International Journal of
Science and Engineering Investigations vol. 1, issue 1, February 2012

For the Choice of Potential Niche Goods and Management of Life Cycle Process Automation

Torgayeva R. Inkara[1], Torgayev A. Rymbek[2], Oshlakova G. Irina[3]
[1,2,3] Kazakh-British Technical University
(inkara.torgayeva@gmail.com [1], r.torgaev.48@mail.ru [2], raduga_011@mail.ru [3])

Abstract- Machinery construction is considered as one of the strategically and developing industry of Kazakhstan. However, import of goods and products in this particular industry significantly exceeds level of export. This means that demand of machinery construction products is mostly satisfied by imported goods. This paper describes the process of choice of niche goods, which production line management lacks effectiveness and outlines the CALS technology as method to improve situation in Kazakhstan machinery construction industry**.**

Keywords- *CALS (Continuous Acquisition and Life cycle Support), machinery construction, niche, segment*

I. INTRODUCTION

There is no country in the world which can be announced as leader in all existing segments of machinery construction and based on world experience, machinery construction of Kazakhstan still have opportunity to be competitive in terms of right and effective usage of existing resource for the specific segments and niche goods production development. In addition, industry performance significantly depends on its production ability which could be increased by automation of all life cycle processes of goods.

II. CAPTURE OF CURRENT SITUATION

Choice of priority segments of machinery construction and potential niche goods had been done with consideration of potential growth internal demand, goods production volume growth in the current level of development, multiple effects from segment development, import volume, potentiality of SMI in the segment, level of technological effectiveness of goods, stability of export and import and etc.

Import and export structure of machinery construction covers all its segments in Kazakhstan. The segments classification with specific Goods nomenclature of external-economic activities and customs union (GNEEA and CU) codes is provided below in Table 1.

Forecasted dynamics of change of some of machinery construction import volumes are shown on Picture 1.

Growing tendency is shown on graphs for all segments of machinery construction, except agricultural machinery construction and consumer electronics.

This tendency is supported by valuation of expected demand on machinery goods.

List of most imported machinery construction goods with 6 signs of GNEEA and CU code definition was defined based on analysis and building a diagram of structures and import volumes of machinery construction segments (Diagram 1). Upper mentioned diagram listed in Table 2.

TABLE I . MACHINERY CONSTRUCTION (MC) SEGMENTSCLASSIFICATION

MC	***GNEEA and CU***	***Main goods groups***
Mining and metallurgy	8425, 8428, 8430, 8454, 8455, 8462, 8466, 8474, 8480	Specific technique and equipment for mineral and coal crop, primary metal processing
Automotive industry	8407-09, 8511, 8609, 8702-09, 8711-16	Manufacturing of cars, trucks, buses, combustion engines and etc
Petroleum	8413, 8481	Specific machines and equipment for petroleum industry including crop, primary processing and liquid pumps
Electric equipment	8539-40, 8543-44, 8547-48, 9001	Torque converter and wires production
Elements basis	8486,8505, 8532-38,8541-42, 8545-46	Scheme, condensator, electrical network switch equipment, clicker, diod and resistor manufacturing
Agriculture	8432-34,8436-37,8701	Agriculture equipment manufacturing
Railway	8601-08	Locomotive, rolling equipment and etc manufacturing

Most growing pace of demand will hit oil and gas products, mining, metallurgical MC and и automotive industry.

Population income growth will lead to growth in demand on consumer electronics and automobiles as 4% and 6% per annum respectively.

Necessity in renovation of machinery assets in agriculture along with demand in automation of manual work load will lead to increase in demand on agricultural machinery – as 5% per annum.

Machinery construction development in Kazakhstan in general along with manufacturing development will lead to increase of demand on goods in machine tools building, components base and elements base as 4%, 5% and 4% per annum respectively.

Increase in consumption of electrical energy and necessity of assets renovation in electric power supply industry of Kazakhstan will lead to increase in demand on electrical machinery as 4% per annum.

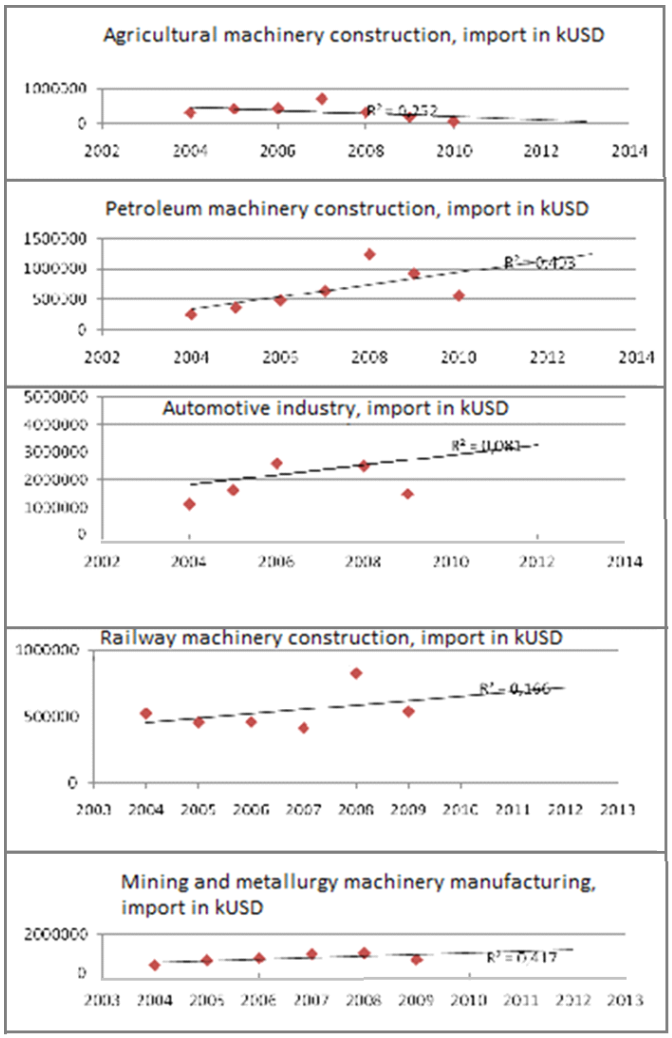

Figure 1. Dynamic of volume changes in import of segments in machinery construction

Review of general relationships between segments of machinery construction shows (Picture 1) that goods of machine tools building are used almost in all fields of manufacturing industry as petro-chemistry, metal industry, machinery construction, woodworking industry, food industry, consumer industry and others. That's why imports volume in machine tools building is significant comparing to other segments of machinery construction and directly depends on condition of assets of machinery construction corporations.

Electric equipment (mostly cables, wires and transformer) is used today in electric networks and generator energy. Due to that, import capacity in that segment mostly depends on electric energy capacity and price of segment products which is included in prime-cost of the electric energy generating companies. Considering the fact that price for electric energy in Kazakhstan is less than it is in main importers of machinery construction products countries, this segment of machinery construction cannot be considered as prioritized one.

The machine tool building segment and thin machinery construction products are mainly used in the complex technique, cars and equipment, vehicles and consumer tools production and machinery construction segments. Because of this fact, import strongly depends on whole process of machinery construction.

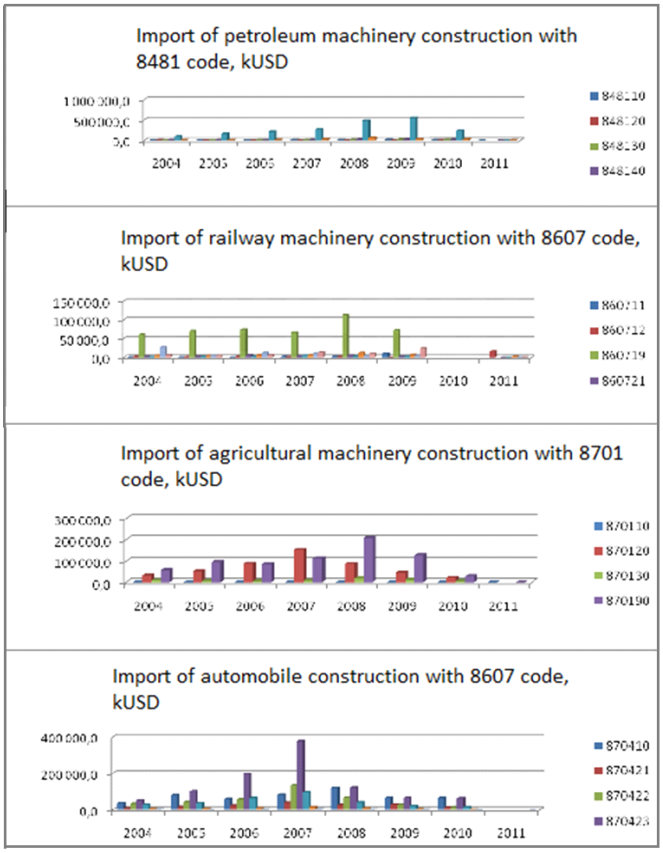

Figure 2. Structure, import volumes of machinery construction segments and dynamics of change during 2004-2011

Component base is used mainly in machine equipment and transport vehicles production. Due to that, import depends on production of that segment.

Element basis is used mainly in consumer tools, electric distributing technique and machine tool building production. Due to that, import of that segment depends on production capacity. Based on what written above, capacity of tools building and thin machinery construction, component base and element base import significantly caused by general condition of main funds and capacity of production of other segments. Therefore, their development practically depends on development of other segments of the industry with government support. Because of that, these segments are not included into the priority list. The most attractive segment for development of SMI are agricultural machinery construction and manufacturing of the specific prescription machines.

From the competitive ability point of view, the most leading segments in level of growth are machine industry, railway, petroleum, metallurgy and agricultural machinery construction. The most growing pace of import is observed in the mining, petroleum and agricultural segments. The same situation is in the growth of demand in those segments. Analysis of import in CIS shows analogical results for the medium technological effective products.

TABLE II. THE MOST IMPORTED TO KAZAKHSTAN MACHINERY CONSTRUCTION PRODUCTS

Automotive industry	
870210	Motor vehicles, aimed to 10 or more people transportation, including driver person: with valve internal-combustion engine and starting upon pressure (diesel or semi-diesel)
870423	Motor vehicles aimed to freight transportation: with total weight of more than 20 ton
Mining and metallurgy machinery construction	
847420	Machines for minerals ragging, used in ceramic items manufacturing
847480	Equipment for agglomeration, forming of ceramic contents for medical industry
Railway machinery construction	
860610	Carriage: of all types
860692	Carriage: others, opened, with fixed edges of less than 60 sm in height
Petroleum machinery construction	
841350	Liquid pumps with flow-meter or without it; liquid contents lifter; large scale backward progressive pumps and others
841370	Liquid pumps with flow-meter or without it; liquid contents lifter; centrifugal pumps and others
Agricultural machinery construction	
870120	Agrimotor: wheeled for semi-trailers
870190	Agrimotor: others
Electrical equipment	
850213	Electro-generator mounts with valve engine external-combustion and starting upon pressure more than 375 kVA
850423	Transformer with liquid dielectric with capacity of more than 1000 kVA
…	…

Results from the government support for Kazakhstan machinery construction are expected to raise production of the mining, metallurgy, petroleum, railway and agricultural machinery construction.

Research provided above leads to come to decision that priority segments of machinery construction are following segments: petroleum, mining, metallurgy, agriculture, railway and automobile industry.

Considering what is provided above, potential niche goods positions in machinery construction are listed in the Table 3.

Analysis of developed countries shows that contemporary solutions for increase of competitive advantage of goods includes automated management of its lifecycle, which is based on concept principles of CALS (Continuous Acquisition and Lifecycle Support). Deployment of this tool based on integration of information and cooperation of its participants like designers, manufacturers, operations and maintenance.

Unlike traditional automated management systems, CALS-technologies covers all processes beginning from requests for quotation to maintenance support.

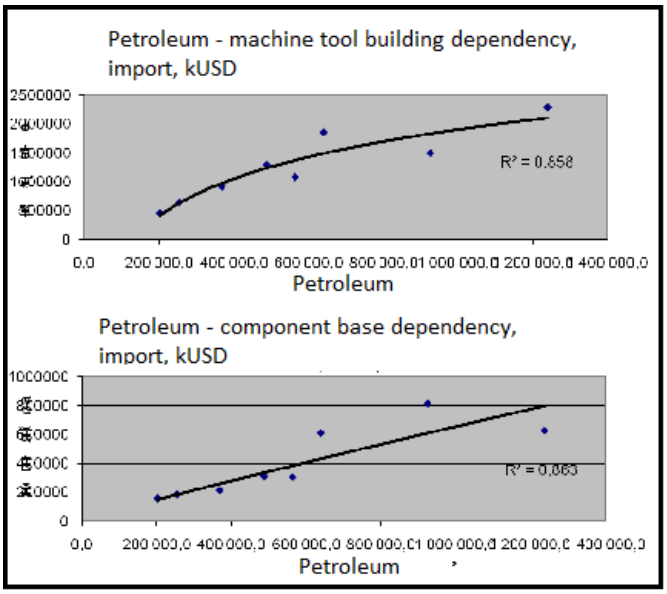

Figure 3. Dependency of segments of machinery construction

TABLE III. LIST OF PRIORITY NICHE GOODS POSITIONS OF MACHINERY CONSTRUCTION

Machine industry	
8702	Motor vehicles, aimed to 10 or more people transportation, including driver person
8703	Cars and other vehicles aimed to transport people
8704	Vehicles for freight transportation
8705	Vehicles of specific prescription
Mining and metallurgy	
8430	Machines and devices for planing, profiling, development, displacement, pounding, condensation, croping and digging
8474	Machines for sorting, separation and cleaning
Railway	

8606	Carriage
Petroleum	
8413	Liquid pumps with flow-meter or without it; liquid contents lifter
8481	Valves, lifters, faucets and analogical devices for pipes, boilers, reservoirs, tankers, containers and others, including reduction and temperature-controlling valves
Agriculture	
8432	Agriculture, garden and forest machines for soil preparation
8433	Machine and devices for cleaning or threshing in agriculture, including press machines, hay cutters or grass-cutters; machine for clearing, sorting and calibration of eggs.
8701	Agrimotors

Based on foreign data sources CALS technologies has significant potential: from direct design cost decrease, technical documentation preparation time decrease to decrease of time to market. Moreover, operational and financial indicators increased significantly.

At the same time, those in charge of maintenance services, are able to access interactive electronic technical manuals, which increases performance and productivity; for those in charge of manufacturing takes advantage of increasing their production, operational and financial indicators.

Designers are able to access mathematical model database, integrated into design process, which in turn decreases design time and increases its quality and specifically its accuracy.

Implementation of CALS concept is based on software package, which allows automation of project management, configuration of technological goods, configurations changes, design and technological engineering, preparation of interactive electronic technical manuals, modeling and business processes analysis and many other work aspects. Therefore the most complex task is selection of right software package. For this reason general requirement has been developed which is listed in Table 4.

TABLE IV. GENERAL REQUIREMENTS FOR LIFE CYCLE MANAGEMENT AUTOMATION SOFTWARE

1.	***Requirements for solving problems***
1.1	Organization and operations support for United and integrated platform of RAD members interaction functioning.
1.2	Management of engineering data, business processes, projects using united electronic archive for all business units based on integration with ERP-systems.
1.3	Support operations of software functionality, which is based on forming of automated working places set for engineering data management (PDM-systems, CAD-systems, CAE – systems, CAM – systems and etc.)
2.	***Requirements for performing functions***
2.1.	Construction and production of working documents automation – APM constructors: 1. Items development, 3D models creation of items and building units, sketch – graphics documentation formation, integration with PDM system. Creation of digital model from scanned physical object. 2. Items and process data visualization directly in 2D and 3D mockup; 3D models revision. 3. Import/ and export of data from such programs as Inventor, Slod Works, AutoCAD and etc.
2.2.	**Engineering computation and simulation modeling automation – APM for engineering computation:** **1.** Computation of constructions with various types of loading, total construction calculations, residual resource estimation **2.** Calculation models development **3.** Dinamic analysis, analysis of flows, nonlinear analysis, movements modeling
2.3	**Technology preparation of production automation – APM of technology:** 1. Conceptual models of section working process libraries creation 2. Production – technological processes planning 3. Automation and robotic processes automation and simulation
2.4.	**Electronic and interactive documentation preparation manuals – APM of specialist of IETM**
2.5	**Engineering data management automation – APM PDM – systems:** - Data revision and task performance control; - Interface to adjacent automated systems; - Navigation in 3D models; - United electronic achieve leading and data, documents and reports management, access to data; - Modeling, analysis and reengineering of business processes and etc.
3.	***Requirements for data sharing and integration with general computational network*** 1. Software must have an access to any item data, stored as electrical format in local or remote server and manage these data; 2. Software has to be modular, flexible and adaptive.

[1] Customs control Committee of Ministry of Finance of Republic of Kazakhstan, "Export– import of machinery goods 2004-2011 years". Astana 2011.

[2] Statistics agency of Republic of Kazakhstan, "Manufacturing of Kazakhstan and its regions", Statistical digest. Astana 2010.

[3] Statistics agency of Republic of Kazakhstan," Preliminary data as of 2010". Astana 2011.

[4] KAZNEX agency, "Machinery manufacturing of Kazakhstan" unpublished. Almaty 2008

[5] V. Bakayev, "Information supply, support and service of product lifecycle". *Machinery-1 Informative-study guide*, Moscow 2005.