product costs and raise the profitability of shipbuilding enterprises.

Such an approach will make it possible as well to significantly increase product output from the existing production capacity. For solving this important practical task, all the internal economic reserves related to the maximum use of fixed productive capital should be mobilized at the shipbuilding enterprises. This is possible only on the basis of the coordinated efforts of the entire production collectives.

In the work of the shipbuilding enterprises under the new system of planning and economic incentive, improved use of the fixed productive capital is one of the most effective ways for reducing product costs and raising enterprise profitability. Certainly the funds for the material incentive of the collectives aimed at further encouraging production efficiency are formed from this source. Thus, an improvement in fixed capital utilization combines the interests of the collectives of the individual shipbuilding enterprises and the national economy as a whole.

In order to achieve the maximum possible level in the use of fixed productive capital at each shipbuilding enterprise, sufficiently sound and diverse economic knowledge is needed by the employees of these enterprises and this industrial sector as a whole. As was pointed out in a special decree of the CPSU Central Committee on improving the economic education of the workers (September 1971), at the present stage of communist construction, with its high rate of scientific and technical progress, and significant qualitative changes in the economics of production and the character of labor, constantly greater demands are placed upon the economic education of the personnel and the broad masses of workers. Here, the economic training of the personnel operates as a most important condition for raising the scientific level of management, for increasing the creative initiative and activeness of the workers in managing production and in implementing the program outlined by the 24th CPSU Congress for the development of all national economic sectors, including the shipbuilding industry.

In this regard, the extremely important practical question is posed of a fundamental improvement in the economic education of the personnel. This education should be based on a study of the economic policy of the party elaborated at the 24th CPSU Congress. Here there must be a close tie between the economic education of the personnel and the organization of all economic work at an enterprise in order that it contribute maximally to a systematic rise in the level of management and ultimately, to the successful fulfillment of the quotas of the five-year plan.

The seeking out of reserves for improving the utilization of fixed productive capital at each shipbuilding enterprise necessitates a serious, analytical approach. Here there must be first of all an analysis of the composition and structure of the capital, as well as the character and rate of its reproduction. The pamphlet gives significant attention to these questions.

The pamphlet reviews the criteria and indicators for the economic efficiency of fixed productive capital at a shipbuilding enterprise, an analysis of return on investment and profitability is given, the effect of the capital-to-labor ratio on the growth of labor productivity is shown, and the use of modern computer equipment for calculating and analyzing fixed capital utilization in shipbuilding is described.

Particular attention has been paid to analyzing the use of equipment and production capacity at shipbuilding enterprises and to determining the ways for improving its utilization, with an assessment of the possible economic effectiveness.

The pamphlet has been written using the materials of the Nikolayevsk-na-Amure Shipyard (Khabarovskiy Kray). However, it can be of use to the employees of any shipbuilding enterprise, since its basic content is founded on the general methodological provisions for analyzing the use of fixed productive capital.

1. COMPOSITION AND STRUCTURE OF FIXED PRODUCTIVE CAPITAL AT A SHIPBUILDING ENTERPRISE

The basic task of the shipbuilding industry in the national economic complex is to fully satisfy the needs of the maritime and river fleet, the fishing industry, as well as the scientific institutions and organizations. The Directives of the 24th CPSU Congress envisage a significant increase in the output of shipbuilding product with a maximum reduction in its cost. Under modern conditions, one of the basic ways for effectively solving this problem is the intensification of shipbuilding production on the basis of a sharp improvement in the use of fixed productive capital.

The productive capital of a shipbuilding enterprise is the means of production (the means of labor and the subjects of labor) which are needed for creating the shipbuilding product, and participate in the production process of shipbuilding production. In the course of the work of an enterprise, they make a planned continuous circulation, passing through the stages of production and distribution. Depending upon the character of its participation in this circulation and the role in the shipbuilding process, productive capital is divided into fixed and working.

The working capital includes that portion of the productive capital which represents the means of labor, and serves the production process over an extended period, therein maintaining its physical form, and transferring its value to the created product gradually, part by part, along with its wear (in the form of the so-called amortization deductions). The aggregate of the fixed capital of a shipbuilding enterprise forms the physical and material composition of its physical plant.

The working capital is the other part of productive capital which is continuously consumed (spent) in the production process during a single cycle, and the value of which herein is completely transferred to the product of labor (the created product). This capital includes the subjects of labor, and precisely: Raw products, materials, intermediate goods, fuel and electric power, inexpensive and rapidly wearing out supplies, as well as incomplete production.

Fixed capital holds a predominant proportional amount in the productive capital. Here its share systematically increases. This phenomenon is completely natural, and is caused by the growth of the technical equipping and level of labor mechanization in industry, including in shipbuilding.

According to the current classification, the fixed productive capital of industry is divided into nine major groups: 1) Building; 2) installations; 3) transfer devices; 4) power machinery and equipment; 5) working machinery and equipment; 6) metering and control devices and equipment and laboratory equipment; 7) means of transport; 8) tools; 9) production and office supplies as well as other fixed productive capital. Here all the fixed capital is viewed both in physical and monetary forms.

In physical terms, the fixed capital consists of qualitatively different elements having various units of measurement (cubic volume for buildings, power for engines, number and productivity for machine tools, and so forth).

A monetary evaluation provides compatibility of the qualitatively different elements of fixed capital. It makes it possible to calculate the overall volume, the structure and dynamics of change both of all the productive capital in an aggregate, as well as its individual groups in particular. The monetary evaluation makes fixed capital quanitatively comparable in the sense that it provides a comparison of labor expenditures on its reproduction in comparable units (in monetary terms), that is, on a single scale.

Thus, with the help of a monetary evaluation, fixed capital becomes uniform (for it expresses its value through money) and quantitatively comparable (for the amount of value is measured with the same scale).

In terms of the feature and degree of participation in the production process, fixed capital are divided conditionally into two parts: Active and passive. Here the fixed capital, an increase in which is directly involved with the increase in the volume of production and the scale of production, is considered as the active part. The active part of the fixed capital in industry includes: 1) Working machinery and equipment; 2) power machinery and equipment; 3) metering and control instruments and devices, and laboratory equipment; 4) means of transport; 5) tools.

The passive fixed capital is considered to be that portion which does not have a direct effect upon the subjects of labor, but merely creates the necessary conditions for the normal course of production, namely: 1) Buildings; 2) installation; 3) transfer devices; 4) production and office supplies.

At the various shipbuilding enterprises, depending upon their specific features, the cost ratio between the individual groups of capital varies, and to a significant degree is determined by the character of the produced product. This ratio forms the fixed capital structure of an enterprise.

A study of the quantitative composition of the capital is essential for correctly assessing the shifts in its structure, since to a great degree the results of enterprise operations, and particularly the indicators for the use of the capital itself, depend upon the composition of the productive capital. An increase in the capital and its qualitative improvement are a necessary condition for the further development of the shipbuilding industry as a component of the nation's economy.

The differences in the fixed capital structure of shipbuilding enterprises are also caused by their territorial locations. The shipbuilding enterprises of Khabarovskiy Kray which are marked by a comparatively low level of specialized production, repairs and centralization of the means of transport, have in their composition various auxiliary systems which reduce the share of production-end fixed capital, and particularly the active part, the working machines and equipment.

Of definite interest is a comparison of the fixed productive capital of the Nikolayevsk-na-Amure Yard with certain similar enterprises in the European USSR (see Table 1).

Table 1

Structure of Fixed Productive Capital at Nikolayevsk-na-Amure Yard
(in % of total)

Types of Fixed Capital	Group of Enterprises in European USSR	Nikolayevsk-na-Amure Yard
Buildings	29.5	17.9
Installations	34	55.9
Transfer devices	2.5	0.9
Power machinery and equipment	3.4	2.2
Working machinery and equipment	25.0	15.4
Metering and control devices and instruments, laboratory equipment	0.4	0.3
Means of transport	4.0	4.6
Tools	0.4	0.2
Production and office supplies and other fixed capital	0.8	2.6
Total	100	100
Including, active part	33.2	22.7

From the given comparison it follows that the fixed capital structure of the Nikolayevsk-na-Amure Yard is characterized by a number of particular features, namely: A somewhat smaller proportional amount of buildings, a higher proportional amount of installations and means of transport, as well as a smaller share of working machinery and equipment.

The smaller share of production buildings in the fixed capital of the examined shipbuilding enterprise is caused by the fact that a significant portion of the production processes is carried out outside the buildings (the assembly of the ships on open ways, the higher proportional amount of finishing them in the water), by the presence of a significant portion of temporary production buildings which are to be demolished and should be replaced by capital structures, and so forth.

The relatively high proportional amount of the group of installations is explained by the specific features of this shipbuilding enterprise. Such a ratio is related predominantly to the presence of a highly developed and expensive ways system which under winter conditions is used as areas for hauling out the vessels.

The highest proportional amount of installations in the productive capital of the Nikolayevsk-na-Amure Yard is caused by the presence of an expensive drydock used for performing dock ship repairs which is not in herent to shipbuilding. The value of this dock is approximately 50 percent of the total value of all the plant's installations.

The high amount of means of transport in the fixed capital of this yard has been the result of using its own vessels and devices (pontoons, tugs and so forth) with a low level of their efficient centralized use.

A characteristic feature of the structure of the fixed productive capital at the Nikolayevsk-na-Amure Yard is the low proportional amount of the active part and above all its most important element, the group of working machinery and equipment.

Among the particular features of the fixed capital of this enterprise, in comparison with related western plants, one must also mention the increased value of fixed capital. This excess equals the value of the delivery of materials and equipment, and, consequently, in the corresponding share is reflected in an increase in the total amortization deductions.

Analysis of statistical data for the last 10 years shows that the dynamics of the fixed productive capital structure at the Nikolayevsk-na-Amure Yard and certain other shipbuilding enterprises in Khabarovskiy Kray has the following basic trends:

1) A decline in the proportional amount of production buildings in the total value of the fixed capital, as a result of the more effective use of production areas, the employment of more productive equipment, a reduction in building-installation work in construction, the elimination of excesses in construction, and so forth;

2) A certain, although insufficient growth in the proportional amount of production equipment, that is, the most active part of the fixed capital;

3) A reduction in the proportional amount of power equipment and transfer devices caused by the development of the electrification of production and by the rationalization of its forms (for example, by centralized power supply, and so forth);

4) A decline in the share of production and office supplies due to the fact that the expansion of the remaining portion of the capital did not necessitate a proportional increase in it to the same degree;

5) A reduction in the share of the tool group with an absolute rise in its unit value, although as a result of the mechanization of production, it should, generally speaking, increase with the growth of the active portion of the fixed capital;

6) An increase in the proportional amount of the group of installations which are specific for enterprises of the shipbuilding industry in the composition of the capital; their share, being rather high at present, due to technical progress, is showing a stable trend toward a further rise;

7) An increase in the proportional amount of means of transport caused by further mechanization of intrashop and intershop transport which can and should be retarded by the rational centralization for using all types of intraplant transportation.

Having analyzed the structure and composition of the fixed productive capital at the Nikolayevsk-na-Amure Yard, the following conclusions can be drawn:

1. The fixed capital structure of this enterprise, in being marked by the high diversity of its composition, is far from perfect. Individual groups of capital (working machinery and equipment, tools, automatic equipment, and so forth) still have an insufficiently high proportional amount in the composition of the fixed capital. The predominant growth of the share of the active part must be considered a positive factor in the formation of the capital structure.

2. The absolute increase in the fixed capital of the enterprise in 1960-1970 was significant. Its annual average amount was 5-6 percent.

3. As a result of the transition to the sectorial principle of centralized management for shipbuilding, at the enterprise the long-range plans reflected the tendency for an increase in the proportional amount of shipbuilding in the total volume of production, and toward an expansion of specialization and cooperation. This should entail the corresponding shifts in a direction of the more rational formation of the fixed capital structure.

2. ANALYSIS OF THE TECHNICAL STATE OF FIXED CAPITAL

The technical state of the fixed capital which is characterized by the age composition, and by wear, replacement and withdrawal coefficients, is an important national economic characteristic making it possible to judge the level of the physical plant of shipbuilding production and the possibilities for intensifying capital utilization.

The production capacity of a shipbuilding enterprise is determined not only by the quantitative composition of the equipment necessary for fulfilling the plan and by its structure, but to a great degree as well by its qualitative level, that is, by the age and ensuing degree of the capital's physical wear and obsolescence.

Over the last 10 years, the age composition of the production equipment at the Nikolayevsk-na-Amure Yard has been improved by its replacement. The proportional amount of equipment under 10 years of age has increased by an average of 10-15 percent due to a decline in the share of the old equipment.

The given data show that at the enterprise relatively modern and technically advanced equipment has been installed, and it can perform highly productive functions in terms of its immediate purpose, and provide the successful fulfillment of the production programs set for the enterprises.

At the same time, it cannot be considered normal that at the Nikolayevsk-na-Amure Yard, about 15 percent of the equipment is over 20 years of age. The presence of such a quantity of worn out and obsolete equipment tells negatively on the efficient use of the productive capital of this enterprise, as well as on the quality of the produced product and the growth of labor productivity among the workers. The data on the structure of this equipment are given in Table 2.

The data given in the table indicate that the first to be replaced should be the metal cutting, forging-stamping and woodworking equipment. At the same time, the materials handling equipment is in the best state in terms of age.

Table 2

Distribution of Equipment by Age Over 20 Years According to Purpose (in % of total)

Name of Equipment	In % of Total
Metal cutting	23
Forging-stamping	35
Woodworking	27
Materials handling	7
Foundry	8
Total	100

In examining analogously the age composition of the individual elements of metal cutting equipment, it can be concluded that the first to be replaced are the planers, gear cutters and boring machines. The replacing of these machine tools by new more productive ones would provide an opportunity to significantly raise the productivity of metalworking and reduce product costs.

The characteristics of the technical state of the fixed capital or its individual groups is shown most completely by such an indicator as the wear coefficient. It is the ratio of the total transferred wear of the fixed capital (amortization deductions for full replacement) to its initial value (or in terms of replacement value, if there has been a reevaluation of the fixed capital). In particular, the wear coefficient for the fixed productive capital of the Nikolayevsk-na-Amure Yard in 1960 was 47 percent, and in 1970, 40 percent. Its reduction in recent years has been caused by the completion of new buildings and installations (in place of the old worn out wooden structures).

With the expanded reproduction of fixed capital, there is a simultaneous change both in the amount of wear and the value of the capital. Here the wear coefficient can either rise or decline, depending upon the growth rate of the capital and its wear. If the growth of all groups of fixed capital is the same, the wear coefficient will remain a constant amount. With the disruption of such a stable relationship, and this occurs most often in reality, this coefficient will grow, if the growth rate of the value of the fixed capital will begin to lag behind the rate of wear.

The fixed capital replacement coefficient characterizes the degree of its replacement, that is, how intensely it is renewed. It, along with the wear coefficient, shows the most essential qualitative changes in the capital composition. The replacement coefficient is determined by the ratio of the value of newly received fixed capital over the report period to the total value of all capital at the end of this period. This coefficient reflects

rather fully that share which is made up by new, newly received capital in the total amount of its initial (or replacement) value.

At the examined shipbuilding enterprise in Khabarovskiy Kray, the annual average replacement coefficient of the capital for the period from 1960 through 1970 averaged about 7-8 percent. This means that the increase in the fixed capital over the last decade has reached approximately the level of its initial value in 1960.

The given data show the significant rate of fixed capital replacement. However, as analysis indicates, the actual increase in the capital is somewhat less, since in replacing the capital it has also been withdrawn, and this entails the selling (transfer) of unused technical means or writing them off from the balance sheet as a consequence of the complete wearing out and the impossibility or economic inadvisability of their further utilization.

The withdrawal coefficient is defined as the ratio of the value of withdrawn fixed capital to the total value of all capital at the end of the report period. The increase in the fixed capital withdrawal coefficient at the enterprises of Khabarovskiy Kray in recent years indicates greater attention to the questions of writing off obsolete and worn out equipment and the transfer of unutilized technical means to other enterprises. The necessity of transferring equipment to other enterprises is caused by the effect of the periodic change in the range of produced product, and in recent years, by the requirements of the economic reform related to the improved use of fixed capital in all national economic sectors.

Analysis of the present technical state of the fixed productive capital at the shipbuilding enterprises of Khabarovskiy Kray indicates that the problem of a systematic improvement in its efficient use is extremely urgent for these enterprises, and requires an immediate practical solution. The necessary objective prerequisites for solving it have been created by converting the enterprises to the new system of planning and economic incentive which offers broad opportunities for raising the economic efficiency of shipbuilding production.

3. REPRODUCTION OF FIXED CAPITAL

In all the national economic sectors of our country, on the basis of the most recent achievements of scientific and technical progress, an intensive process is occurring of replacing and qualitatively improving the fixed productive capital. On the one hand, this is occurring by the use of new technically most advanced and economically efficient means of production in the event of new construction, by reconstruction or expansion of the enterprises, and, on the other, by the modernization or replacement of equipment at operating enterprises. The aim of reproduction is to replace the worn out fixed capital or create new capital to replace that withdrawn from the production process.

In terms of its content, two types of reproduction are distinguished: 1) simple, when the replacement of the capital does not exceed the amount of wear; 2) expanded or net when there is not only the replacement of wear, but also an increase in the fixed capital.

Major overhaul holds a special place in the system of fixed capital reproduction. It necessitates significant material and labor expenditures which, as a whole for the USSR national economy, annually reach more than 10 billion rubles. With the rise in the fixed capital, the expenditures for it [repairs] systematically increase, year after year. For this reason, the question of the economic role of the major overhaul of fixed capital is of great practical significance.

In the process of major overhaul, the natural form of the individual worn out parts or assemblies of the fixed capital is merely replaced. Here, the quantity of machines, equipment or other types of productive capital does not increase, the number of parts in them, as a rule, does not change, and their technical and operating parameters are not raised. More often, on the contrary, they do not achieve the initial built-in level.

Periodic major overhauls of fixed capital at shipbuilding enterprises annually require significant labor and material expenditures which have a substantial effect on the cost of building the ships.

It must be pointed out that at the shipyard in Nikolayevsk-na-Amure economically sound overhaul on the fixed productive capital is still carried out unpromptly and in an insufficient volume. Nonfulfillment of the repair plans is also permitted for individual groups of capital, as well as an unjustified arbitrary redistribution of assets between the nonproduction and production projects.

Such an approach is explained by the fact that the repair services do not provide prompt and high quality repair of the equipment. Such a situation, combined with the absence of proper maintenance and planned preventive repairs, inevitably causes a deterioration of the technical state of the fixed capital. The repair services are one of the "bottlenecks" at the shipbuilding enterprises, including at the Nikolayevsk-na-Amure Yard. The elimination of this "bottleneck" is in importance among the primary tasks.

We must particularly point out that shortcomings in the organization of the work of the repair services are common for a number of shipbuilding enterprises. These include: Poor production capacity of the repair facilities; high personnel turnover and the related understaffing of the repair services with skilled workers, engineers and technicians, with the main reason being in the lower level of their wages in comparison with the same categories of employees in basic production (where, in addition, a more advanced bonus system is employed); the failure to observe the schedules for planned preventive repairs which are often lacking, and for this reason, as a rule, the repairs are done not according to the schedule, but when one or another piece of equipment fails; the execution of major overhauls without removing the equipment from the base or foundation, and this tells negatively on the quality of the repair work and on the activities of the basic production shops and sections; unsatisfactory centralized supply of spare parts for repairing the equipment and poorly organized cooperation with other enterprises; insufficient introduction of the unit method for repairing equipment; the distraction of workers from the repair shops (sections) to perform work of basic production and other jobs not specific to them; the low level of organizing repairs and insufficient attention to the repair services, as auxiliary productions, by the enterprise leadership; the invalidity of a number of ideas on which the current system of planned preventive repairs is based.

In comparing the actually performed volume of major overhauls with the amortization deductions, instances are often disclosed of understating the volume of repair work on all types of equipment and an overstating of the amount of repairs on buildings and installations. Here unplanned construction and installation work is sometimes done with repair money.

From what has been said, it follows that insufficient attention is given to the questions of equipment repairs. As a result of this, the technical state and production accuracy of the equipment deteriorates, and the technical and economic indicators of its use decline.

The leadership of the plants often have an attitude toward the repair service at shipbuilding enterprises of a third-rate subdivision, the chief task of which is to maintain the equipment in a working state. In other words, the function of purely repair production is shoved to the forefront, and the economic role of this service is played down. In accord with this role, the service, along with basic production, is an equal participant in the production and economic activities of any enterprise. This situation has been aided in the past by assessing enterprise operations depending upon plan fulfillment for gross product, as this did not encourage product output with the minimal expenditures of live and embodied labor. Under the conditions of the economic reform, in line with the changeover to assessing the operations of shipbuilding enterprises according to profit and profitability, the attitude toward the repair services should be substantially changed. Here, due to their extended lag in the level of organization behind basic production, significant reserves have accumulated for raising enterprise profit, and these necessitate maximum use. The expanded reproduction of fixed capital at a shipbuilding enterprise is carried out using the following capital investment sources: Budget allocations; enterprise development fund; amortization deductions and certain other sources (money received from the sale of surplus equipment, bank credits, and so forth). The proportional amount of each financing source in the total volume of capital investments is given in Table 3.

Table 3

Structure of Capital Investment Financing Sources
(in % of total)

Sources	Shipbuilding Enterprises of Khabarovskiy Kray	
	1961-1965	1966-1970
Budget allocations	85.0	78.0
Amortization deductions	11.5	14.0
Enterprise development fund	2.5	5.5
Other	1.0	2.5
Total	100	100

From the data of the table it follows that the basic source of capital investments for shipbuilding enterprises prior to their conversion to the new conditions of planning and economic incentive was budget funds which reached 85 percent of the total capital investment. Prior to 1966, these enterprises still did not sufficiently use Gosbank loans (credit) for expanded reproduction. Under the conditions of the economic reform, the situation has changed significantly. For example, for the 1966-1970 period, the share of capital investments carried out from the enterprise development fund rose by 2.2-fold, and the share of credit investments by 2.5-fold.

An analysis of the volumes of expanded reproduction at certain enterprises of Khabarovskiy Kray indicates that the completion of fixed productive capital for virtually the entire Eighth Five-Year Plan was less than the total capital investments into the capital. For this reason, incomplete construction rose constantly. From the standpoint of production development and its efficiency, a rise in incomplete construction is an extremely unfavorable factor. The funds tied up in incomplete construction represent that portion of the annual accumulation fund which does not produce any productive return. Of course, a reasonable amount of it is inevitable to the degree that it is caused by the necessity of creating production installations. However, the construction of projects at shipbuilding enterprises, as a rule, is carried out with a significant exceeding of the existing time standards, and this leads to the formation of excessive frozen stocks of material means in the uncompleted projects.

The lengthening of construction times is related primarily to the scattering of funds over numerous projects and to the low level of construction organization. The problem of reducing the volume of incomplete production can be solved only by concentrating the capital investments on the most important projects, by reducing the number of such projects to an optimum level, by improving their material and technical supply, and by raising the level of organization in all construction. These ways have been outlined by the CPSU Program where it is particularly stressed that a concentration of capital investments in the decisive areas, the elimination of the scattering of capital expenditures and an acceleration in completing the enterprises under construction should become an indispensable condition for economic planning and organization.

Expanded reproduction of fixed capital at shipbuilding enterprises has been accompanied not only by a quantitative rise in the operating means of labor, but also by their qualitative improvement. The quality aspect of expanded reproduction of the fixed capital is determined by scientific and technical progress in shipbuilding and in the sectors producing equipment for the shipbuilding enterprises.

Modernization of the operating equipment is one of the important directions in technical progress within the shipbuilding industry and an effective means for raising labor productivity.

The necessity of modernizing the fixed productive capital of the shipbuilding enterprises is caused by its obsolescence. In contrast to major overhaul, modernization is to a certain degree an element of expanded reproduction, regardless of what sources are used to cover the expenditures on carrying it out. If a major overhaul basically involves additional labor expenditures merely for maintaining the operating equipment in a workable state, modernization leads to a strengthening of its efficiency and to a rise in capital efficiency. For this reason, modernization expenditures are provided by capital investments for fixed capital from the major overhaul funds, Gosbank credits, below-limit capital investments, and the production development fund.

Modernization is a most important means for eliminating losses from the obsolescence of technical means, and an inseparable component in the uninterrupted replacement of fixed capital of a shipbuilding enterprise in the process of expanded reproduction. It provides a systematic rise in labor productivity by improving the capital on the basis of the achievements of scientific and technical progress, being one of the most effective ways of production intensification.

Practice shows that by modernizing operating productive capital, in a number of instances the same (and even higher) results are achieved in raising labor productivity, improving the quality of the product produced, and so forth, as with the installation of new equipment. It must be pointed out that expenditures on modernization usually do not exceed 30-50 percent of the value of new equipment.

Equipment modernization at shipbuilding enterprises in the kray in no way is a temporary and compulsory measure caused by current difficulties in replacing (renewing) obsolete machinery and equipment. It must be viewed as an important component of the measures aimed at improving the productive capital, and as one of the rational engineering and economic solutions for renewing the means of production in a modern form in the course of expanded socialist reproduction for saving both live and previous labor. For this reason, the greatest attention should be given to the questions of modernizing fixed capital in the Ninth Five-Year Plan (1971-1975).

The rate of equipment modernization in the USSR national economy has risen particularly significantly since the June (1959) Plenum of the CPSU Central Committee which recognized the necessity of accelerating the execution of this work. Here the standard designing and elaboration of annual modernization plans made it possible to achieve rather high rates of its execution. Under the conditions of the economic reform, additional economic prerequisites and incentives were created, contributing to the modernization of the productive capital.

As is known, equipment which has been in operation for a long time is subject to obsolescence. The level of obsolescence at shipbuilding enterprises is rather high, and to a significant degree it can be reduced by modernization.

However, sufficient attention is still not given to equipment modernization. The funds provided for carrying it out in the annual plans are rather insignificant. At the Nikolayevsk-na-Amure Yard, the modernization plans were often not even worked out, and the small actual expenditures on it were of a random sort. These funds were created by redistributing money earmarked for the major overhaul of fixed capital.

It must be pointed out that any number of instances, modernization has not led to the desired results due to the fact that it is restricted to insignificant technical decisions (for example, to minor design changes in assemblies, to replacing flat drive belts with V-shaped ones, and so forth). The

equipment modernization plan often includes measures which do not improve the most important technical and economic characteristics of the units (for example, the installation of all the possible additional control handles, various types of safety guards, redesigning dials, changing the vernier, and so forth). Certainly such improvements on old machine tools are essential. However, they should be put in a separate group and carried out under the list of repairs and not by the modernization funds.

It must be pointed out that up to now the work related to equipment modernization has been done on a decentralized basis, chiefly by the forces of the shop repair bases or by the repair shops of the enterprise. The repair services themselves are at times equipped with obsolete and worn out equipment, they are overloaded with orders for manufacturing nonstandard equipment, and are also forced to provide help in fulfilling the plant plan for the output of basic products. All of this, without any doubt, is reflected both in the quality and in the cost of modernization work. In addition, the enterprises do not have standard modernization plans.

Prior to the economic reform, the shipbuilding enterprises were little interested economically in equipment modernization, since the new equipment was virtually received without charge, and own funds had to be spent on modernization. For this reason, modernization was carried out to a great degree under administrative pressure or in those instances when the needed new equipment was not allocated. A reason for the absence of proper interest by the shipbuilding enterprises in equipment modernization was also the periodic underloading of the equipment with production orders, as can be seen from the low shift coefficient for its work. The actually existing equipment surplusses lead to a low use factor, to unplanned repairs and an underestimation of the importance of modernization. The disclosing of surplus capital was often impeded by the absence of accounting for the use of equipment and calculations of its load factor.

With the conversion of the enterprises to the new system of planning and economic incentive, the replacing of productive capital, now linked to a payment for the capital, caused an increase in the profit payments to the budget. Under the conditions when, on the one hand, the state must be paid for the use of fixed capital, and on the other, the enterprise has an opportunity to channel, at its discretion, money of the production development funds for major overhauls and modernization to replacing obsolete equipment, an economic basis for the ways for the optimum renewal of fixed capital assumes primary practical significance.

4. CRITERIA AND INDICATORS FOR THE ECONOMIC EFFECTIVENESS OF FIXED CAPITAL UTILIZATION

For evaluating the level and effectiveness of fixed capital at a shipbuilding enterprise, it is essential to proceed from the criteria of the economic effectiveness and a system of indicators which most fully determine the use of this capital. Such a procedural approach makes it possible on an economically sound basis to assess the effectiveness of the individual measures aimed at maximally utilizing the internal production reserves related to the functioning of fixed capital.

The complete satisfying of the needs of the nation for shipbuilding with minimal capital and current expenditures is the national economic criterion for the economic effectiveness of fixed capital utilization in the shipbuilding industry. As for the effective use of fixed capital at the individual enterprises, for this purpose a system of special interrelated indicators is required, making it possible to provide a rather complete and objective assessment.

Since the effectiveness of shipbuilding production must be viewed primarily from the position of meeting the requirements of the national economy for its product, the use of its fixed capital is subordinate to solving this basic task. Here for assessing the effective use of the fixed capital, as a consequence of the complexity of this technical and economic phenomenon, it is impossible to restrict oneself to any one generalizing indicators. At the same time, the use of several indicators complicates the solving of this important problem, since the indicators themselves may have a contradictory character. Using a system of indicators, for example, it is impossible to obtain a standard answer to the question of at what enterprise the effective use of the fixed capital is higher. This becomes possible under the condition that a basic and generalizing indicator is determined in the aggregate of indicators. The possibility of a comprehensive evaluation of the effective use of fixed capital is achieved by the choice of such an indicator. Here, the importance of the other indicators which describe fixed capital utilization from various positions (time, productivity, and so forth) maintain their significance. In this sense, the effective use of the fixed capital is, as it were, expressed through a system of indicators.

Certain economists have proposed considering the amount of national income per worker as the basic, generalizing indicator for the effective use of fixed capital, others have proposed the return on investment, and still others the level of fixed capital profitability. Let us examine the applicability of these indicators for judging the economic effectiveness of fixed capital utilization at shipbuilding enterprises.

As is known, an increase in national income from a rise in labor productivity has always been viewed as a most important indicator for all the national economic development plans, and its fulfillment has been at the center of attention of the planning and economic bodies. However, this indicator can characterize the effective use of fixed capital only on a level of the individual industrial sectors or the national economy as a whole. But for describing fixed capital use at individual enterprises, such an effectiveness indicator is too general.

An indicator which more concretely characterizes the effective use of fixed capital within an enterprise can be considered the profitability level defined as the ratio of the total profit to the annual average value of fixed capital and normed working capital. The realisticness of this indicator depends greatly upon how accurately the prices for shipbuilding products correspond to the socially necessary labor expenditures.

However, the dynamics of this indicator can be contradictory even with economically sound prices. This may occur, for example, in the instance when the volume of shipbuilding production is increased insignificantly, at the same time that significant measures are carried out at the enterprise to improve production and its organization, and involving an increase in fixed capital. In the designated instance, the total return on investment measured by the volume of gross product to the annual average value of working capital can decline, while the profitability level may rise.

Moreover, instances are possible when an increase in product output outstrips the growth of the value of fixed capital. Here, to a significant degree this is related to a rise in production outlays. Then, with an increasing return on investment, a decline in the indicator of the profitability level is possible.

For substantiating the above-given, Table 4 presents a comparison of the dynamics of the indicators of the overall return on investment and the profitability level of a shipbuilding enterprise.

The data of the table illustrate the discrepancy in the dynamics of the overall return on investment and the profitability level. In line with this, it is essential to conclude that for analyzing the effective use of enterprise fixed capital, a combined use of these indicators is not always possible. Here it is essential to bear in mind that the use of each of these indicators separately for assessing the effective use of fixed capital is all the more undesirable. The problem is that the profitability level in and of itself

Table 4

Dynamics of the Indicators of Overall Return on Investment and Profitability Level in 1970 (in % of 1965)

Indicators	Growth
Volume of gross product	125
Profit	150
Average annual value of fixed productive capital	145
Annual average value of fixed productive capital and normed working capital	130
Overall return on investment	85
Profitability level	120

cannot always disclose an unfavorable ratio between the dynamics of fixed capital and the product volume, while the overall return on investment has a number of weak aspects related to the imperfection of the gross product indicator.

In terms of shipbuilding enterprises, the shortcomings of the overall return on investment indicator consists in the following. First of all, the shifts in the assortment of the produced product which cause a change in its material intensiveness inevitably are reflected in a distorted manner on the capital return indicator, regardless of the actual improvement or deterioration in the use of equipment and production capacity.

The second, most essential shortcoming of this indicator consists in its dependency upon a change in the level of specialization and cooperation of the enterprises. Here it is characteristic that if an enterprise creates its own production of certain articles, its return on investment will inevitably decline. But if it receives these articles through subcontracting, then the level of the overall return on investment indicator will rise accordingly.

One of the essential negative aspects of the overall return on investment indicator is the fact that this indicator can decline with a rise in the level of the mechanization and automation of production processes, and even with an improvement in working conditions, aesthetics and production efficiency. Such a dependency is caused by a certain rise in the value of the fixed capital related to the effect of the above-indicated factors, in the absence of the proportional growth of product output.

However, a decline in the return on investment in the designated instance is temporary, and over a certain period of time should be compensated for by a corresponding rise in labor productivity from the introduced innovations at

the enterprise. It is essential to point out that this shortcoming of the return on investment indicator, in comparison with the ones noted previously, is the least essential, and for this reason should be considered last.

In line with the presence of the above-noted shortcomings, the return on investment indicator has recently been subjected to extremely sharp criticism in the economic press. Here they wrongly overlook its important practical significance. In line with this, it is essential to improve this indicator in the proper manner in order to reduce the manifestation of the shortcomings inherent to it. Such an approach is very important because, in line with the changeover of the enterprises to the new system of planning and economic incentive, without employing the return on investment indicator, it is simply impossible to get by in the planning and management of shipbuilding production, and also in evaluating its effectiveness.

The above-examined shortcomings of the return on investment indicator can be eliminated by replacing the gross product indicator which is used for calculating it by the indicator of conditionally net product. The advantages of the conditionally net product indicator, in comparison with gross product in measuring the return on investment, are so obvious that they do not necessitate any special proof. Here it is essential to stipulate that by conditionally net product one understands the product obtained by subtracting from gross product the cost of the raw product, materials, fuel and electric power, as well as contractual deliveries and work.

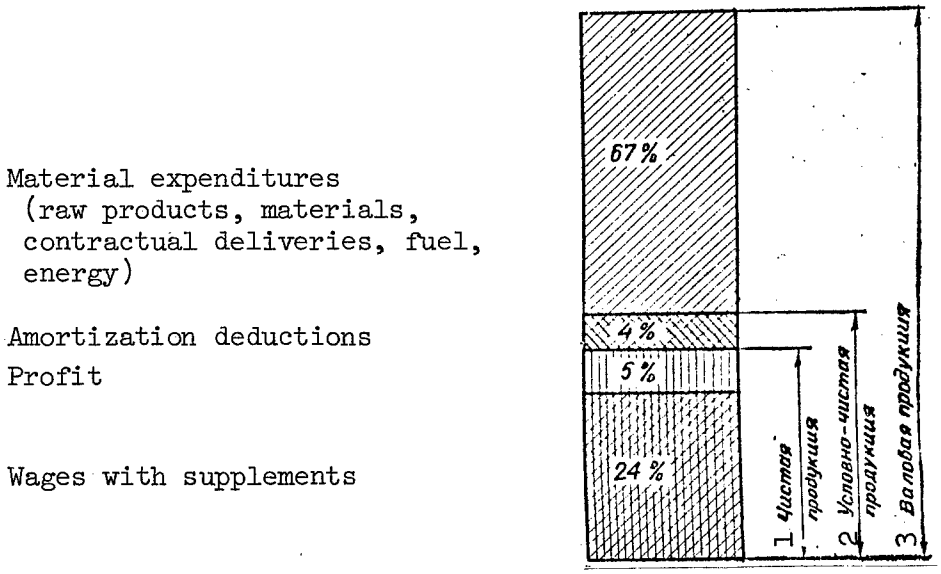

Fig. 1. Structure of Gross, Conditionally Net and Net Product

Key: 1. Net Product
2. Conditionally Net Product
3. Gross Product

In order to provide a sufficiently complete notion of the essence and structure of gross, conditionally net and net product, let us examine the scheme of the economic content of these indicators as shown in Figure 1. From the given scheme it can be seen that in the gross product of the examined shipbuilding enterprise, the newly created value, minus the transferred value, comprises only one-third, while expenditures of other sectors, the product of which has been consumed at the given enterprise during the year, comprise a predominant share.

On the basis of conditionally net product, it is possible to construct an indicator for the conditionally net return on investment which is characterized by its ratio to the value of the fixed productive capital according to the following calculation scheme:

$$F_{cn} = \frac{P_{cn}}{C_{pc}} = \frac{G_1 - (V_{bm} + V_{am} + V_f + V_e + V_c)}{C_{pc}} \times K(\text{rubles}),$$

where F_{cn}--indicator of conditionally net return on investment;
P_{cn}--conditionally net product;
C_{pc}--value of fixed productive capital;
G_1--gross product in wholesale prices in effect in analyzed period;
V_{bm}--value of raw products and basic materials (from the estimate of expenditures on production);
V_{am}--value of auxiliary materials;
V_f--value of fuel;
V_e--value of electric energy;
V_c--value of contractual work and deliveries;
K--conversion factor for current wholesale prices into fixed prices, equal to $G_2:G_1$;
G_2--gross product in fixed wholesale prices.

The indicator of the conditionally net return on investment is more objective, since it, being cleansed of the transferred material expenditures, is free of double counting, and does not depend upon such factors as a change in the proportional amount of the material intensiveness of the product, the volume of specialization and subcontracting, and so forth. Its most important feature is that with structural shifts in the shipbuilding program and in the composition of the fixed productive capital of the enterprises, this indicator, in contrast to the overall return on investment, rather completely characterizes the degree of the effective use of fixed capital. For this reason, it is essential to apply the above examined indicator of conditionally net return on investment as the basic indicator which most fully characterizes fixed capital use and is free of the effective factors which do not depend upon the work of the shipbuilding enterprises.

Thus, an evaluation of the effective use of fixed productive capital at shipbuilding enterprises, in order to avoid incorrect and subjective conclusions, should be carried out on the basis of the indicator of conditionally net

product which characterizes the amount of newly created value without double counting.

The practical use of this indicator in analyzing fixed capital utilization at a number of ship repair and shipbuilding enterprises has proven fully effective. Such an approach made it possible to more objectively assess the actual situation in the area of fixed capital utilization, and on this basis provide the most effective recommendations which were used in practice.

The basic advantage which makes it possible to consider the conditionally net return on investment as the most generalizing (analytical) indicator for the effective use of fixed capital consists in the fact that this indicator reflects both the quantitative (the production volume) as well as the qualitative (the intensity of capital utilization) characteristics in their relationship and reciprocal causality.

The other technical and economic indicators employed in analyzing fixed capital utilization (capital profitability, the capital-to-labor ratio, capital intensiveness, output of product per unit of area, and others) in reflecting fixed capital effectiveness from the corresponding particular positions, rationally compliment the above-examined basic generalizing indicator (the conditionally net return on investment). They perform the functions of complimentary or auxiliary indicators used for analyzing fixed capital effectiveness from the standpoint of labor intensiveness, labor productivity and the use of production capacity and areas.

5. ANALYSIS OF THE RETURN ON INVESTMENT AT A SHIPBUILDING ENTERPRISE

The achieving of the greatest results with the least expenditures, particularly under the conditions of the new management system, is becoming the basic requirements of socialist production. An improvement of just 1 percent in the use of the fixed productive capital of industry is tantamount on a nationwide scale to an annual savings of capital investments running into the billions of dollars.

The indicator of conditionally net return on investment, as was pointed out above, is a generalizing indicator for the use of fixed productive capital. It is determined by the ratio of the volume of conditionally net product to the average annual value of the fixed productive capital. Here the capital is usually accounted for according to its initial value, and if a reevaluation has been carried out, then according to the replacement value without discounting wear.

In determining the indicator of conditionally net return on investment, one should account for both owned as well as leased fixed capital. This is essential because the designated indicator characterizes the net production result achieved as a consequence of the net use of all fixed capital participating in the production process at the given shipbuilding enterprise.

The indicator of conditionally net return on investment is of important significance both for analyzing fixed capital utilization as well as for planning practices (in particular, for establishing proportions between the production volumes and the amount of fixed capital in terms of its value, for adjusting this ratio in a direction of the predominant growth of the production volume in comparison with an increase in fixed capital).

In acting in the role of a regulator of the ratio of the production volume and fixed capital, the indicator of the return on investment as well as the indicator which is the inverse of it (capital intensiveness) can be used for determining the necessary volume of capital investments into the fixed capital of a shipbuilding enterprise and shipbuilding as a whole.

The level of the conditionally net return on investment is influenced simultaneously by a multiplicity of frequently contradictory factors. Some of them increase the amount of the return on investment, while others, conversely, cause a reduction in it. Among the factors which change the return on investment, one must make a distinction between the objective ones which do not depend upon the shipbuilding enterprises, and the subjective ones related to the work of the enterprises themselves.

A characteristic feature of many enterprises in Khabarovskiy Kray is the increased value of the fixed capital caused objectively by the severer natural and climatic conditions, by the higher level of transport costs, and by certain other external factors. As a result, these factors significantly effect the reduction in the level of the return on investment. For the same reason, the capital intensiveness of the product is high, significantly surpassing its average level at the enterprises in the western regions of the nation.

Analysis of fixed capital utilization over the 1960-1970 period shows that at a number of enterprises in Khabarovskiy Kray, including at the shipyard in Nikolayevsk-na-Amure, the average level of conditionally net return on investment prior to 1966 was low. Beginning with 1967, a tendency could be seen toward its increase.

An indespensable condition for the growth of conditionally net return on investment is the more rapid growth of the production volume, in comparison with increase in the value of the fixed capital. With a violation of this ratio, the return on investment declines, and this is caused by a worsening of fixed capital utilization as a result of the disproportion between the capital and the production volume.

From the practical standpoint, it is very important to establish the reasons for a change in the level of a return on investment, and to analyze the degree of the influence of various factors on it. For this, it is essential to use a special, correctly constructed analysis method.

The authors of this work have proposed a variation of the factor analysis method for the indicator of the net return on investment as worked out on the basis of the method of the Scientific Research Economics Institute of the USSR Gosplan for evaluating fixed capital utilization according to the overall return on investment. This variation of the method considers the particular features of forming the indicator for conditionally net return on investment, in comparison with the indicator of the overall return on investment.

Among the important factors which influence the change in conditionally net return on investment are: The level of extensive and intensive use of the equipment; the production structure of the fixed capital; the proportional amount of product material intensiveness, contracting deliveries and work; the value of uninstalled, surplus and spare equipment and machinery; the level of the wholesale prices for the produced shipbuilding product.

Using a hypothetical example, let us examine the method of evaluating the effect of each listed factor on the return on investment indicator. The calculation is based upon the return on investment in the base year (for which we have used 1960) and equal to 1 ruble 20 kopecks of conditionally net product. The problem is to determine what factors were responsible for the actual change in the return on investment in 1970.

The set problem is solved in the following sequential stages:

1. The effect on the initial conditionally net return on investment by changes in the extensive use of equipment can be shown according to the following formula:

$$\Delta F_1 = F_0(K_1-1) , \tag{1}$$

where ΔF_1--increase in the conditionally net return on investment due to a change in equipment use over time, rubles;
F_0--return on investment in base period, rubles;
K_1--coefficient for the change in the level of extensive use of fixed capital. This coefficient is the following ratio:

$$K_1 = \frac{T_1}{T_0} . \tag{2}$$

In this formula, the values of T_1 and T_0 are the actually worked time as an average for each unit of installed equipment during the current and base periods, respectively. Let us assume that at a shipbuilding enterprise 1,470 hours in 1960 and 1,100 hours in 1970 were worked, respectively, per unit of equipment. Consequently, the increase in the return on investment during this period as caused by the action of the designated extensive factor equals:

$$\Delta K_1 = 1.20 \left(\frac{1100}{1470} - 1\right) = -0.3 \text{ rubles.}$$

The fact that the increase in the conditionally net return on investment in the given example was with a minus sign shows that actually a decline occurred (by 0.3 ruble). Here the decline in the return on investment occurred as a result of the poorer use of the enterprise fixed capital (in the designated example, by almost 25 percent). The level of this reduction in relation to the base level of the return on investment was also approximately 25 percent (0.3:1.20).

2. The amount of the change in the conditionally net return on investment as a consequence of the change in the intensive use of equipment (F_2) can be determined according to the formula:

$$\Delta F_2 = F_0(K_2-1) , \tag{3}$$

where K --coefficient for measuring the level of intensive equipment use determined in the following manner:

$$K_2 = \frac{N_1}{N_0}, \tag{4}$$

where N_1 and N_0--output of conditionally net product per unit of equipment during the current and base periods, rubles.

At the plant viewed as an example, the output of conditionally net product per unit of equipment in 1960 equalled 29,000 rubles, and in 1970, 22,000 rubles. Respectively, the change in the conditionally net return on investment, under the effect of the intensive use of fixed capital, equalled:

$$\Delta F_2 = 1.20 \left(\frac{22,000}{20,000} - 1\right) = -0.288 \text{ rubles.}$$

3. The change in the conditionally net return on investment under the influence of changes in the production structure of the fixed capital (F_3) can be determined in the following manner:

$$\Delta F_3 = F_0(K_3 - 1), \tag{5}$$

where K_3--coefficient measuring production structure of fixed capital determined by the following formula:

$$K_3 = \frac{(Ca_0 + Ca_1 B) \cdot P_0}{P_1 C_0}. \tag{6}$$

In this formula:

P_0, P_1--average annual value of fixed capital in base and current periods, respectively, rubles;
Ca_0--value of its active portion in base period;
Ca_1--increase in its value over designated period, rubles;
B--coefficient reflecting price ratio for equipment (price index) in current and base period (price increase or decline).

In our example, let us assume:

P_0 = 9,395,000 rubles; P_1 = 13,273,000 rubles.
Ca_0 = 1,713,000 rubles; Ca_1 = 1,072,000 rubles. Here B = 1_1, since the prices for the acquired equipment have remained unchanged.

Hence:

$$\Delta F_3 = 1.20\left(\frac{9395(1713+1072\times 1)}{13273 \times 1713} - 1\right) = 0.22 \text{ rubles.}$$

4. The effect of the change in the proportional amount of product material intensiveness, contractual deliveries and work on the net return on investment is calculated according to the formula:

$$\Delta F_4 = F_0(K_4-1) , \qquad (7)$$

where $K_4 = N_0/N_1$--coefficient for the change in the proportional amount of materials contractual deliveries and work in product cost;

N_0, N_1--proportional amount of materials, contractual work and deliveries in the total product volume during base and current periods.

In our example: N_0 = 61.3 percent; N_1 = 61.2 percent.

Hence:

$$\Delta F_4 = 1.20\left(\frac{61.3}{61.2} -1\right) = 0.02 \text{ rubles.}$$

5. The dependence of conditionally net return on investment upon the change in the amount of uninstalled, surplus and spare equipment (ΔF_5) can be determined in the following manner:

$$\Delta F_5 = F_0-\left(\frac{T_1 \times K_5}{Cu_0-Cu_1}\right) , \qquad (8)$$

where Cu_0, Cu_1--average annual value of uninstalled, surplus and spare equipment in base and current periods, rubles;

$K_5 = G_2/G_1$--conversion factors for wholesale prices operating in report year into fixed prices of base period;

G_1, G_2--volume of gross product, respectively, in current and fixed wholesale prices, rubles.

Hence, in our example:

$$\Delta F_5 = 1.20-\left(\frac{9764}{13274-5180} \times 1.035\right) = -0.01 \text{ rubles.}$$

6. The effect of the change in the wholesale price level on the level of conditionally net return on investment is calculated according to the formula:

$$\Delta F_6 = F_0(K_6-1) , \qquad (9)$$

where

$$K_6 = \frac{B_1}{B_2} . \qquad (10)$$

In the designated example, its amount equals: K_6 = 0.97.

Consequently, the change in the wholesale price level influences the conditionally net return on investment in the following amount:

$$\Delta F_6 = 1.20(0.97-1) = 0.036 \text{ ruble.}$$

In other words, the reduction in wholesale prices caused a decline in conditionally net return on investment by 3.6 kopecks.

As a whole, the change in the conditionally net return on investment in the designated example can be represented in the following manner:

$$F_1 = F_0 + \Sigma\Delta F_1, \tag{11}$$

where ΔF_1--total changes in return on investment under effect of examined complex of factors.

In our example:

$$F_1 = 1.20+(-0.30-0.288+0.22+0.02-0.01-0.36)$$
$$= 0.78 \text{ ruble.}$$

Thus, in the examined example the return on investment has declined basically due to a worsening of the extensive and intensive use of the fixed capital. An increase in the proportional amount of the production equipment of the basic shops in the total value of the fixed capital caused a rise in the conditionally net return on investment. The change in the proportional amount of materials, contractual deliveries and work in the current period was insignificant. For this reason, the increase in the conditionally net return on investment due to this factor was insignificant. During the current period, the value of uninstalled, surplus and spare equipment reached a significant amount, and this also entailed an additional decline in the net return on investment.

An important factor which influences the level of the return on investment is also a price change. The decline in the wholesale prices which were in effect during the current period, in comparison with the fixed prices on 1 July 1955, led to a decline in the return on investment. As a result of the composite action of all the factors, the conditionally net return on investment also declined, and this shows the unsatisfactory use of the internal production reserves.

The dynamics of the return on investment indicator calculated as the ratio of conditionally net product to the average annual value of the fixed productive capital still does not provide a sufficient complete picture. Only factor analysis of this indicator makes it possible to judge by how much the level of the return on investment has changed depending upon the factors which determine the use of fixed productive capital.

It is essential to point out that at the shipyard in Nikolayevsk-na-Amure, for an extended period there was a decline in the return on investment which was caused by a number of objective factors. A portion of them to a certain degree was related to a change in the shipbuilding programs caused by the development of the Far Eastern economy. However, aside from the objective factors, the decline in the return on investment was strongly influenced by the absence of sufficiently effective economic accountability incentives to raise the economic effectiveness of fixed capital utilization. As a consequence of this, the plant did not pay proper attention to the economically advisable amount of productive capital and new construction. As a result, a situation developed at the plant where economic accountability in its practical application was little related to the efficient use of the fixed capital. The only economic accountability lever which could have "worked" was crediting for the introduction of new technology and for increasing the output of consumer goods. However, due to the fact that crediting, in addition to paying interest on the credit, envisages the complete repayment of the obtained loans in a comparatively short period of time, it could not assume a mass character, and was used at shipbuilding enterprises only for the most efficient measures with a short repayment time.

With the transition of the shipbuilding enterprises to the new management conditions, the attitude toward fixed capital utilization changed sharply. This can be seen from the higher growth rate of the conditionally net return on investment indicator at the Nikolayevsk-na-Amure Yard in 1970 (in comparison with 1966).

6. ANALYSIS OF FIXED CAPITAL PROFITABILITY

Profitability, along with the volume of sold product, is one of the most important economic indicators which most fully reflects the effectiveness of production and economic operations at a shipbuilding enterprise. The profitability indicator in a way accumulates all the other indicators which to one degree or another characterize the individual elements of the efficiency of the production process. An important ultimate task in improving the fixed capital utilization of shipbuilding enterprises is, along with high production results expressed by the production volume indicator, to also provide a high economic effect. The basic generalizing quantitative indicator for the economic effectiveness of fixed capital utilization is profit, and the qualitative one is the profitability level.

With the conversion of the shipbuilding enterprises to the new conditions of planning and economic incentive, the indicator of the profitability level has been set as the basic one, and is measured as the ratio of profit to the average annual value of the fixed capital and normed working capital.

However, in using this profitability level indicator, it is essential to consider the sectorial features of the shipbuilding enterprises. Their important feature is primarily the high proportional amount of working capital in the total value of the productive capital.

With a high share of working capital significantly surpassing the share of the value of fixed capital, the actual picture of the effective use of fixed capital is distorted in the event of using the profitability level indicator for assessing it. With such a ratio, the change in the value of working capital at the enterprise will have a greater effect on forming the profitability level than a change in the fixed capital. Here the actual effectiveness of fixed capital utilization remains undisclosed. For this reason, for this purpose it is more correct to use an indicator for the profitability level of the fixed capital (capital profitability) defined by the ratio of total profit to the average annual value of the fixed capital. This eliminates the distorting effect of working capital in assessing fixed capital utilization.

Certainly the indicator of capital profitability cannot serve as the only indicator in analyzing the economic effectiveness of fixed capital utilization. It must be viewed in close relation and causality with the indicator for the level of overall profitability.

The use of just one capital profitability indicator leads, on the one hand, to the incomplete disclosure of the true picture of fixed capital utilization, since it ignores the influence of the fixed capital on saving current expenditures for raw products, materials, energy and live labor. On the other hand, the capital profitability indicator in and of itself cannot always show the development of an unfavorable ratio between the dynamics of fixed capital and the product volume.

As practice indicates, the application and comparison of two complimentary indicators for conditionally net return on investment and capital profitability makes it possible to show much more profoundly and completely the real level of the effective use of fixed capital. The economic encouraging of the collectives at shipbuilding enterprises on the basis of the capital profitability indicator forces the collectives to be more concerned with increasing the return on investment, the growth of which is one of the important factors in raising overall profitability of shipbuilding production.

7. INDICATORS OF THE CAPITAL-TO-LABOR RATIO AND THEIR EFFECT ON THE GROWTH OF LABOR PRODUCTIVITY

The most recent achievements of scientific and technical progress which make it possible to further improve fixed capital create the necessary prerequisites for reducing its relative value (per unit of production capacity) and for raising the return on investment. Technical progress and economics are interrelated and reciprocally caused. It is impossible to develop new equipment without considering the expenditures on its creation and the repayment of capital investments into it. The ignoring of economic questions in fixed capital formation can lead to a decline in the return on investment at the shipbuilding yards. Here what should be a rational ratio between the growth of labor productivity, the capital-to-labor ratio and the return on investment?

There exists a close relationship between labor productivity, the return on investment and the capital-to-labor ratio; this can be expressed by the following dependence:

$$P_1 = \frac{V}{N} = \frac{V}{C} \times \frac{C}{N} = F_0 \times F_1 \text{ rubles per man} , \qquad (12)$$

where P_1--productivity;
V--production volume;
N--number of workers;
C--value of productive capital;
F_0--return on investment;
F_1--capital-to-labor ratio.

From this it follows that labor productivity can rise with an increase of both the capital-to-labor ratio and the return on investment. In this regard, it can rise even with a certain decline in the return on investment due to an increase in the capital-to-labor ratio which, with the development of equipment and production methods caused by technical progress, should systematically rise. However, it is desirable that these indicators increase simultaneously.

With the scientific organization of shipbuilding, the return on investment should also grow continuously, since, on the one hand, more modern and economic implements of labor are being put into use, and on the other, measures are being carried out for their rational utilization (a rise in worker skill, and an improvement in the organization of labor and production). However, insufficient attention to this important economic indicator often leads to a situation where at a number of shipbuilding enterprises there is a decline in the return on investment and labor productivity with a simultaneous rise in the capital-to-labor ratio. This shows shortcomings in fixed capital utilization.

Let us examine the ratio of the dynamics of labor productivity and the capital-to-labor ratio at the Nikolayevsk-na-Amure Shipyard (see Table 5).

Table 5

Dynamics of Capital-to-Labor Ratio and Labor Productivity in 1960-1968

Years	% of 1960	
	Capital-to-Labor Ratio	Labor Productivity
1960	100.0	100.0
1961	102.0	110.0
1962	105.0	116.5
1963	108.0	122.0
1964	117.5	129.0
1965	133.0	139.0
1966	140.0	145.0
1967	144.0	148.0
1968	150.0	153.0

From this it follows that the capital-to-labor ratio at the designated enterprise rose by 50 percent over the analyzed period in comparison with 1960. Here the growth rate of labor productivity each year outstripped the growth of the capital-to-labor ratio by 5-14 percent.

However the picture would change sharply if we examined the dynamics not in terms of the gross but rather the net labor productivity defined as the ratio of conditionally net product to the number of production personnel. In the future, the analysis of the ratio of the capital-to-labor ratio and labor productivity will be made only proceeding from indicators calculated on the basis of conditionally net product as this more objectively and fully characterizes actual output of product at the enterprise. Let us examine the ratio of net and gross labor productivity at the same enterprise (Table 6).

Table 6

Dynamics of Net and Gross
Labor Productivity in 1960-1968
(in % of 1960)

Years	Net	Gross
1960	100.0	100.0
1961	109.0	110.0
1962	110.0	116.5
1963	118.0	122.0
1964	103.0	129.0
1965	107.0	139.0
1966	90.0	145.0
1967	101.5	148.0
1968	105.0	153.0

On the basis of analyzing the data of the table, it can be seen that the gap in the rate of change of net and gross labor productivity during the individual years reached a significant amount (up to 40 percent and more).

The existing approach to planning labor productivity using the examples of shipbuilding enterprises indicates that behind the apparent constant rise in the rate of gross labor productivity, an actual decline in it has frequently been concealed. This situation is clearly substantiated by the given dynamics for the indicator of net labor productivity. For this reason, the existing procedure for planning labor productivity which is based upon the gross product indicator should be revised. Here it is essential to convert to using the conditionally net product indicator for this purpose.

One of the important factors which predetermines the growth of labor productivity is the equipment-to-labor ratio calculated as the ratio of the average value of the active portion of fixed capital to the average listed number of employees on the largest shift.

The equipment-to-labor ratio should outpace the capital-to-labor ratio, and this means a necessity of the more rapid growth of the active portion of the fixed capital, in comparison with the passive. The growth of the equipment-to-labor ratio in turn must be compared with the dynamics of labor productivity. A normal ratio is considered to be one where labor productivity grows more rapidly than the equipment-to-labor ratio. The non-observance of this condition at the designated enterprises led to a decline in the efficiency of the production apparatus (see Table 7).

The data of the table indicate that the equipment-to-labor ratio at the designated enterprise by the end of the analyzed period had risen by 56 percent, in comparison with 1960.

Table 7

Dynamics of Equipment-to-Labor Ratio and Labor Productivity in 1960 - 1968 (in % of 1960)

Years	Equipment-to-Labor Ratio	Net Labor Productivity
1960	100.0	100.0
1961	101.0	109.0
1962	114.0	110.0
1963	112.5	118.0
1964	123.0	103.0
1965	143.0	107.0
1966	149.0	90.0
1967	152.0	98.5
1968	156.0	103.0

The data of Tables 6, 7 and 8 which characterize the ratio of the increase of the capital-to-labor ratio, the equipment-to-labor ratio and labor productivity show great fluctuations. In each individual instance, the reasons for these fluctuations can be ascertained, but it is not possible to establish any regular links between the actual dynamics of labor productivity and the capital- and equipment-to-labor ratios.

At the present stage of national economic development, the basic directions of technical progress are electrification, mechanization and automation of production, the use of chemistry in the production processes, the use of atomic energy, electronic equipment and other scientific achievements.

The development of energy is the basis of technical progress. The rise in the amount of electric power available per worker has a determining effect on raising labor productivity, since the latter grows chiefly as a result of replacing manual labor with machine labor (and particularly electrified).

It is customary to make a distinction between the potential and actual electric power available per worker. The potential reflect the power of the enterprise engines and electrical equipment per worker on the largest shift, while the actual is the amount of energy used as a motive force by one worker per unit of time.

The level of electric power available per worker tells substantially upon the rate of raising labor productivity. A comparison of their growth rates make it possible to draw valid conclusions on the rational use of electric power at the enterprises.

The potential electric power available per worker at the shipbuilding enterprises of Khabarovskiy Kray in 1970 rose by 2-2.5 fold in comparison with the 1960 level. This characterizes the growth of the mechanization of manual labor by electrifying production.

The actual electric power available per industrial worker in 1960-1970 at the Nikolayevsk-na-Amure Yard declined somewhat, and in 1970, was 75 percent of the 1960 level. However, its decline in the given instance was not a negative factor, and was caused basically by the saving of electric power at the enterprise by carrying out a number of measures.

A comparison of the electric power available and the net labor productivity for 1960-1970 shows a lag in the growth rate of the latter. This was due to the insufficiently effective use of electric power at the shipbuilding enterprise.

On the basis of analyzing the ratio between the level of labor productivity and such factors which determine it as the capital-to-labor ratio, the equipment-to-labor ratio, and the potential and actual electric power available per worker, it is possible to conclude that there are serious contradictions in the dynamics of these indicators. The problem is that with the growth of these indicators, net labor productivity does not show a tendency toward a stable increase (and in certain years has even declined).

Thus, it can be concluded that at the designated enterprise, the growth of the capital-to-labor ratio, the equipment-to-labor ratio and the electric power available per worker did not have the proper effect over an extended period on the growth of net labor productivity. This shows the poorer use of fixed capital (and above all its active part).

8. ANALYSIS OF THE USE OF EQUIPMENT AND PRODUCTION AREAS

An important reserve for increasing product output and raising the economic effectiveness of the work of shipbuilding enterprises is an improvement in the use of fixed capital and above all its active portion, the production equipment, which determines the capacity of the enterprise. The equipment available to the enterprises is replenished annually. For example, in 1970, the value of the operating machinery and power equipment in USSR industry was over 45 billion rubles. An increase in the output by the equipment of just 1 percent would mean an additional increase in industrial product worth millions of rubles.

The output of gross product over the last decade at the shipbuilding enterprises of Khabarovskiy Kray has markedly increased. Only a significant rise in the level of the technical outfitting of these enterprises could provide the high growth rate of production.

However, for a correct evaluation of the degree of the equipping of any enterprise with the corresponding equipment, it is essential to analyze not only its quantity, but also the technical structure which plays a very important role. For example, in analyzing the available metalworking equipment, it is essential to divide it into the groups of metal cutting machines, forging-stampind and foundary equipment.

As is known, a higher proportional amount of forging-stamping equipment shows a progressive structure of the available metalworking equipment. For this reason, the task has been posed of the more rapid development of its production within those limits which this requires for creating an optimum structure of metalworking equipment in the nation's industry.

Let us examine the structure of metalworking equipment at the Nikolayevsk-na-Amure Yard, the data for which are given in Table 8.

The data of the table show that the structure of the equipment which has formed at the Nikolayevsk-na-Amure Yard (the proportional amount of forging-stamping equipment is 23 percent) must be considered rather progressive.

Table 8

Structure of Available Metalworking Equipment
(in % of total)

Types of Equipment	USSR Shipbuilding Industry	Nikolayevsk-na-Amure Yard
Metal cutting	80	73
Forging-stamping	17	23
Foundry	3	4

The observance of certain proportions and a correct combining of metal cutting and forging-stamping equipment determine the direction of the technical policy in the area of shipbuilding methods, they influence the quality of the articles manufactured and the use of fixed capital, and also provide an overall economic effectiveness of shipbuilding production.

In terms of the degree of putting the available equipment into production, all the existing equipment at the enterprises is divided into uninstalled, installed and actually working. The shipbuilding enterprises should endeavor that all the available equipment be in operation, although under real conditions this is not always possible. For this reason, an important indicator for equipment use is a maximum coincidence of the amount of available and working equipment. Providing the complete use of all equipment is an important reserve for raising the production capacity of the enterprise and for raising product output.

For describing the degree of putting the technical means into production, coefficients for the use of available and installed equipment have come to be used. Here the coefficient for the use of available equipment (K_a) is determined by the ratio of the quantity of working (E_w) and the total available equipment (E_a)

$$K_a = \frac{E_w}{E_a} \leqslant 1.0$$

The basic task of this coefficient is to describe the gap between the available and operating equipment.

The coefficient for the use of installed equipment characterizes the ratio of the quantity of working and installed equipment (E_i)

$$K_i = \frac{E_w}{E_i} \leqslant 1.0$$

It determines the amount of the gap between the installed and working equipment.

Analysis shows that at the Nikolayevsk-na-Amure Yard, the unused equipment comprises around 7 percent, of which up to 2 percent is uninstalled.

Such a rather significant proportional amount of idle (uninstalled and unused) equipment causes great harm to the national economy. With the achieved level of the output of gross product per ruble of the value of fixed capital, the putting of idle equipment into operation would make it possible to substantially increase the production volume of the shipbuilding industry in the kray.

The formation of surplus equipment at the shipbuilding enterprises has been caused by substantial shortcomings in material and technical supply, as well as by the fact that the enterprises in the past, when the fixed capital was not subject to a payment, endeavored to obtain as much equipment as possible, even if there was no actual need for it. Such a situation to a significant degree was due to the large range of shipbuilding products, and to the absence of a clearly expressed specialization of the enterprises, as well as plan instability. The shipbuilding enterprises at virtually any time of the year could receive an additional plan or new order. Under the conditions of frequent changes in the production program, the enterprise leaders were often forced to, keep, as they say, for a rainy day, idle equipment as a reserve which might be suddenly needed.

The presence of a significant quantity of surplus and little-used equipment at certain shipyards of Khabarovskiy Kray ultimately caused a reduction in the overall level of fixed capital utilization. This was also related to the number of machine tool operators per machine. As an example, Table 9 gives the appropriate data for the Nikolayevsk-na-Amure Yard (in comparison with Soviet industry as a whole).

Table 9

Proportional Number of Machine Tool Operators
(persons)

Profession	USSR Industry	Nikolayevsk-na-Amure Yard
Lathe operators	1.68	1.36
Turret lathe operators	1.07	1.36
Drill operators	1.45	1.0
Borers	0.37	x
Planers and slotters	0.93	0.25
Milling machine operators	1.01	1.0
Gear cutters	0.29	x
Polishers	1.04	0.17
Sharpeners	0.93	x

Note. The "x" designates a variation when the machine tools are operated by combining jobs.

From this it follows that at the designated shipbuilding enterprise of Khabarovskiy Kray, the equipment load is insufficient.

One of the most important indicators characterizing the degree of use of production equipment is the output of conditionally net product per ruble of its average annual value (the conditionally net return on investment).

The efficient use of fixed capital at shipbuilding enterprises to a great degree depends both upon the intensive and extensive use of working machines. The maximum return on metalworking equipment is possible only with a rational combination of using working time and equipment capacity.

The system of operational accounting of equipment operations at the shipbuilding enterprises of Khabarovskiy Kray still does not provide a full description of its use, and does not disclose the internal reserves. At certain plants, the accounting of the operation of the available machine tools is done from the shift reports of the foremen, and these reflect the causes of stoppages and the guilty parties. Naturally, such accounting has a subjective character and does not reflect the real level of machine tool utilization.

The characteristics of the use of production equipment over time at the Nikolayevsk-na-Amure Yard are given in Table 10, where coefficients are given for the extensive use of equipment (K_e) and the shift coefficient for its operation (K_s).

Table 10

Indicators of the Extensive Use of Production Equipment

Equipment Name	K_e	K_s
Metal cutting	0.41	0.80
Forging-stamping	0.22	0.50
Woodworking	0.39	0.75
Electric welding	0.43	0.83
Foundry	0.25	0.48
Materials handling	0.39	0.75

According to the data of the table, it can be seen that particularly great stoppages are observed for the forging-stamping equipment. This tells extremely negatively on the product costs of shipbuilding, since this group of equipment at the shipbuilding enterprises consists of expensive machine tools which require great expenditures for operating them.

As analysis shows, the highest proportional amount is made up of stoppages due to the absence of work and unsatisfactory material supply. There are also large stoppages due to the absence of workers. These two factors are

responsible for up to 70 percent of all stoppages. Their basic part is caused by shortcomings in production organization, by the unrhythmical operations, by the presence of surplus equipment, and by a number of organizational and technical factors.

An increase in the economic efficiency of fixed capital at shipbuilding enterprises is inconceivable also without an improvement in its use per unit of time, that is, the intensity of its work. The basic intensity indicators here are the rate of machining, the amount of input and the use of power. Ultimately these indicators cause an increase in product output.

At a number of shipbuilding enterprises in the kray, with a low equipment use coefficient over time, insufficient attention is also paid to its intensive use. Moreover, this is considered a secondary matter from the standpoint of the possibilities of raising production efficiency. The economic reform has necessitated a revision of such a position, as a result of which significant shifts can already be noted toward an improvement in equipment use.

The capacity of metal cutting machines is also insufficiently used, and the machining rate still remains low. In particular, the universal screw-cutting lathe of the 1K62 model (with a maximum spindle speed of 2,000 rpm) which is in the greatest demand is almost not used for working parts above 1,000 rpm.

A majority of the metalworking equipment in shipbuilding is made up of universal machine tools. The working of parts on them is carried out by such cutting conditions whereby the speed and power of the drive are not more than 25-30 percent utilized. The situation is no better with using the productivity of other types of equipment.

Consequently, the reserves for improving equipment use in the shipbuilding of the kray are still very great. On the basis of an analysis of the statistical data, one can conclude quite soundly that the structure of the working time of the equipment at the shipbuilding enterprises requires a substantial improvement.

Table 11

Table 11

Dynamics of Gross Product Output Per m^2 of Production Area in 1960-1967 (in rubles)

Years	Rubles/m^2
1960	590
1961	600
1962	650
1963	700
1964	587
1965	699
1966	690
1967	695

Of great significance for a shipbuilding enterprise is the economic and rational use of production areas which comprise a significant portion of the fixed capital value. Its effect is tantamount to increasing the quantity of operating equipment without the construction of new buildings, and for this reason can be viewed from the position of saving capital investments. The level of use of the production area is usually characterized by the output of gross product per square meter in cost and physical terms. As an example, Table 11 gives data characterizing the dynamics of the level of this indicator at the Nikolayevsk-na-Amure Yard.

From the data of the Table, it can be seen that the output dynamics of gross product per square meter of production area shows an extremely unstable character, although in recent years there has been a certain trend toward an increase in this indicator.

Thus, analysis of the use of equipment and production areas indicates that at the shipbuilding enterprises of Khabarovskiy Kray there are major reserves, the use of which will greatly raise the economic effectiveness of fixed capital utilization. In this regard it is essential to work out a special complex of organizational and technical measures aimed at solving this important practical problem.

9. USE OF ELECTRONIC COMPUTERS FOR CALCULATING AND ANALYZING AVAILABILITY AND USE OF FIXED CAPITAL

In order that shipbuilding be highly efficient, there must be the rational use of the available fixed capital, in aiming for a maximum return from it. For this it is essential, aside from all else, to organize reliable and comprehensive accounting of its utilization on the basis of a specially constructed system of indicators. For providing effective control over capital utilization, it is essential to organize a system of information which will provide a possibility for promptly intervening into its use. This is particularly important in line with the conversion of the shipbuilding enterprises to the new system of planning and economic incentive.

Reliable information on fixed capital utilization is also an indispensable condition for the successful management of a shipbuilding enterprise. At the same time, up to now not only the leadership of these enterprises but even the economic planning and production planning services did not have such information in the intervals between the annual reports. Consequently, this essential information was missing also for the leaders of the superior management bodies (ministry).

If the information on the course of plan fulfillment for product output is organized rather precisely and on its basis there is sufficiently high informing of the enterprise leaders, they are little informed on the possibilities and composition of the physical plant, the technical condition of its elements, and the use of equipment and production area. Such a situation is caused by the fact that prior to the conversion of the enterprises to the new management conditions, the enterprise leadership was little interested in these questions. Moreover, the existing bookkeeping methods, in being imperfect, do not make it possible to obtain the necessary data for the purposes of analyzing fixed capital utilization. The situation of accounting was also influenced by the fact that there was no proper incentive to improve the use of fixed capital. The introduction of a capital payment sharply strengthened the attention paid to accounting for its use.

For operational management of the production process, the leadership of the shipbuilding enterprises should have rather reliable operational information

on the presence and use of fixed capital installations, and promptly take adjusting decisions aimed at its more efficient use and improve the economic indicators of enterprise operations. The successful solving of these problems at the present stage of technical progress is inconceivable without using the most recent computers.

The use of electronic computers in managing shipbuilding opens up broad opportunities for highly efficient use of the computers in the aim of accounting for and analyzing the fixed capital (in particular, in a system for the automated management of an enterprise [ASUP]).

The realization of automated accounting and analysis of fixed capital utilization at a shipbuilding enterprise requires the solving of the following complex of problems with the providing of the appropriate technical and economic indicators: Object-by-object accounting of the availability and movement of the capital; accounting of availability and its movement by groups; figuring and distribution of amortization deductions; calculation of wear and determining the amount of the capital payment; determining the quantitative and qualitative indicators which characterize effective use of the capital.

In constructing such a system, mechanization of labor-intensive calculations and automation of data processing are achieved, as well as a rise in the quality and accuracy of the calculations. Here an opportunity is also provided for the multivariant solving of problems and recalculations which improve on the initial targets, multiuse of information, and the strengthening of the scientific soundness of the calculations and their reliability.

The use of computers for fixed capital accounting at a shipbuilding enterprise makes it possible to work out and draw up for any date, at the request of the leadership, the necessary data and information on the availability, movement and use of capital both for the enterprise as a whole, as well as with a differentiation for the shops and responsible officials, as well as receive necessary data for analyzing the composition of the capital by groups and assessing the level of its use.

Automating the accounting and analysis of fixed capital use increases the efficiency and reliability of the accounting data, and makes it possible to promptly provide the enterprise leadership with all the necessary information for production management, it reduces the time for data processing and receiving the reporting, it improves the analytical possibilities of accounting and helps to strengthen control over the effective use of the machinery equipment, means of transport and other means of labor.

In 1971, the laboratory of the Kherson Shipyard worked out a standard plan for organizing fixed capital accounting and analysis using calculator-punch equipment and a Minsk-22 electronic computer. Of greatest interest for the shipbuilding enterprises is the computerized plan which meets all the basic requirements for automated data processing and is based on the following

basic principles: unity of the procedures of planning and accounting, standardization of the primary documents, the selection of a rational method for recording accounting information, the creation and keeping of standard reference files, the constructing of the accounting process and methods for organizing bookkeeping and reporting.

For solving the problems of fixed capital accounting, as the primary documents, the inventory stock card has been used combined with the statement of acceptance of the fixed capital for buildings, installations and transfer devices; the accounting stock card and the fixed capital acceptance statement for machinery, equipment, tools, production and office supplies and means of transport; a waybill for the internal movement of fixed capital; a statement of liquidation and transfer of fixed capital.

The primary documents have been worked out on the basis of the standard forms for primary fixed capital accounting in industry and construction and as approved by the Central Statistical Administration Under the USSR Council of Ministers, considering the requirements of automated processing.

Regardless of the great advantage of the Kherson plan for fixed capital accounting based upon the use of a computer, it is not devoid of a number of essential shortcomings established in the designing. In this standard plan the questions of accounting for the availability and dynamics of fixed capital have been reflected with sufficient detail and with exhaustive completeness, but the section for analyzing its use has not been worked out with any sufficiency whatsoever. For example, the plan does not provide for determining such important indicators for analysis which characterize the effective use of fixed capital as the age composition of the production equipment; coefficients for the wear, replacement and withdrawal of capital; the capital-to-labor ratio; the equipment-to-labor ratio and the electric power available per worker; the return on investment and capital profitability; output of product per unit of production area.

In our opinion, it is essential to improve this plan of automated accounting in the direction of providing for the obtaining of all necessary data for analyzing fixed capital utilization at a shipbuilding enterprise.

10. WAYS FOR IMPROVING FIXED CAPITAL UTILIZATION AT A SHIPBUILDING ENTERPRISE

The problem of systematically improving fixed capital utilization under modern conditions is assuming the most important national economic significance. In terms of its economic impact, it is equivalent to increasing the capital, and consequently, to a corresponding rise in product output without additional capital investments. Aside from the savings in capital investments and the increase in the production volume, an improvement in fixed capital utilization leads to a rise in the return on investment and labor productivity, to a reduction in labor intensiveness and product costs, and to a rise in the profitability of shipbuilding.

The ways and possibilities of improving the use of production capacity at the enterprises are extremely diverse. The basic measures in this area of production and economic activity have been indicated in the Directives of the 24th CPSU Congress. In terms of the enterprises of the shipbuilding industry, the most important of them are: Improving the fixed capital structure, replacing production equipment on the basis of new technology, raising its intensive and extensive use, improving the system of fixed capital accounting, rationalization of the organization and methods of repairs, and improving the system of production planning and management.

Regardless of the high growth rate of fixed capital and the equipping of the enterprises with modern equipment, at the shipbuilding enterprises many production operations are still performed manually. For example, at individual shipbuilding enterprises up to 60 percent of all the workers are employed in manual jobs.

Obviously, the decline in the return on investment which has occurred at the designated enterprises over the last decade is a result not so much of the excessive saturating of them with the means of production, as it is a consequence of the insufficient use of available fixed capital and a lag in the full mechanization of the enterprises.

One of the most important directions for raising the effective use of fixed capital is an improvement in its structure. The capital investments should be channeled first of all into increasing the active portion of the capital which provides for the basic rise in produced product.

Improving the fixed capital structure is most effective when the capital investments for this purpose are used in reconstructing existing enterprises. Here the share of expenditures on construction-installation work occupies, as a rule, a significantly smaller proportional amount than with new construction.

Progressive shifts in the fixed capital structure to a significant degree are aided by an improved use of the production areas, a reduction in the cost of construction-installation work, and an improvement in design solutions (block assembly of the buildings, the creation of individual original and economic complexes, and so forth).

The rational formation of the fixed capital structure at shipbuilding enterprises and its efficient use are positively influenced by the following basic factors: An increase in the series run and a reduction in the number of types of vessels simultaneously under construction, a rise in the level of specialization and cooperation for all production as a whole and its individual subdivisions, an improvement in the technology and methods for building the vessels, a rise in the level of mechanization and automation in the production processes, and a strengthening of production concentration.

One of the important reasons for the insufficiently effective use of fixed capital at individual shipbuilding enterprises in Khabarovskiy Kray has been its irrational structure. Thus, in 1970, in comparison with 1960, the share of the active portion of fixed capital rose as a total from 0.5 to 2 percent. Such a rise is far from providing the possibility of achieving a rational capital structure.

Under today's conditions, it is particularly important to solve the problem of optimizing the fixed capital structure of the shipbuilding enterprises. The sense of this task consists in determining what is the structure of the capital that would provide for the fulfillment of the given shipbuilding program with minimum cost of the fixed capital. Such a solution can be achieved only by using mathematical economics methods and electronic computers.

A rise in the economic effectiveness of the fixed capital by improving the extensive and intensive use should be carried out on the basis of a maximum involvement of all available equipment in production with an increase in its productivity per unit of working time, the time of its work during a work shift, and a rise in the shift coefficient. All these directions are closely interrelated, and for this reason they should be used together for achieving a maximum effect.

Surplusses of production equipment inevitably lead to its unsatisfactory utilization, to unplanned repairs and an underestimation of the role of modernization. For this reason, the solution to the questions of the maximum involvement of available equipment in production, as well as a rise in its extensive and intensive use cannot provide the desired results under these conditions.

The solving of the problem of increasing the economic effectiveness of fixed capital at shipbuilding enterprises should be achieved by involving all the designated directions on an integrated basis, and primarily by raising the shift coefficient for the work of the enterprises as a whole. This is the most feasible and effective.

The most important reasons for the insufficient level of use for installed equipment and the low shift factor for enterprise operations are the serious shortcomings in planning and organizing and shipbuilding. The production programs set for the enterprises are often made up without considering the existing reserves for increasing product output by better utilizing capacity and improving the organization of production and labor. For example, at present there is no strictly established shift conditions for the operation of the shipbuilding enterprises, as has been done in the machine building, textile and other industrial sectors.

With an increase in the shift coefficient and bringing the operations of the shipbuilding enterprises up to two full shifts, a significant increase in product can be achieved from the same production area. If one proceeds from the fact that planned stoppages for adjusting machine tools, performing repairs and other auxiliary purposes should comprise 15-17 percent of their shift time, the shift coefficient should rise at least up to 1.7.

A rise in the shift coefficient will provide a great savings of money. The Institute for the Economics and Organization of Industrial Production Under the Siberian Division of the USSR Academy of Sciences has estimated that per ruble of increase in industrial product by raising the shift coefficient from 1.0 to 1.7, capital investments of just 28 kopecks are needed, but for building new production capacity, 1 ruble 14 kopecks. For the shipbuilding enterprises, these data are of equally important significance.

The high economic effectiveness of converting the shipbuilding enterprises to two shift operations and the feasibility of doing this can be achieved in working out and carrying out the following group of measures at the yards:

1. Planning enterprise loads considering the optimum amount of the shift coefficient, and this should become an organizing factor in showing initiative to seek out and use internal production reserves.

2. The making up of the lacking number of basic production personnel of the enterprises by redistributing the auxiliary group on the basis of the Shchekino method, the possible hiring of second members of families, and the hiring of the lacking portion of employees from outside. Certainly, a real solution to this question is also related to the possibilities of providing the newly hired workers with housing and children's institutions.

3. The maximum involvement of all the available equipment of the enterprises in production (or the sale of unnecessary, surplus equipment to those who need it).

4. A rise in the extensive load coefficient for production equipment by at least to 0.6 of the operating time, and reducing entire shift equipment stoppages during repairs by using rational repair methods and the correct technical exploitation of the machine tools.

5. Broadening all types of production specialization on the basis of manufacturing spare parts for various machines, employing group machining methods and standardization of the production processes.

6. The wide development of the principle of multimachine operating.

7. Raising the intensive use of production equipment by improving the structure of its working time and operating conditions, providing efficient designs of the parts, quality of the stock and concentration of the operations.

8. Consideration of the particular features of multishift production (organization of the shifts, selection of the shift conditions, the setting of the work hours of the shifts, the operation of municipal transport, and so forth.

Thus, the problem of converting the shipbuilding enterprises to two-shift operations is not only highly effective, but completely realistic. Aside from saving on capital investments, the effective use of fixed capital is raised, measured by the growth of the return on investment by an average of 30-40 percent under these conditions.

The possibility of improving fixed capital utilization to a significant degree is predetermined by its technical state, as well as by the methods of its repair and maintenance. An economically intelligent approach by the repair services at the shipbuilding enterprises leaves much to be desired, regardless of the progressiveness of the PPR [planned preventive repair] system itself. The basic reasons for such a situation are to be found in the absence of any proper interest by the enterprise leadership in the economic organization of repairs and by the unsoundness of certain provisions on which the existing PPR system is based.

The basic directions for overcoming the lag in the organization of equipment repairs at the shipbuilding enterprises can be combined in the following basic groups: Centralization and specialization of equipment repairs on the basis of creating specialized repair bases and expanding the output of spare and replacement parts; improving the existing system of PPR and the methods of organizing repairs; organization of reliable accounting for equipment use to provide promptness of repairs, and the conversion of the repair services to full economic accountability.

The centralized manufacturing of spare and replacement parts will make it possible to increase the period between repairs by an average of 25-30 percent for the machinery and equipment, and respectively reduce the number of personnel needed for technical and repair servicing at the consumer ship-

building enterprises. Such an approach will tell positively on the consumption of materials for repair needs. It has come to be considered that it is economically ill-advised to create the necessary assortment of rolled metals for repair services. This does not make it possible to manufacture spare parts with a minimum consumption of materials. With such an approach, metal consumption as an average per part manufactured in the repair shops of shipbuilding enterprises is approximately 15-20 percent higher than in the event of their specialized production. Repair work, as a rule, is little mechanized.

An improvement in the quality of equipment repairs by its centralization and specialization, combined with a rise in the reliability and durability of the replacement and spare parts, will make it possible to significantly extend the period between repairs, and on this basis obtain a great savings in material and labor resources, as well as money.

A study of repair practices at shipbuilding enterprises shows that the PPR system exists formally. This is substantiated by the following facts:

1. About 50 percent of the volume of all work occurs in major overhauls and medium repairs which, as a rule, are done not in accord with the unified PPR system, but only out of forced necessity, that is, with the breakdown of the equipment. As a result, these types of repairs in essence do not have a strictly periodic character, but are random and enforced.

2. Approximately 30-40 percent of the total number of workers at shipbuilding enterprises are directly or indirectly involved in eliminating various sorts of failures and emergencies, and becuase of this more than one-third of the labor intensiveness of repairs is outside the sphere of the planned regulation of repair work.

3. Regular planned inspections of the equipment at many enterprises are a very rare phenomenon. Current repairs are carried out chiefly in those instances when the further operation of the equipment is impossible without them. Thus, this type of technical repair servicing basically having a preventive character and on which the PPR system should be based also in essence is not properly encompassed by plan regulation.

On the basis of what has been stated, it can be concluded that out of the total volume of repair work, not more than 20 percent is envisaged by the PPR plans. This shows that the existing PPR system does not have an active effect upon the organization and economics of repairs on technical means at shipbuilding enterprises.

At present, the PPR system is usefully employed only in compiling the annual, quarterly and monthly labor plans and for setting material orders for repairs. Consequently, these plans are virtually not carried out. Ultimately, the number of repairmen is determined not by following the PPR standards, but rather proceeding from the achieved level of their number. As for the

material orders of the repair services, they, as a rule, are not fully satisfied, and all the materials lacking for repairs are ultimately taken from basic production.

Among the basic procedural shortcomings of the PPR system one must put the fact that it has been based upon the average computed operating lives of the equipment, and not upon the actual operating time. In this regard the PPR plans do not reflect the actually necessary periodicity of one or another repair servicing. This gives rise to great mistakes in the range and volume of planned repairs. At the present stage of technical progress, when by using computers it is possible to provide dependable accounting of the actually worked equipment time, the necessity of revising the existing PPR system on this basis becomes even more acute. The effectiveness of equipment repairs will basically depend upon the prompt and effective solving of this problem.

The industrial enterprises of our nation have acquired significant experience in an automated accounting system for equipment use. The use of such a system at the shipbuilding yards is advisable not only from the standpoint of improving the repair system, but also is of important significance for analysis and working out measures to improve fixed capital utilization. According to tentative estimates of the Institute for the Economics and Organization of Industrial Production Under the Siberian Division of the USSR Academy of Sciences, the introduction of such an accounting system into production will make it possible to improve equipment use, and by this raise labor productivity of machine tool operators by 10-12 percent, as well as reduce the cost of the manufactured product by 5-7 percent.

Improving the equipment repair system at the shipbuilding enterprises would be somewhat obstructed without solving a number of economic questions related to the organization of repairs, as one of the important reserves for raising production efficiency. In line with carrying out the economic reform and the changeover to assessing the operational results of the enterprises on the basis of the profit and profitability indicators, good conditions are created for raising the effectiveness of repairs. The converting of the repair services to full economic accountability must be considered as a most important measure providing for the solving of this problem.

At the present stage of technical progress, the problem of improving the forms and methods of production planning and management is one of the most important economic problems. At present it is simply impossible to manage production processes efficiently in shipbuilding using the old traditional and often primitive methods, since the processes have become much more complicated and comprehensive, and even minor mistakes in managing them can lead to large economic losses.

The constantly growing volume of technical and economic information at the enterprises has caused a significant complicating of the production management processes. Even now, at a medium-sized shipbuilding enterprise, each month several tens of millions of primary indicators characterizing the

state of the production process must be processed. In filling out the document forms, billions of calculation operations are executed, and the engineers, technicians and white collar personnel spend at least 30 percent of their time on this. If one considers the various rough drafts, memos and other office operations, then the amount of work in processing the information virtually doubles.

Under these conditions, the only way out of the existing situation is an improvement in management on the basis of its scientific organization and maximum mechanization of engineering and management labor. This will put in the hands of the economic leaders the necessary possibilities for efficient organization of production and optimum use of all existing resources. The most effective means for solving this problem is the elaboration and introduction of an automated production management system (ASUP) at the shipbuilding enterprises.

The experience of working out and introducing ASUP at the shipbuilding enterprises has shown that the basic sources for raising the economic efficiency of production due to using it are an improvement in the extensive and intensive use of the fixed capital and production capacity of the enterprise (above all its basic production equipment) and the subjects of labor (raw products, materials, energy and fuel), a reduction in the expenditures of live labor and a decline in the losses of working time, an increase in the production volume and a reduction in product costs, as well as a rise in the labor productivity of the production workers and engineers and technicians.

Thus, the introduction of ASUP, the elaboration of which is presently being carried out on a broad front, will make it possible to solve a very complex and interrelated group of management questions needed for sharply increasing the efficiency of shipbuilding in the national economy (including by improving fixed capital utilization).

CONCLUSIONS

Improving fixed capital utilization of a shipbuilding enterprise, as one of the important ways for increasing product output and lowering its cost, is a permanent task and not a brief campaign. It should be based upon a group of organizational and technical measures carried out on the basis of a special plan.

Under present conditions, particular attention should be given to optimizing the fixed capital structure of the shipbuilding enterprises. This task can be carried out on the basis of employing mathematical economics methods and electronic computers. With such an approach it is possible with sufficient grounds to disclose lacking or surplus equipment and create a fixed capital structure which will provide for the output of the set product volume with a minimal fixed capital value.

A most important component element in the problem of raising the efficient use of fixed capital must be considered the modernization and prompt replacement of obsolete equipment, considering the most recent achievements of technical progress in shipbuilding.

It is also essential to work for a possible stabilization of the shipbuilding programs for the individual enterprises in order to provide the maximum possible even load on production capacity. This creates the best prerequisites for the optimum use of fixed capital.

A very significant rise in the effectiveness of fixed capital must be expected in introducing ASUP into shipbuilding, as this provides an opportunity for effective control and efficient regulation of the extensive and intensive use of equipment.

The practical realization of the measures examined in the pamphlet will make it possible to raise significantly the economic efficiency of fixed capital in shipbuilding, and to increase product output without additional capital investments.

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