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GALILEO NANOTECH: Lower Cost of RFID Tags



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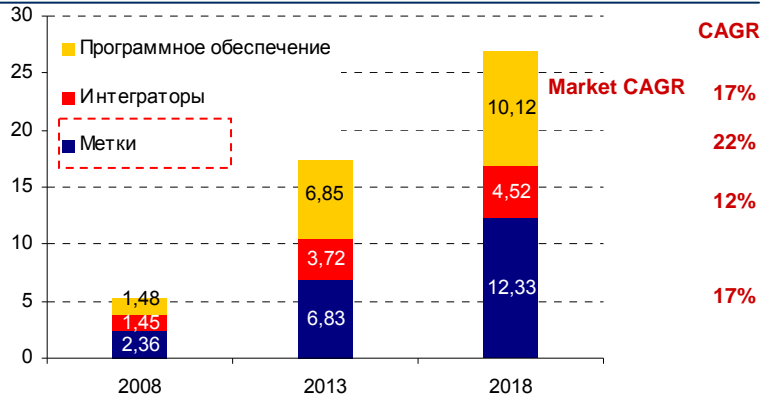
GLOBAL RFID MARKET

RUSSIAN RFID MARKET

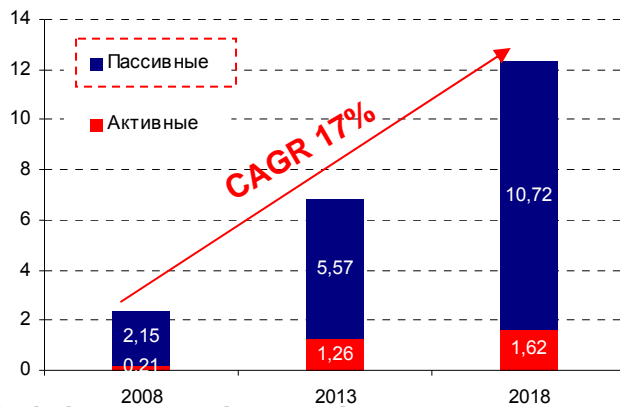
GALILEO NANOTECH

GLOBAL MARKET OF RFID SYSTEMS

Estimated value of the global market of RFID systems 2008 - 2018, \$ bn.*

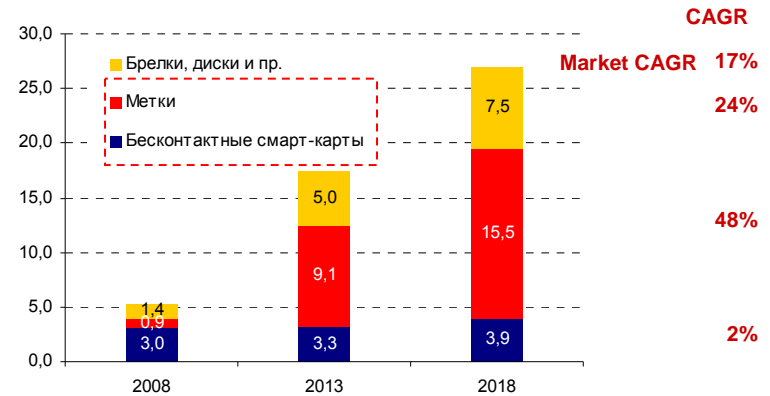


Estimated value of the global market of RFID tags 2008 - 2018, \$ bn.

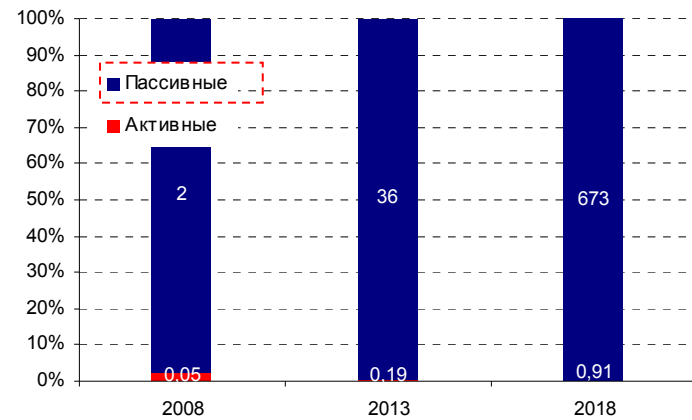


* Tags include smart cards, smart keys, etc.

Estimated volume of the global market of RFID tags by type, 2008-2018, bn. pcs.



Estimated distribution of the global market of RFID tags 2008 - 2018, bn. pcs.



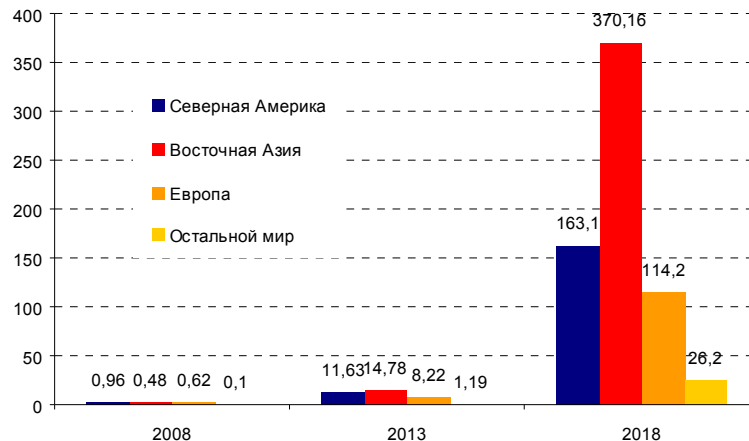
Source: IDTechEx

GLOBAL MARKET OF RFID TAGS BY REGION

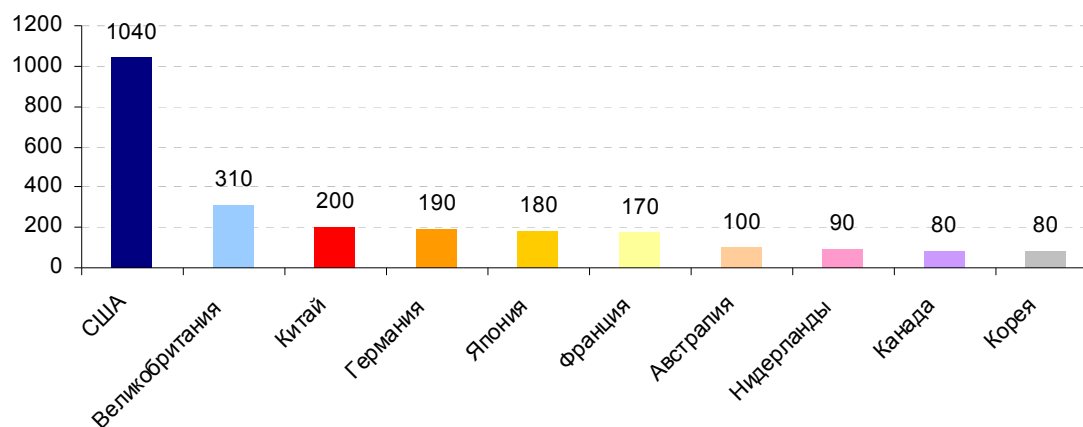
Estimated value of the global market of RFID tags by region, 2008 - 2018, \$ bn.



Estimated volume of the global market of RFID tags by region, 2008 - 2018, bn. pcs.



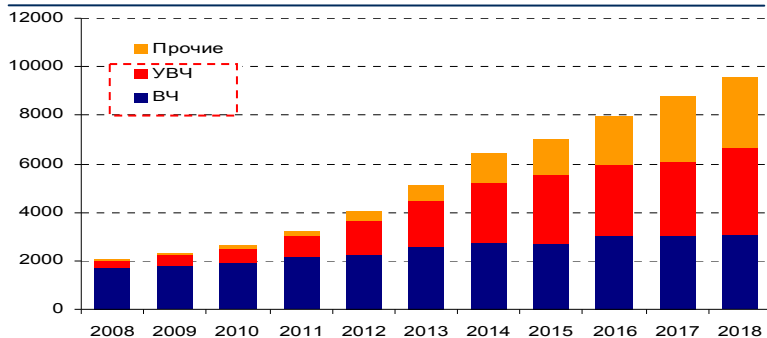
Number of implemented projects, per country



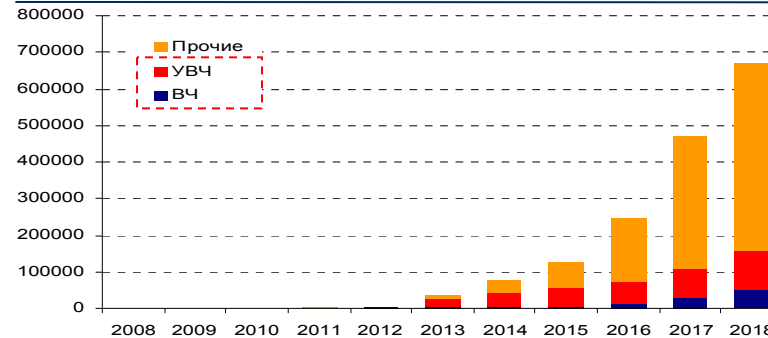
Source: IDTechEx

GLOBAL MARKET OF RFID TAGS BY FREQUENCY

Estimated share of the global market of passive RFID tags 2008 - 2018, \$ mil.



Estimated share of the global market of passive RFID tags 2008 - 2018, mil. pcs.

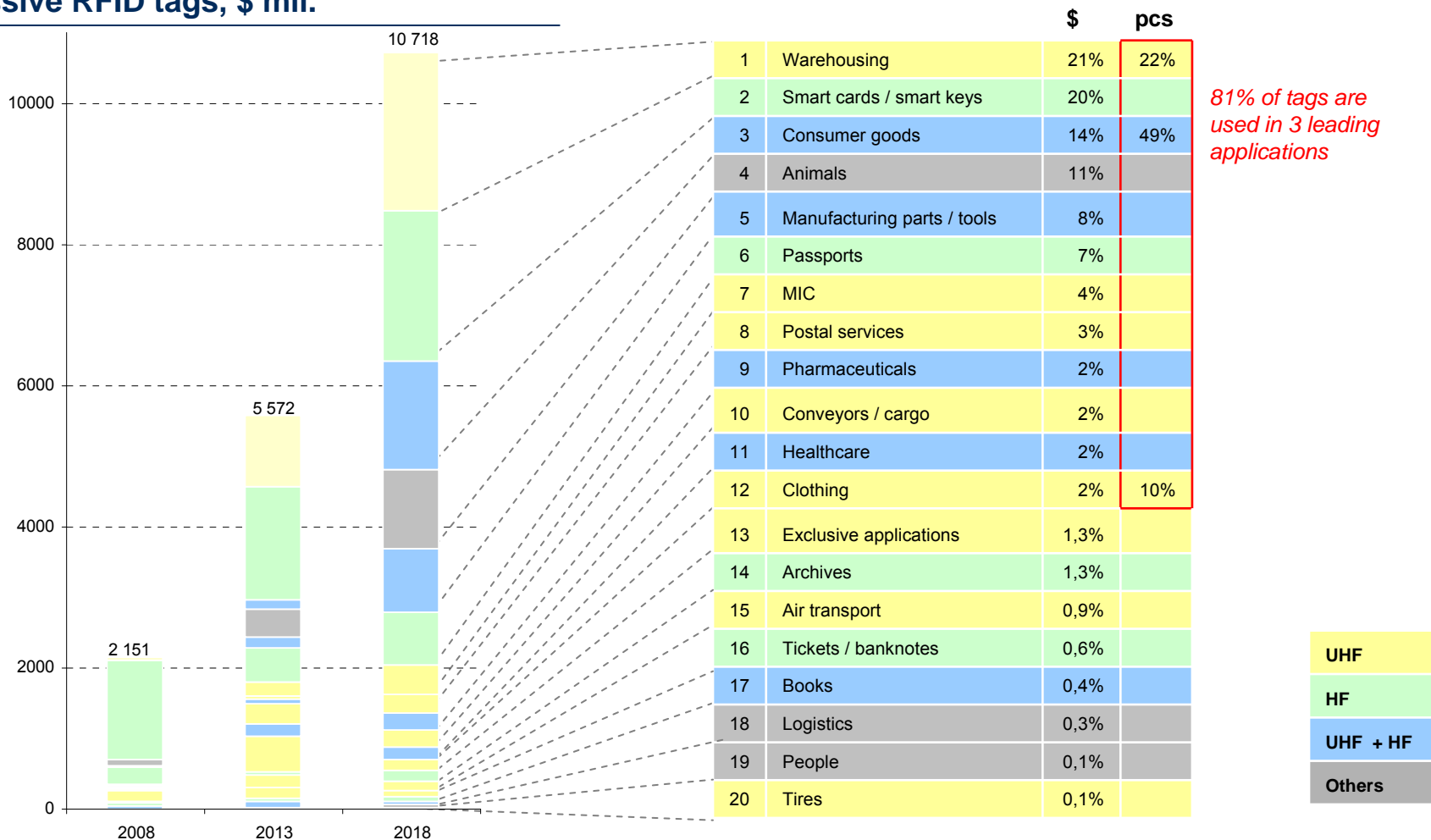


Implemented projects per region and per industry

	Clothing and consumer goods	Financial sector, security	Logistics, postal services	Transport, cars	Animals, agriculture	Books, libraries, archives
North America	Largest number	Second largest number				
Eastern Asia		Largest number		Second largest number		
Europe		Largest number	Second largest number			
Australia					Second largest number	Largest number

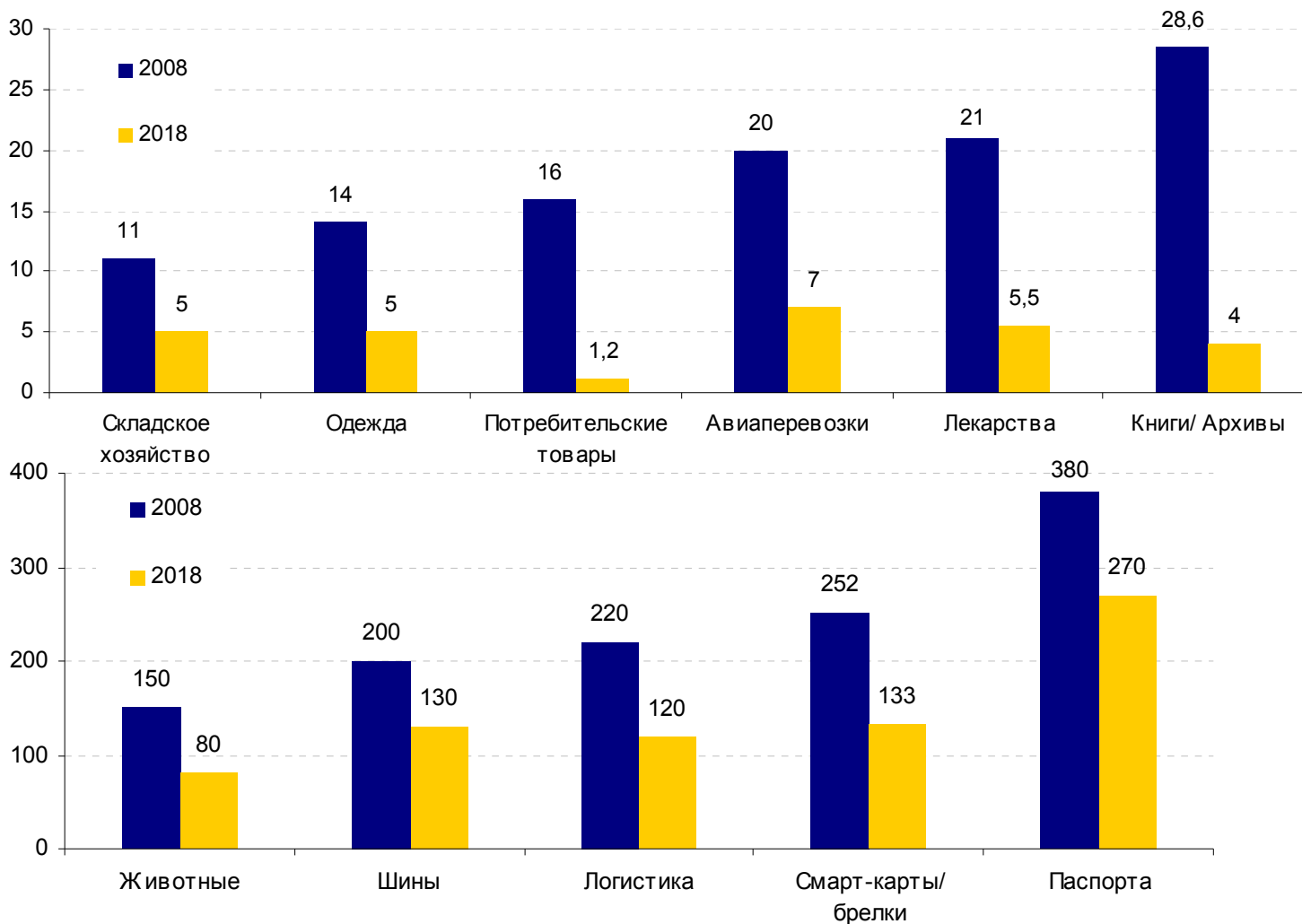
PASSIVE RFID TAG MARKET VALUE BY APPLICATION

Estimated share of the global market of passive RFID tags, \$ mil.



PRICES OF RFID TAGS

Price estimates for passive RFID tags, cents





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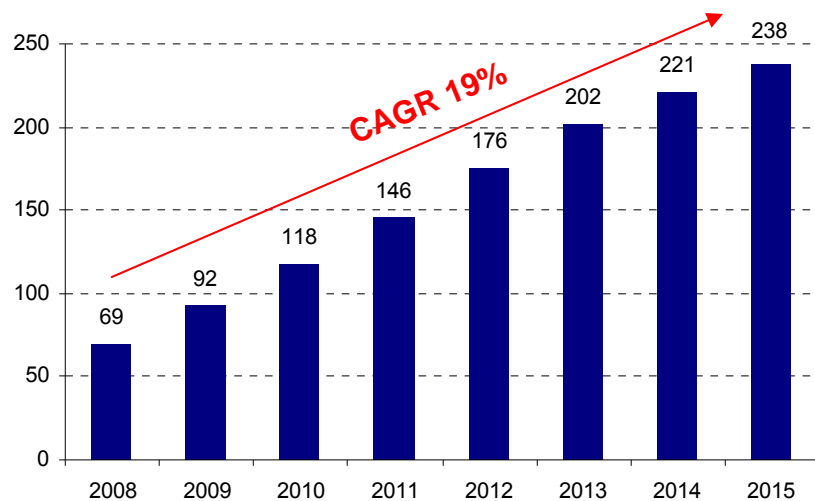
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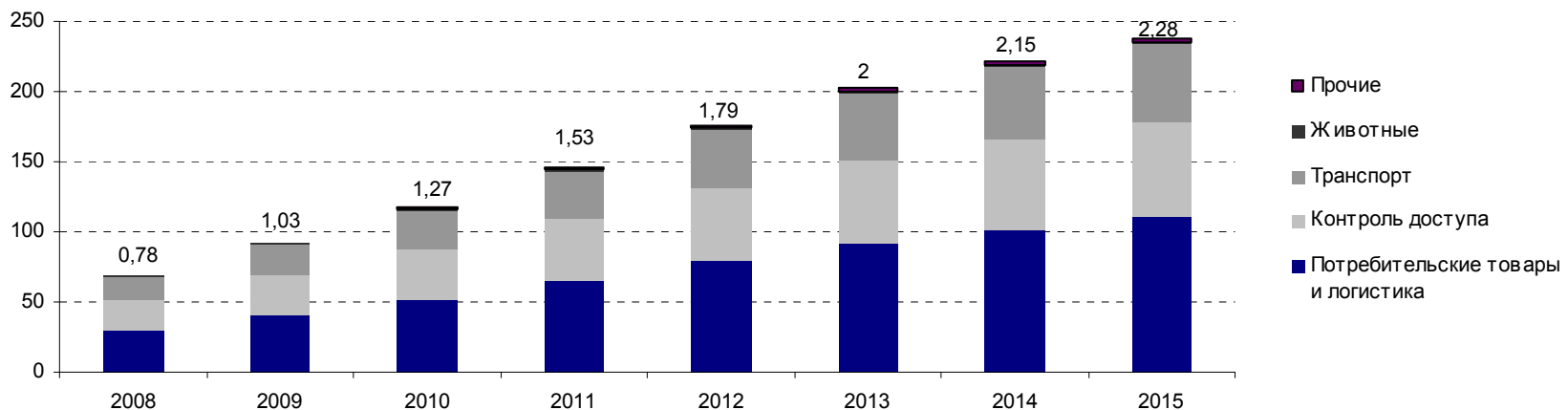
RUSSIAN MARKET OF RFID SYSTEMS

Estimated value of the Russian market of RFID systems 2008 – 2015, \$ mil.



- Global Industrial Analytics (GIA) estimate the value of the Russian market of RFID systems in 2008 at \$69 mil.
- However, the sales of HF tags (Sitronics company) to Metro alone total \$100 mil.
- Our evaluation of the RFID tags market value in 2008 is at least \$200 mil., based on the estimates and forecast of market players.

Estimated value of the Russian market of RFID systems by application 2008 – 2015, \$ mil.



RUSSIAN RFID MARKET TODAY AND FORECASTS

Current and potential applications

- Access control systems (anti-theft systems), where integrators offer available solutions, are most advanced. Operating frequency is selected based (partly) on the following criteria: LF tags are cheaper, HF tags are more reliable. This application has reached the limit of technological development.
- Business applications (“intelligent RFID”) represent a new and growing market trend. Main applications include processes automation, assembly lines, using UHF tags.
- UHF-based RFID systems of inventory management for libraries and archives are another prospective application.

Market players

- Russian system integrators develop their own readers for inventory management / control based on application requirements (reading, reading and comparison, stock taking), tags are purchased from global market leaders.
- Project cost shares are divided as follows: 20% equipment (tags and readers), 80% - implementation, integration. Russian customers try to save costs on integrator services by implementing RFID systems using their own IT staff. Hence, a large share of non-implemented projects (not going beyond pilot stage).
- Tags of required quality are not manufactured in Russia. Tag selection criteria: 1) range difference for tags in the same batch no more than 10 cm; 2) low % of unmarked non-functioning tags.

Impact of crisis

- Impact of crisis was felt at the end of 2008, but market players believe that financial complications will contribute to broadening the implementation of RFID systems due to the potential savings that they offer.

RUSSIAN MARKET TRENDS

Retail, inventory management and logistics

- An introduction of RFID systems for inventory management and logistics by several retailers would stimulate suppliers and eventually the rest of the market to follow
- The use of RFID tags in anti-theft systems, especially in the premium segment
- The use of tags on transport containers (real-time information about each container's location, size and cargo)

Manufacturing and financial services

- Control of the manufacturing process applying RFID tags on containers used in the process
- Technologies tested in large industrial holdings (e.g. color and additional equipment options for BMW 3rd series) have high potential
- Credit card for the payment of transport fare and other services

Transport fare collection and personal identification

- Government contracts for the manufacturing of chips for biometric passports
- Electronic systems for the 2014 Sochi Olympics
- Possible identification of immigrants
- Transport cards in the Metro:
 - Nizhny Novgorod
 - Krasnoyarsk
 - Ekaterinburg
 - Volgograd
- Transport cards for ground transportation



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MANUFACTURING PROCESS

STAGE 1. METALLIZATION

- Loading of materials
- Preparation for metallization
- Metallization with quality control
- Equipment cleaning

Packaging

Entire area

Selective

RFID

STAGE 2. FINAL PROCESSING

Film:

- Roll cutting – following roll's unloading from the metallizer, it is placed on the rewinding device with a circular saw

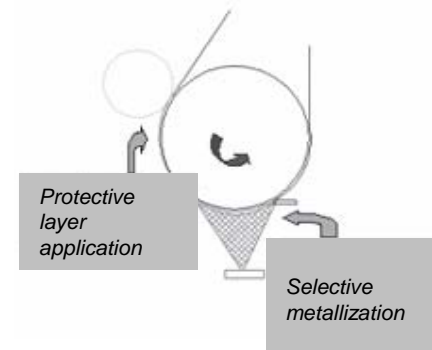
Paper:

- Rolls cut into sheets of predetermined size
- Imprint-to-order

- **Integration of chip antennas** at the assembly equipment – creating work pieces

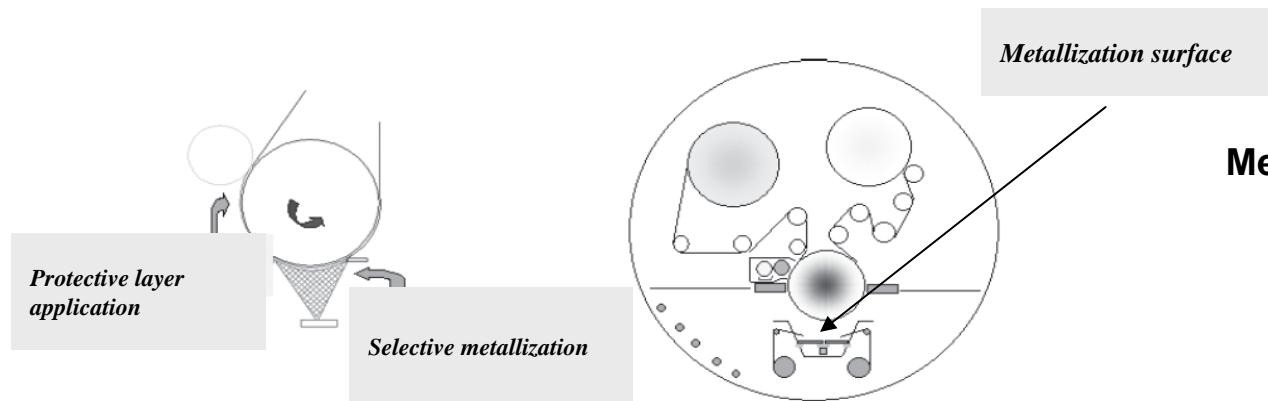
- **Laminating** RFID work pieces into paper and attaching a self-adhesive layer at the equipment

Equipment for metallization



EQUIPMENT

Metallizer construction



Metallization process may be one of two types:

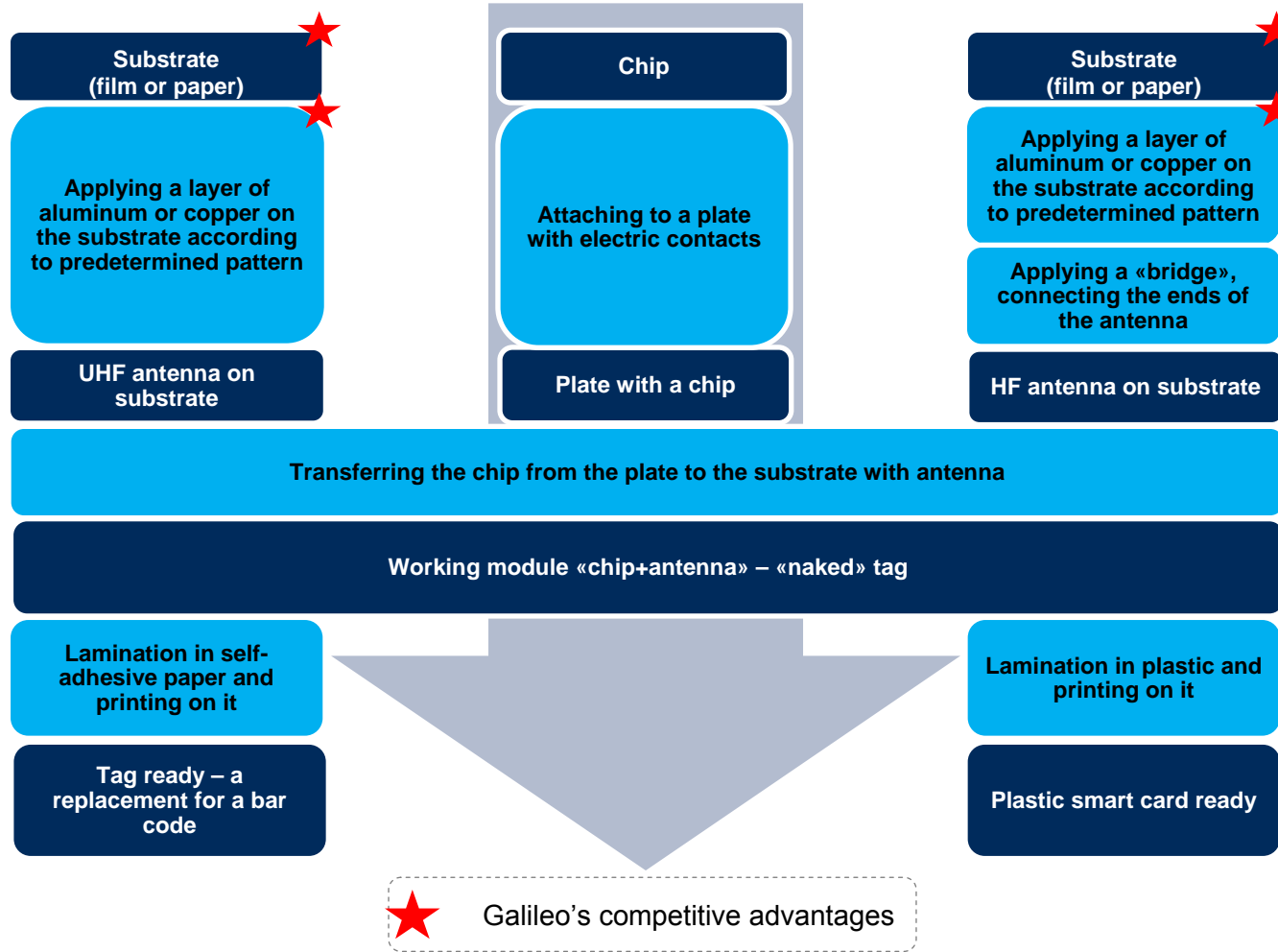
- covering entire area
- selective

- Selective metallization technology has made it possible to apply **complex RFID antenna patterns** both on polymeric and paper substrates.
- Such technology and equipment are currently **not available to any manufacturer** of vacuum metallizers. All existing methods of RFID antennas manufacturing use other technologies that are **inferior to the selective metallization technology**.

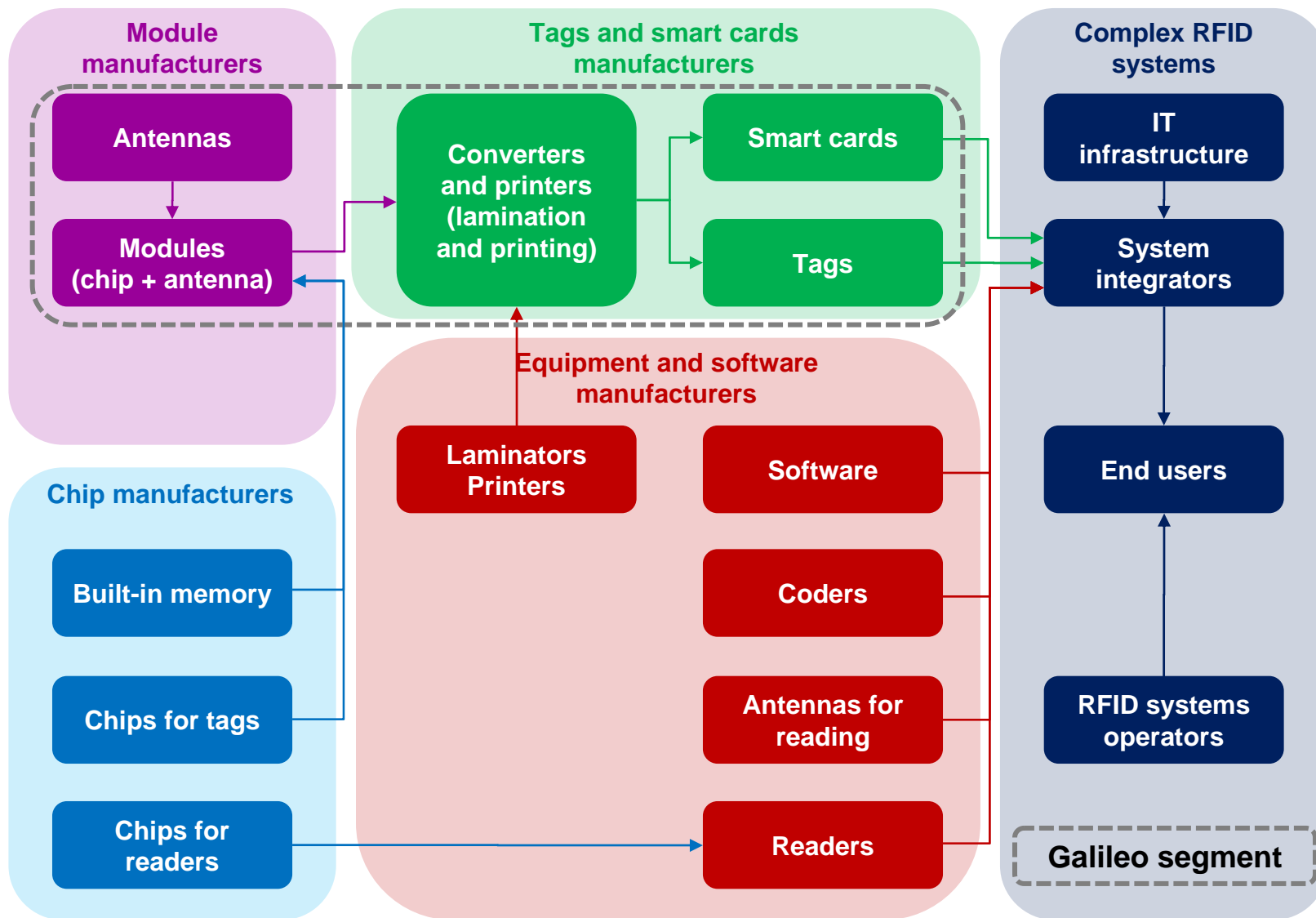
TECHNOLOGICAL PROCESS

Manufacturing of **UHF tags** – example of self-adhesive paper labels

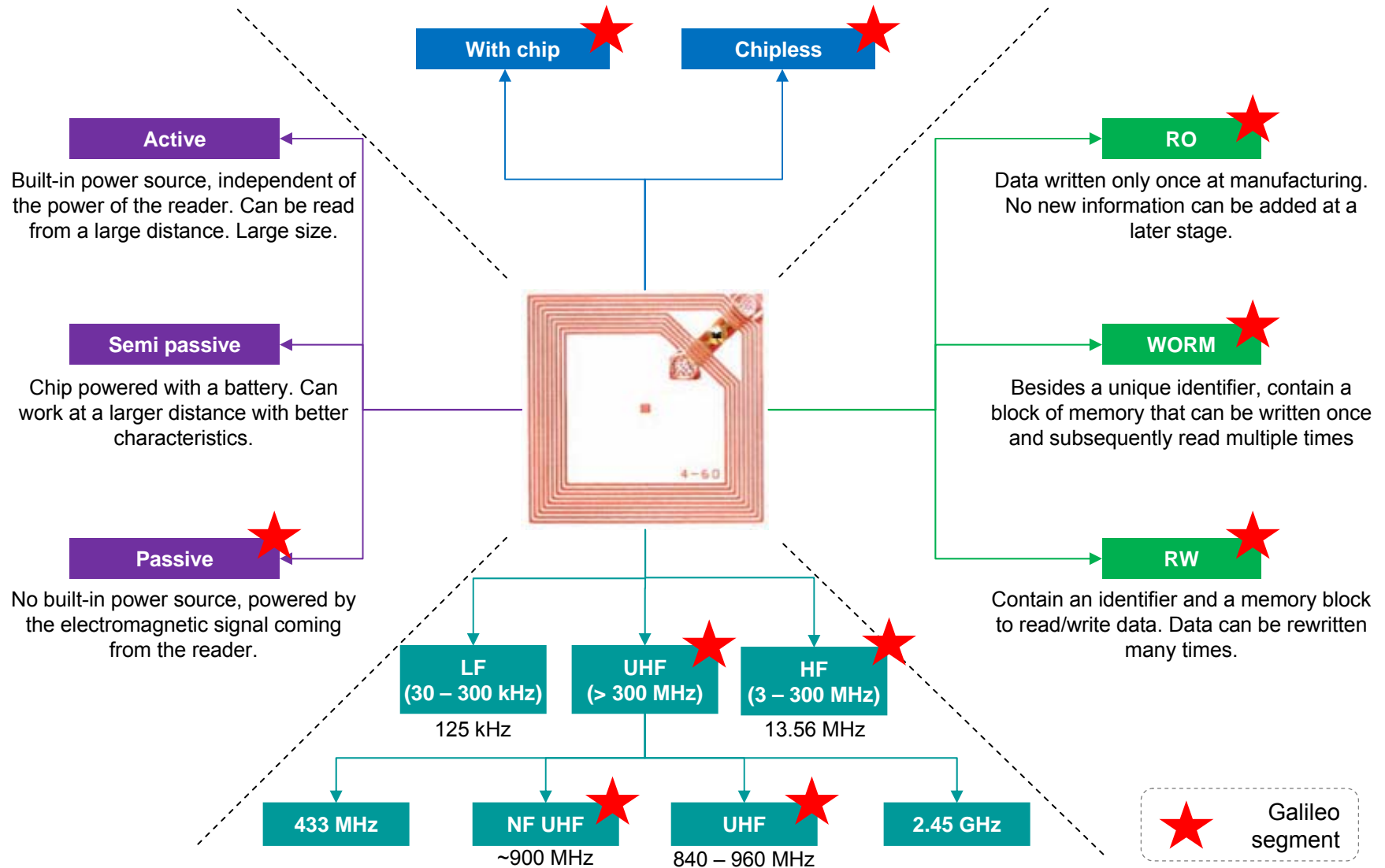
Manufacturing of **HF tags** – example of plastic smart cards



RFID MARKET VALUE CHAIN



RFID TAGS: CLASSIFICATION AND GALILEO SEGMENTS



COMPARISON OF RFID ANTENNA MANUFACTURING TECHNOLOGIES

Technology	Suitable for HF and UHF	Number of stages	Antenna flexibility	Material efficiency	Environment friendly	Innovativeness	Printing on paper	Manufacturers
Coiling	↔	↔	↓	↓	↑	↓	↑	Smartrac, G&D, Gemalto, Schlumberger
Etching	↔	↓	↑	↓	↓	↓	↓	KSW Microtec, UPM RAFLATAC, Omron
DuPont Inkjet Printing	↔	↔	↑	↔	↓	↑	↑	ASK, Poly-Flex, Mark Andy, Stork Screen, Avery Dennison, UPM
Plating	↔	↔	↑	↔	↔	↓	↔	Meco, APT, Ertek, Hanita, LeonardKurz
Electrolytic plating	↔	↔	↑	↔	↔	↓	↓	Conductive Inkjet Technology (CIT), Omron, RCD Technology
Stamping foil	↓	↔	↓	↓	↔	↓	↔	Avery Dennison, TransCore
Galileo Technology	↔	↑	↑	↔	↑	↑	↑	Galileo

Source: IDTechEx

COMPARISON OF PRODUCT CHARACTERISTICS

Comparison of range between Galileo tags with antennas and their equivalents

	Range at 868 MHz	Range at 915 MHz
Equivalent - SYMBOL Trident	6,1 M	4,9 M
Galileo	6,3 M	5 M
Equivalent - IMPINJ Propeller	5,1 M	4,3 M
Galileo	5,3 M	4,6 M
Equivalent - IMPINJ Thin Propeller	4,1 M	-
Galileo	7,2 M	-
Equivalent - IMPINJ near field	11 c M	-
Galileo	10 c M	-

When choosing tags, customers take into consideration the following important characteristics:

- Range – *see table above*
- Share of defective products – *non-functioning tags are automatically marked at the assembly stage*

COMPANY BUSINESS STRATEGY ON RFID MARKET

- Strategic goal: to become a leading supplier of RFID tags
- The company that is being set up will have a diversified range of products including RFID antennas, modules and tags
- The company plans to cover practically all market segments, namely the rapidly growing segment of UHF tags (range of up to 8 m) and the HF tags and smart card segment (up to 1 m) which will dominate the market in the short term
- Company products will be sold both in Russia and globally

Products and prospective customers

Product	Customers
Antenna on substrate	<ul style="list-style-type: none">• RFID tags manufacturers that do not have their own technology for antenna manufacturing• Large manufacturers of RFID tags seeking to reduce tag manufacturing costs by purchasing components from third parties
Module (chip + antenna)	<ul style="list-style-type: none">• RFID tags manufacturers that have limited possibilities for manufacturing different types of tags• Converters (lamination of modules and printing according to end user requirements)• RFID integrators that have their own laminators and printers
UHF and HF RFID tags (including smart cards)	<ul style="list-style-type: none">• RFID integrators• End users representing various market segments: retail, logistics and transport including air transport, electronic documents, payment systems and transport cards, manufacturing, healthcare, archives, libraries, etc.

EXISTING BUSINESS

Sales

Europe

- Greece
- Spain
- Italy
- Cyprus
- Poland
- Portugal
- Russia
- France
- Czech Republic

Asia

- Vietnam
- Israel
- Indonesia
- India
- Iran
- Korea
- China
- Malaysia
- Nepal

Africa

- Pakistan
- Saudi Arabia
- Taiwan
- Thailand
- Turkey
- Sri Lanka

Americas

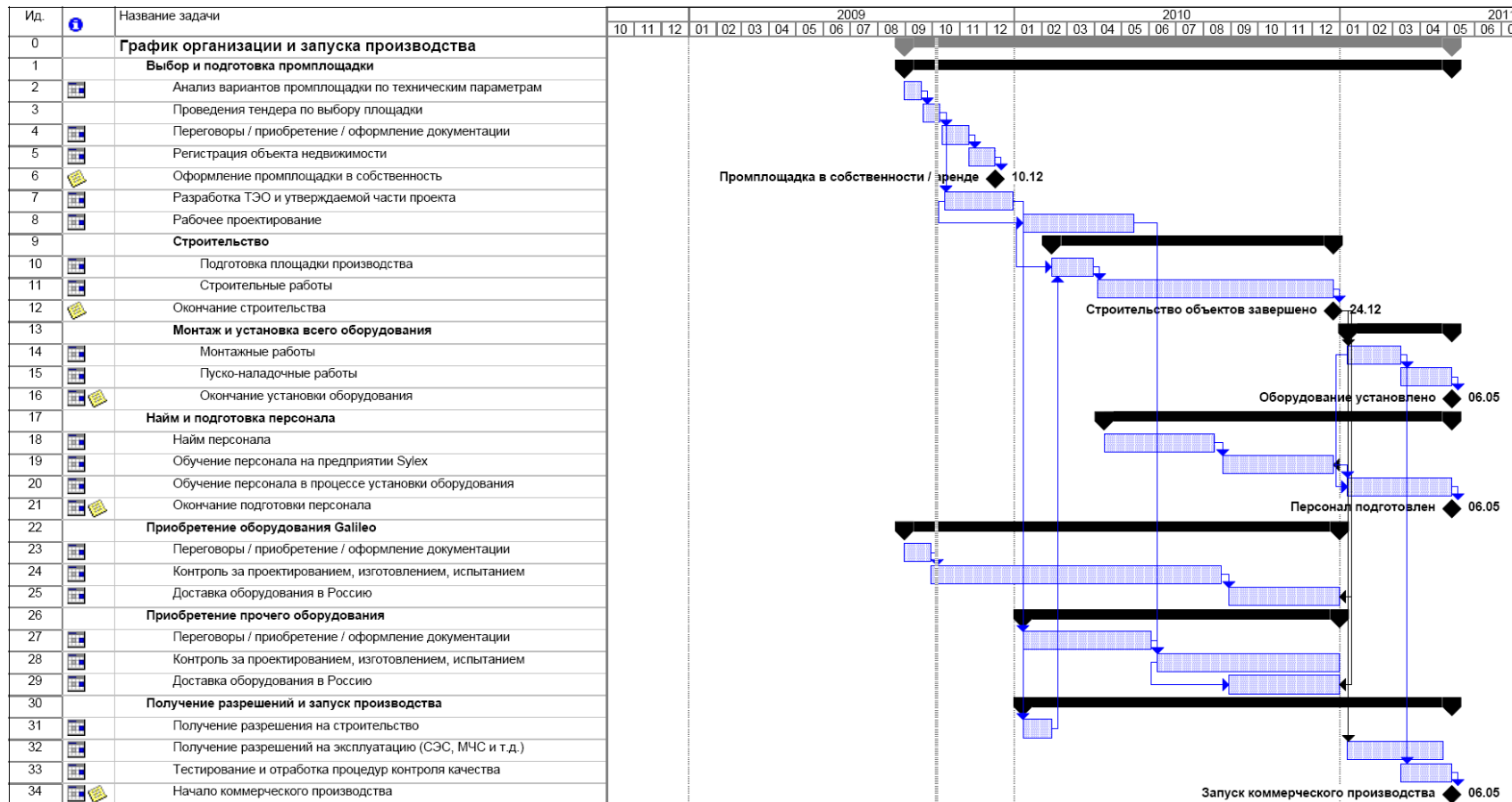
- Brazil
- Mexico
- USA



Manufacturing and R&D in Italy



SCHEDULE OF THE PROJECT IN RUSSIA



Project financial indicators (base case scenario):

- Project NPV = 690 mil. euro
- Project IRR = 148%
- Payback period = 1.9 years

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