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PRINTING PRODUCTS QUALITY CONTROL SYSTEM IN THE CONTEXT OF ISO QUALITY MANAGEMENT

Growing global demand for goods and services has created a modern, highly competitive market, making quality control and regulatory compliance more necessary than ever. Trends in the developing world of printing products with a variety of information content require the solution of information problems, which, accordingly, will increase the efficiency of printing production and product quality. Modern technologies, the use of effective methods, devices and techniques for production management, the implementation of the same production operations, employee training, continuous improvement of production processes and working conditions ensure printing products of consistently high quality. Achieving the proper quality of publishing and printing processes focused on the production of printed products is almost the most important, especially in modern industrial relations, computerization of production, active implementation of information technology, limiting energy resources. The quality control system of printing products is the main part of the process, which performs the task of analyzing the measured quality parameters, determining the causes of identified quality defects and choosing how to eliminate them. After determining the causes of quality changes, the method of their elimination depends on the actions of operational personnel who try to eliminate defects, for example by recalibrating the printing machine, changing environmental conditions, the choice of other consumables.

Keywords: quality control, printing products, resources, system management, information.

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СИСТЕМА КОНТРОЛЮ ЯКОСТІ ДРУКОВИХ ПРОДУКТІВ У КОНТЕКСТІ УПРАВЛІННЯ ЯКОСТЮ ISO

Розглянуто інформаційну систему забезпечення якості в процесі управління поліграфічним виробництвом. Контроль якості є невід'ємною частиною управління якістю, яке спрямоване на виконання вимог якості. Просто контроль якості у виробничому процесі гарантує, що клієнти отримують продукцію без дефектів та задовольняють їхні потреби на найвищому рівні. Зростання глобального попиту на товари та послуги створило сучасний, висококонкурентний ринок, зробив контроль якості та відповідність нормативним вимогам більш необхідними, ніж будь -коли. Показано, що система контролю якості поліграфічної продукції є основною частиною процесу контролю якості, яка виконує завдання аналізу вимірюваних параметрів якості поліграфічної продукції, визначення причин виявлених дефектів якості та вибору способів їх усунення. Після визначення причин зміни якості спосіб їх усунення залежить від дій оперативного персоналу, який намагається усунути дефекти, наприклад шляхом повторної калібрування друкарської машини, зміни умов навколишнього середовища, вибору інших витратних матеріалів. У роботі враховано тенденції світового розвитку поліграфічної продукції з різноманітним інформаційним змістом, які потребують вирішення проблем інформаційного характеру, що забезпечить зростання ефективності поліграфічного виробництва та якості продукції. Досягнення цих цілей досягається шляхом використання сучасних технологій обробки (підготовки) даних, використання ефективних методів, пристроїв та прийомів управління виробництвом, паралельного виконання однакових виробничих операцій, навчання працівників, постійного вдосконалення виробничих процесів та умов. продуктів.

Зроблено висновок, що отримання високоякісних видавничих та поліграфічних процесів, орієнтованих на виробництво друкованої продукції, є важливим у сучасних виробничих відносинах із глибоким застосуванням комп'ютеризації виробництва, активним впровадженням інформаційних технологій, економією та обмеженням енергоресурсів.

Ключові слова: контроль якості, поліграфічна продукція, ресурси, управління системою, інформація.

Introduction

The demand for printing services and products is directly proportional to the world production of goods and services, which allows us to interpret the printing industry as a reflection of trends in the entire national economy. The growing impact of digital and Internet technologies on society has significantly reduced the demand for printed goods (books, albums) and periodicals (magazines, newspapers), replacing them with electronic publications and e-books. At the same time, under the pressure of the market situation and competition, the interest of enterprises in advertising products is growing. Among many types of advertising, the most common group is printed one, including informational job advertisements, such as leaflets, posters, brochures or catalogs. This form of goods representation and services is most often used by the micro and small enterprises sector, for which due to financial constraints it is one of the few opportunities to receive orders.

Large integrated enterprise management support systems are designed for huge companies with great technological capabilities. Each order in its implementation requires an individual approach to the choice of parameters (eg, paper, paints, formatting or binding method), and then adapt the production process to the expectations of the customer, including an acceptable level of quality:

1. The need to apply different standards (ISO 12647-2: 2007, Brunner system, BVD / FOGRA) is due to the instability of orders and consumer preferences typical of small businesses.

2. The need to adapt standards to customer quality requirements.

3. The need for a comprehensive analysis of print quality, taking into account all potential problems.

The point of print quality is a problem that requires constant monitoring and correction, and it cannot be solved once. The solution to eliminate the above problems is to use appropriate IT methods implemented as part of system solutions [1, 2].

Related works

The issue of providing high-quality printing products and reducing the cost of their production has been discussed at many national and international conferences and industry meetings. Research on this issue is also conducted by leading research and development institutions in the field of printing, such as Fogra / Ugra, CIP4, ICC, COBiRPP, Ghent PDF Workgroups [1-3]. The result of the work of these institutions is a set of various quality standards (ISO 12647-2: 2007) [4] and standards (JDF 1.4: 2008, ISO 32000-1: 2008) [5] that systematize the printing process. These standards are the basis for building IT systems that automate printing processes and support product quality control. Such support can be provided at several levels, from individual devices that measure quality parameters, through separate quality control stations, to IT quality assurance systems integrated with printing machines (for example, X-Rite solutions).

IT systems have the most noticeable impact on the activities of printing companies, and there are two main types: automatic control systems and desktop programs [8, 9]. The advantage of the first one is the automatic measurement and analysis of quality parameters and correction of printer settings. The disadvantages are the high cost of implementing the system and its limitation to a specific model of manufacturing printing machines. Examples of such solutions are: Prinect (Heidelberg), measuring systems (Koenig & Bauer), PECOM (Man Roland), FALCON-66 (Soma Engineering). The advantage of desktop applications is the relatively low price of independence from typewriters. The disadvantage is the limited functionality for analyzing only selected quality parameters. In addition, they require the use of additional instruments or measuring stations. Examples of such programs are: GMG Print Control (GMG), MultiCam and SpectralCam (QuadTech).

The current standard that formalizes the printing process is Job Definition Format - JDF 1.4: 2008, which is controlled by an independent consortium CIP4 [2]. The idea of JDF is to gather all the information related to a specific order in one place, from the customer's first request, through DTP, printing and processing, to distribution. JDF is an electronic equivalent of a "technology card", which in its physical form traveled through the following departments and stages of the order. In the quality control process, JDF is a source of order information, such as quantity, print size, type of substrate, binding, screening parameters, or color space. JDF integrates many standards that govern various areas of the order fulfillment process, including JMF (Job Messaging Format), which transmits messages between devices and programs, PJTF (Portable Jobticket Format) [6], automates the processes of printing preparation, or PPF (Print Production Format) [7], which allows initial control of production devices (JDF.1.4: 2008) [5].

The problem of ensuring the required quality of printing products is directly related to printing and requires the integration of company and order production capabilities. Product quality parameters must meet customer requirements and acceptable standards.

Presenting the main material

One of the fundamental aspects of the printing products quality control system development is its location in the structure of the enterprise. This is the basis for determining the type and method of data flow in the enterprise. To do this, it is important to indicate the area of operation of the quality control system of printing products in the adopted ISO model of quality management (Fig. 1).

One of the guiding principles of this model is a systematic approach to quality management, which task is to define, understand and manage interconnected processes as a system [10-13]. It is necessary to participate in the printing products quality control system, which not only allows to control the process of quality improvement, but also helps to identify places where the system deviates from the norm. Places where processes deviate from the norm need special attention, as the occurrence of discrepancies in them can have a negative impact on the level of consumer satisfaction.

Information that is important in the decision-making process regarding control, planning, organization, etc. plays a fundamental role in quality management systems. Information processed from different production areas data is collected in the Management Information Systems (MIS). Communication between MIS and other systems, including the quality control system for printed products, takes place using the Job Definition Format (JDF 1.4: 2008).

Figure 2 shows the information flow structure at the printing company, which is the basis for identifying input and output data sources of the quality control system of printing products [13, 14].

The printing products quality control system is based on information from various areas of enterprise management, which can be divided into administrative information about the customer and the order, product information, information about the implementation of the technological process, technical information and information about the quality level.

In response, the system delivers to MIS the results of the entire monitoring process, which can be used by management for analytical and statistical purposes. This includes information of the control process progress, analysis of product quality parameters and how to fix product quality defects.

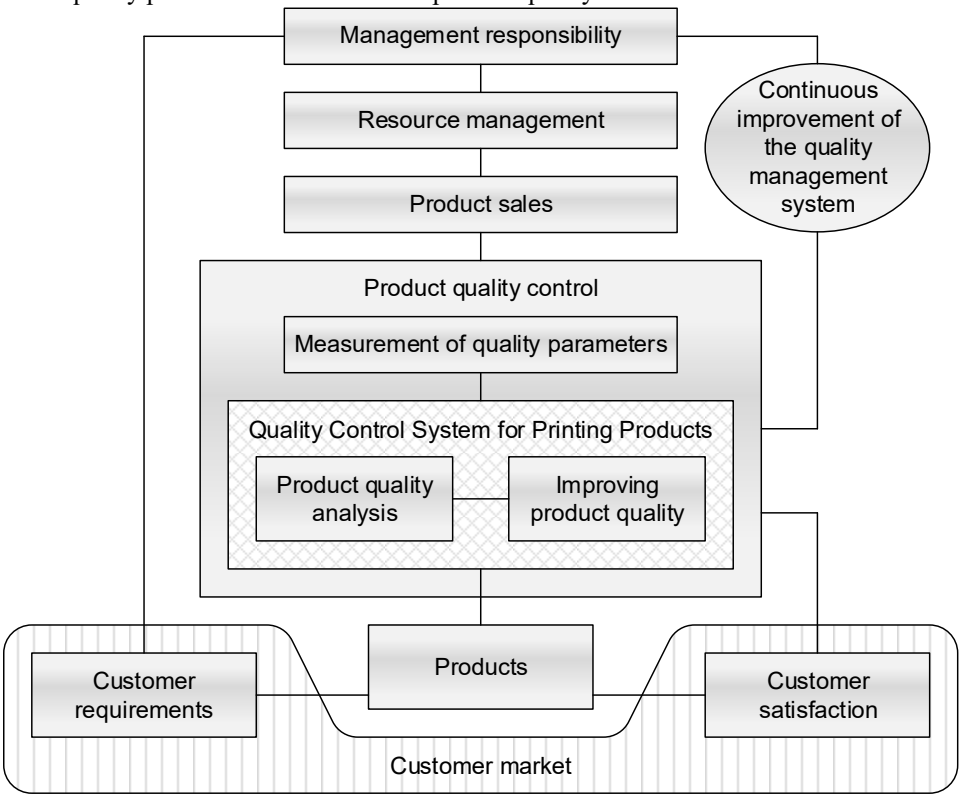

Fig. 1. The place of the quality control system of printing products in the adopted ISO model of quality management system (based on ISO 9001: 2008).

As already mentioned, data is exchanged through JDF. However, this format does not support all the data required for the quality control system of printed products, only allows the connection of additional data blocks. It is also possible to create an additional data transmission channel, which should be compatible with MIS and provide data transmission without collisions for all areas of enterprise management [15, 16].

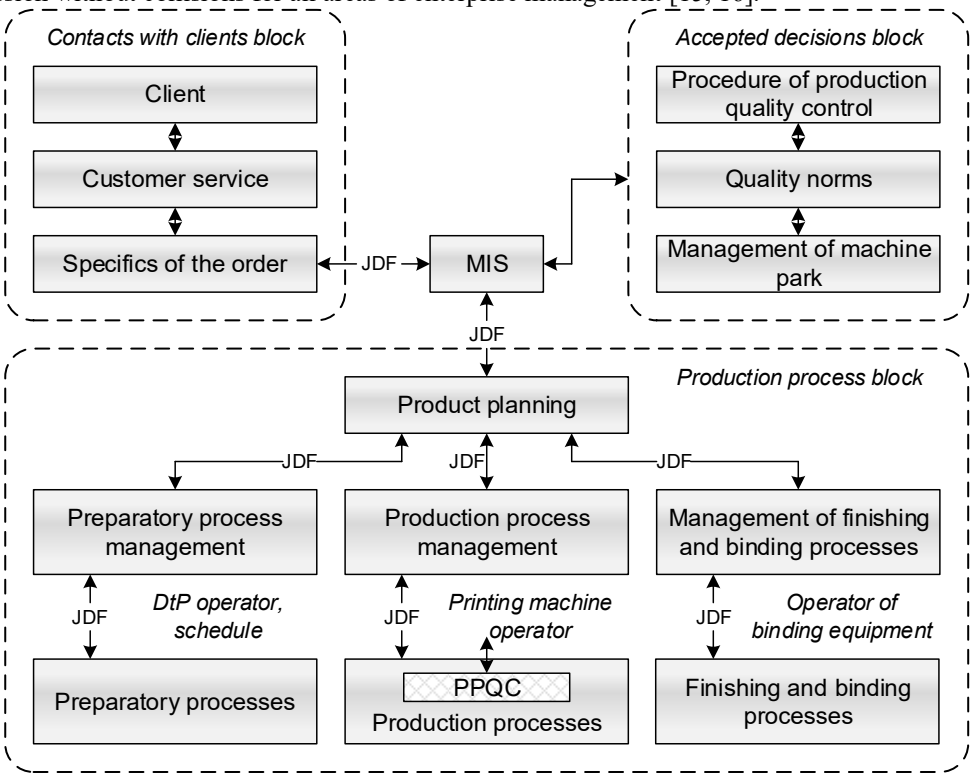

Fig. 2. Data exchange of the printing products quality control system throughout the printing company based on JDF.1.4: 2008)

Table 1 shows a detailed description of the input and output data type in the system of printed products quality control. Data sent using the JDF format is denoted by the number 1.

Table 1

Data types in PPQC system

Types of input data	Data components
Administrative data	Order ID
	Order name
	Short order description (optional)
Product details	Full preview (proof) and partial (separation)
	Product type (purpose)
	Number of copies
Production data	Material type
	Color information, type of paints
	Raster parameters
	Initial calibration parameters of the machine (paint zones, registers)
Technical data	Printing machine manufacturing parameters
	Specification of the printing machine (number of ink zones, levels of adjustment of mechanics)
	Service life of machine parts (bearings, cylinders, substrates)
	Date of last replacement or cleaning mentioned machine parts
	Other technical information
Qualitative data	Placement of cubes (strips) of measurement
	List of quality parameters
	Individual tolerances of product quality parameters
	Quality control procedures (measurement method, measuring devices)
Types of source data	Data components
Information on the quality control process	Number of inspections
	Frequency of inspections (number of sheets)
	Method of measuring quality parameters (automatic, manual, mixed)
	Values of measured parameters
Information on product quality analysis	Deviation of parameter values from quality standards
	Parameter status after quality control
	Indication of causes of quality defects
Information on ways to improve quality defects	Instructions for eliminating quality defects
	Calibration parameters of the printing machine

The most important aspects related to the presence of the system in the printing company can include:

– independence of the printing products quality control system from other information systems used in the printing company,

– independence of the printing products quality control system from the machine park, printing technology, type of printing products,

– the work of the system is not connected with the whole printing process, it works only at the stage of product quality parameters control. The system starts when the data on the new production order is provided and ends when the required quantity of circulation that meets the quality requirements set by the company and the customer is reached. The system goes to rest after each positive product quality control,

– data exchange with the printing products quality control system occurs through MIS integrated with the JDF format or, in the absence of the above, the use of other channels or media, which allows data entry into the system,

– all input and output data from the printing products quality control system are sent in the XML standard, which allows a quick modification,

– the data processed by the JDF is carried out within the Job Messaging Format (JMF), which allows to process messages related to the order. Whereas data not serviced by JDF can be sent via a data block or an additional communication channel in combination with other systems [8-9].

Results of the research

Taking into account the course of the whole production quality control process, it is important to indicate the areas implemented by the printing products quality control system, as shown in Figure 3.

Regardless of the enterprise specifics and the type of product, the origin of defects in the printed products quality can be associated with four reasons (initially, the least common):

– printing conditions,

– operation of the printing machine,

– errors in the preparatory processes,

– incorrect selection of the printer settings.

The first group of reasons that affect the product quality indicators value is related to the printing process conditions surrounding. These include room temperature and humidity. It can affect the properties of the pre-printed form, which in turn can cause a number of problems with virtually every quality parameter. For example, wet or dry paper will not absorb paint properly, causing streaks, stains, dirt, or incorrect color reproduction. The sterility of the production plant is very important, as dusty air will cause dust particles to enter the machine, which are very

difficult to remove. This group of causes can be eliminated by installing sensors and regulators of environmental parameters [17, 18].

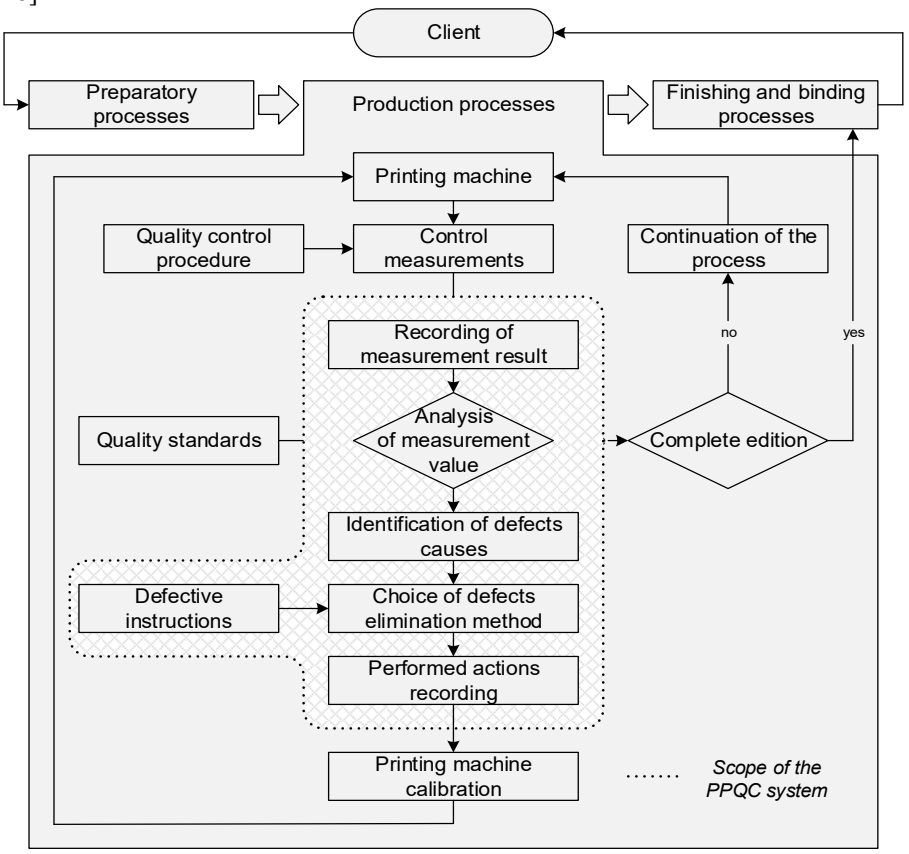

Fig. 3. Functioning area of the printing products quality control system of in the process of quality control

The second group consists of problems with the printing press operation. These may be mechanical defects, such as broken parts, deviations from the norm associated with the technical condition of the machine. Disadvantages associated with the printing press operation may include replacement of ink rollers, bearings in case of halos, replacement or maintenance of the rubber web, offset forms after printing about 30 thousand sheets (depending on the manufacturer), fulfilling or replacement of the humidifying solution or the need to clean the machine mechanisms. In this case, you need to adhere to the operating time in advance and plan a simple machine in advance.

The third group of reasons that affect the value of product quality indicators is related to mistakes made in previous stages of the production process, or incorrect selection of materials. The most common cause of defects is the printing form, or rather the wrong choice of raster parameters, rulers, fill thresholds. Problems with enlarging raster dots can occur due to the incorrect exposure of the printing plate. A large group of errors are related to the use of materials that are not adapted to the specified printing process, for example, the wrong choice of ink or wetting solution can upset the color balance of the print, elastic and tear-proof paper can potentially shift, which will cause problems with fitting and duplication. Elimination of this group of reasons requires the use of appropriate materials and the production of a new printing plate.

The last group of reasons is the result of incorrect choice of the printer parameters. The group of these reasons is the most complex group, which requires not only the identification of those mechanisms, but also to find a correlation between them and the parameters of the quality of printing products.

The general estimation of the set quality reception of printing production includes levels at which elements of quality are formed:

1. the initial level of dialogue "customer-manufacturer";
2. the level of customer requirements coordination with the printing production possibilities;
3. the level of the factors impact assessment on the printed products quality in the process of production and operation;
4. the level of decision-making in quality assessment, based on the resources estimation, data forecasting and technological process strategy;
5. the level of production according to the specific requirements.

Conclusions

The paper proposes an approach to solving the problem of the printed products quality ensuring in the form of an information system for monitoring the quality. To do this, there are needed:

– Analysis of all printing products quality parameters defined by norms and standards (for example, ISO, PN, BN, FOGRA).

– Identification of the causes of product quality defects related not only to the printing machine, but also to other factors (materials, operating conditions, printing conditions, previously made errors).

– Printing machine parameters adjustment to achieve the quality parameters specified in the ISO quality standards.

– Consideration of a complex network of printing machine quality parameters and settings interdependencies.

– Usage of the existing information and technical infrastructure of enterprises.

– Low costs for the implementation and maintenance of the system in the enterprise through the use of standard components for its construction of information components.

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