



铁矿石流通过程中的挑战和机遇

中国冶金科工集团有限公司
2018年2月5日星期一，北京

机密和专有

未经中冶集团授权严格禁止使用本资料



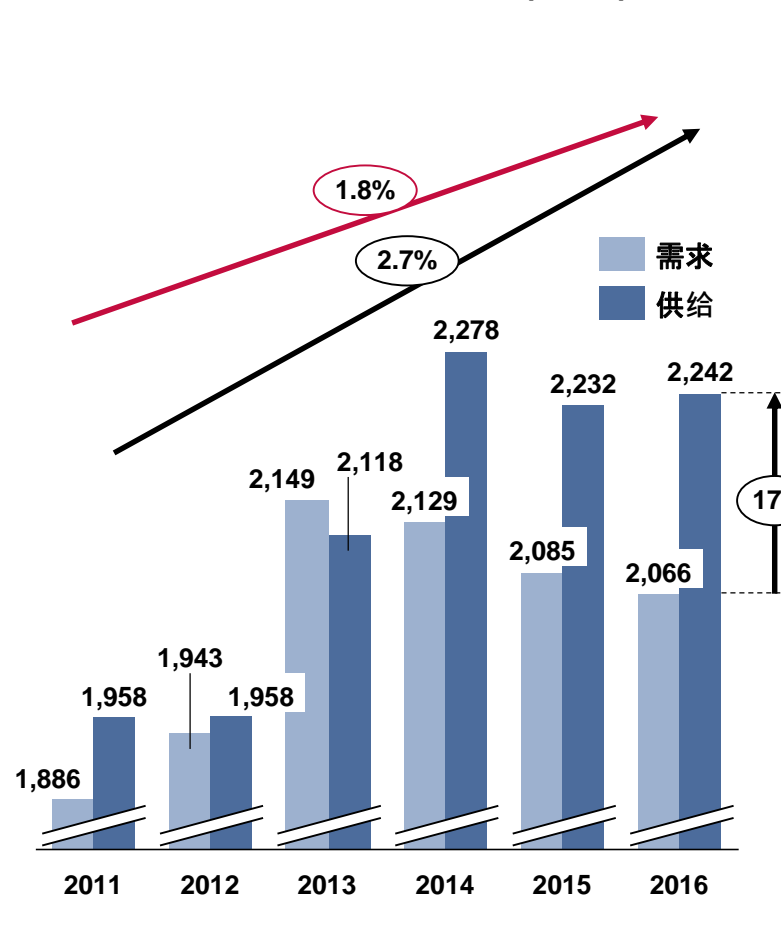
C 目录

CONTENTS

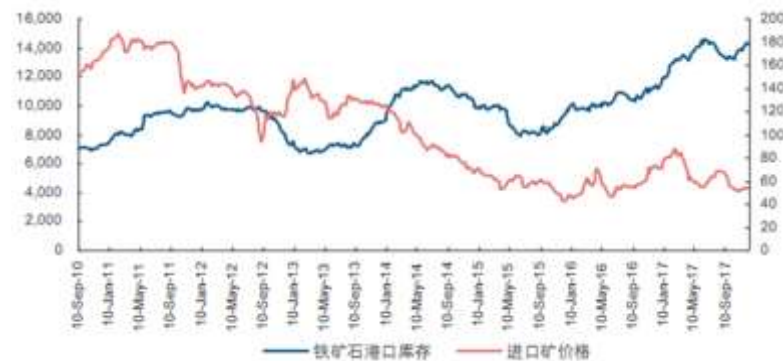
- 1 前言
- 2 铁矿石流通过程中的挑战
- 3 铁矿石流通过程中的机遇

过去五年，全球铁矿石供给增长的速度大于市场需求的速度。基于铁矿石供大于求的现实和未来发展趋势，铁矿石供给侧的竞争压力会逐步加大。本报告主要想探讨的是，在这样的大背景下，从铁矿石流通的环节中，能否构建更有利于供需双方的机制和平台，以及在未来流通环节中将面临的主要挑战和机遇。

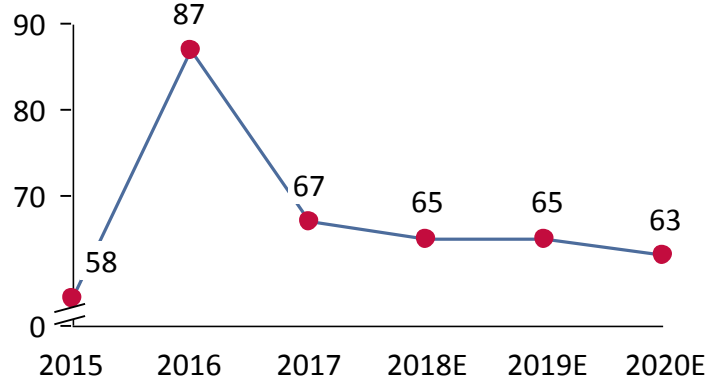
2011-2016 全球铁矿石供需情况，(10⁶t)



2010-2017 铁矿石港口库存量和进口矿价格，(万t、美元)



2015-2020 铁矿石价格及预测，(美元/t)



C 目录 CONTENTS

1 前言

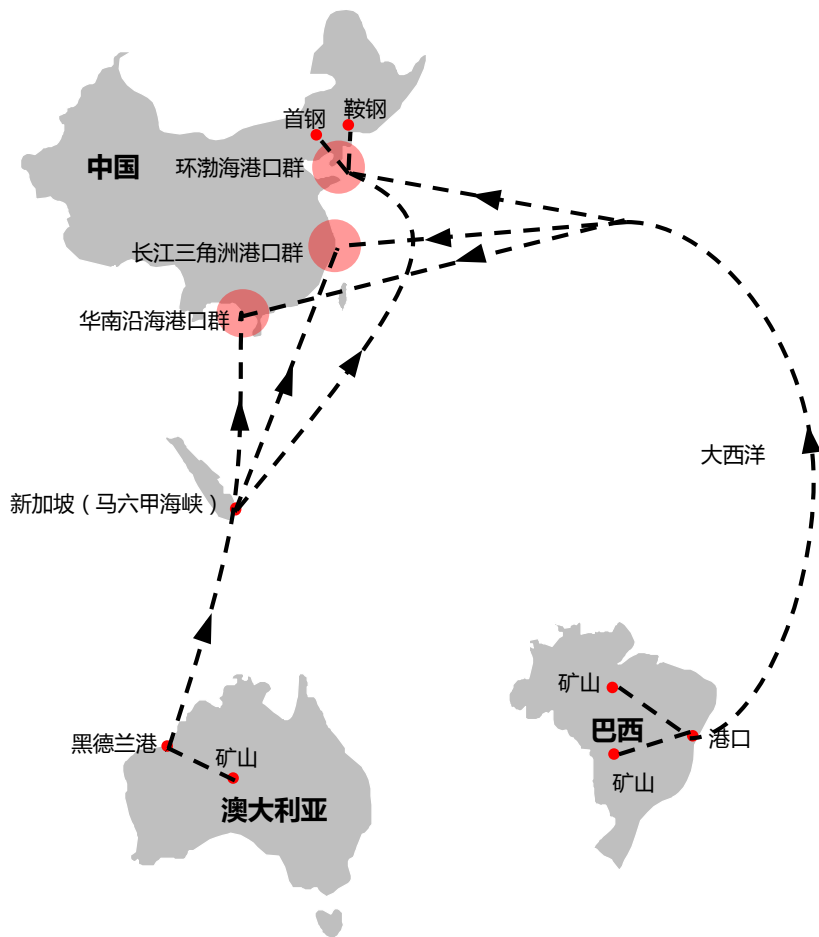
2 铁矿石流通过程中的挑战

3 铁矿石流通过程中的机遇



铁矿石的流通环节：以中国需求的铁矿石为例，2017年近90%以海运进口为主，主要来源为澳大利亚和巴西，流通主要环节包括：矿山堆场、输出国港口堆场、海运、输入国港口堆场、钢铁企业矿石原料堆场。

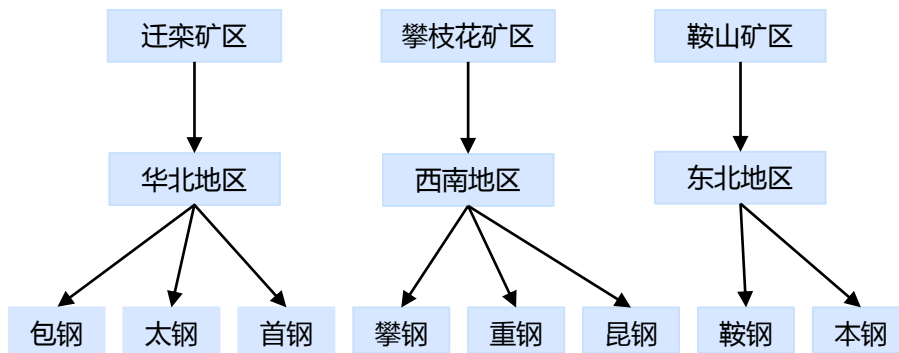
澳大利亚、巴西进口矿石至中国运输路线



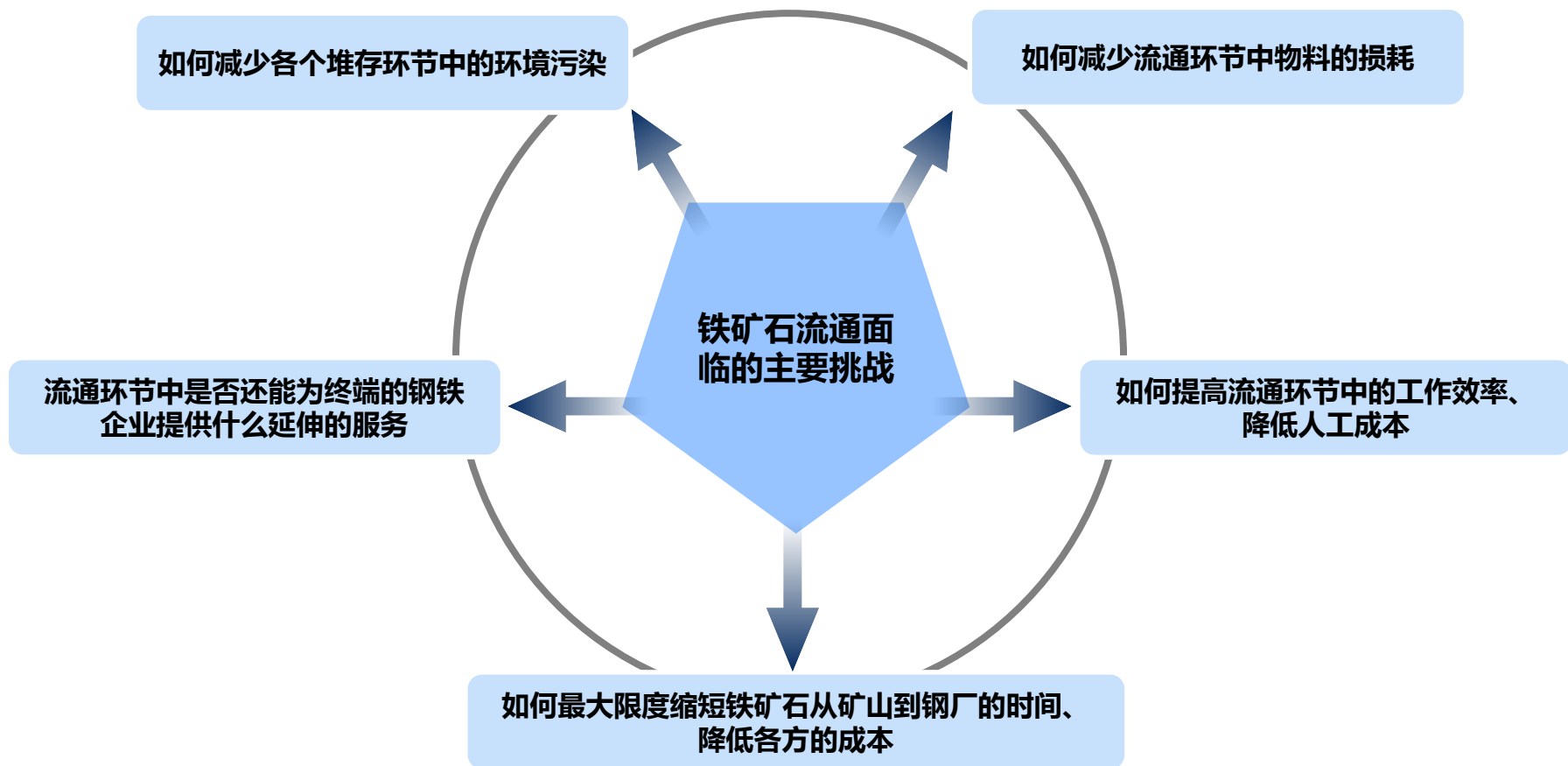
进口矿流向：



国内矿流向：



面向未来，在铁矿石流通环节中面临的挑战将主要集中在环境的压力、如何降低铁矿石流通环节中的成本、如何为最终用户提供更便利的服务等方面。



环境压力：在铁矿石贮存、转运、输送过程中，环境污染是个共性的问题。因此，矿石物流周转过程中，将面临的环境保护的**压力也会日益增大**。可以预见，严控铁矿石流通环节中的**粉尘污染**，必将会成为环保法律的强制性要求。

环境
保护
压力
日益
增大

1 贮存



2 转运



3 加工



4 输送



流通环节中的物料损耗：矿石原料中转、倒运过程中大风、雨水冲刷、转运、输送等原因会对矿石原料造成损耗。以年度计，流通各环节的物料损耗将是一个不小的数字

码头堆场因天气原因造成物料损失可达
0.2%-0.5%



钢厂堆场因转运、输送等过程造成物料损失达
0.5%-2%



- 大风、雨水冲刷等天气原因以及中转、倒运、输送等原因会对矿石原料造成损耗

提高效率和降低成本的需求：在铁矿石物流环节中，提升工作效率，降低人工成本，还有很大的潜力可挖，尤其是在铁矿石贮存和混配环节

原料堆存仍大量采用铲车作业，效率较低，有很大上升空间



智能化技术的应用为提升效率提供了技术支撑



提高周转效率的需求：铁矿石从开采到最终进入钢厂的烧结工序，大约需要100天左右甚至更长的时间，最大限度降低流通环节时间对各方都是有利的

矿山



- 0.5-1天
- 矿山一般根据订单生产，基本不存在铁矿石积压

矿山→输出国港口



- 1-2天
- 一般矿山到输出国港口的运输方式较为固定

输出国港口



- 7-20天
- 输出国港口可能存在等待拼装、转港等情况

海运（输出国→中国）



- 40-45天
- 海运受气候、运费等因素影响较大，航期不固定

输入国港口



- 10-60天
- 输入国港口可能存在泊位、场地、装卸能力不足等问题

输入国港口→企业料场



- 1-5天
- 因钢厂位置不定而采取铁路、公路或内河等不同运输方式

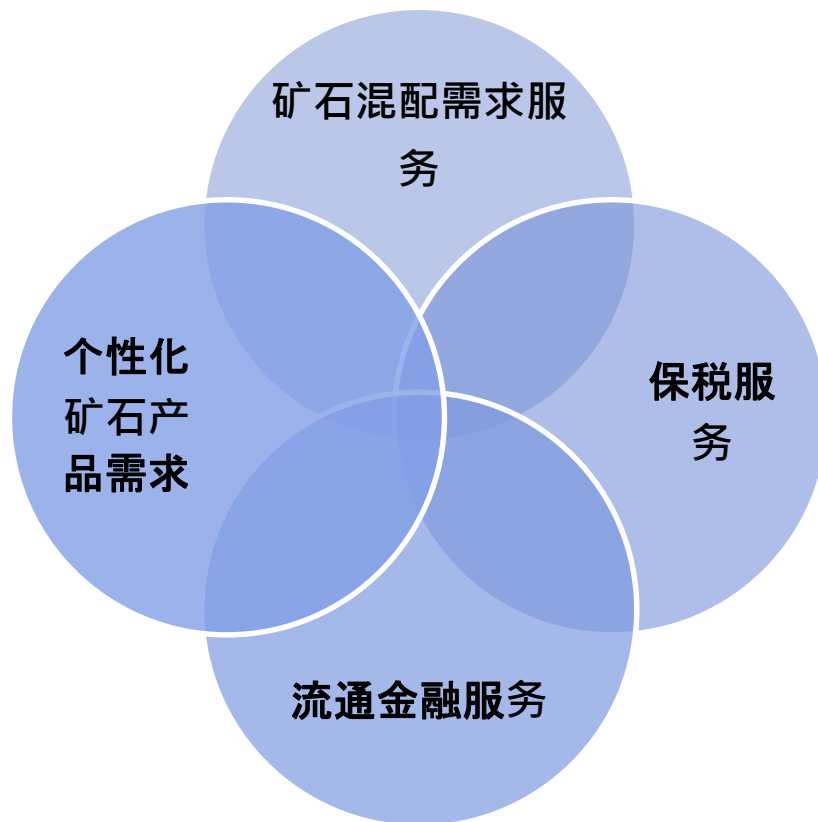
企业料场



- 7-20天
- 不同来料运输方式的企业其原料储存料周期不同



增值服务的需求：矿石供应商和最终的钢铁企业，对铁矿石流通的环节，也提出了如混配、保税、金融、个性化等越来越多的服务的需求



C 目录 CONTENTS

1 前言

2 铁矿石流通过程中的挑战

3 铁矿石流通过程中的机遇



粉尘污染应对：在铁矿石流通环节中，已经有非常成熟的技术应用在贮存和转运过程中，对大幅降低环境污染和降低物料损耗效果显著，当前大多数技术已经在钢铁企业成为强制标准，未来其他流通环节也将会很快提上议事日程

环保料场机械化应用及各类防尘措施

- 转运过程机械化应用，头部清洁化转运集成产品包、高效环保溜槽、密封导料槽、复合缓冲床及多功能托辊组等
- 贮存过程机械化应用，高架环保型堆料机、料场内清洁机具搬运台车、长形仓密封活门等
- 各种粉尘控制措施，采用高效清扫、多重密封、可控导流、集中抑尘、撒料控制与自动回收等产品

测试粉尘



环保料场应用效果



- 减少粉尘排放量**90%**以上
- 减少输送撒料**90%**
- 延长输送转运设备寿命**50%**
- 减少块状料粉碎率约**20%**
- 减少环境维护工作量约**60%**

提高效率应对：提升铁矿石贮存和周转环节中的自动化和智能化水平，降低人工成本，提高工作效率，也将成为未来铁矿石流通环节的重要竞争力之一，相关的技术也已经有成功应用的案例。

原料场实施智能化以后人员减少情况

	操作工	生产管理人员	合计
自动化管理模式	60	6	66
智能化一期	20	4	24
智能化二期	6	4	10

备注：有少量取料机未进行无人化改造

成本降低情况

- 胶带机空转率降低**~60%**
- 整体能耗降低**3%~5%**

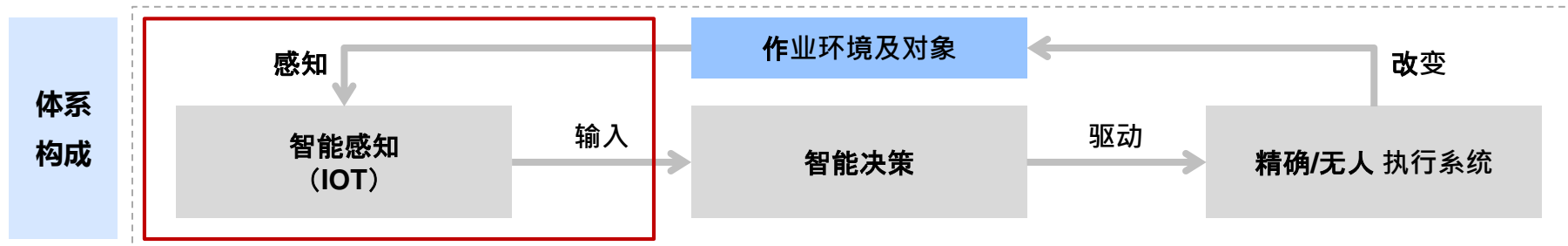
整体效率提升情况

- 料场利用率提高**10%~20%**
- 盘库效率提高**~90%**，库存优化
- 意外故障停机率降低**~60%**

国内
B企
业实
施效
果

提高效率应对：实例一(智能化原料场)

通过机器视觉智能识别散装物料的位置、体积等信息，为自动盘库和智能调度提供了信息输入，是全场智能化的基础



技术构成

1 实物

2 识别结果

3 中控室可查看信息

序号	库名	体积	起始位置	结束位置
1	A-1	45.011	0.000	18.000
2	A-2	1110.726	18.000	64.000
3	A-3	559.039	64.000	91.000
4	A-4	4129.862	91.000	161.463
5	A-5	224.607	161.463	204.000

实物 | 视觉识别

1 | 2

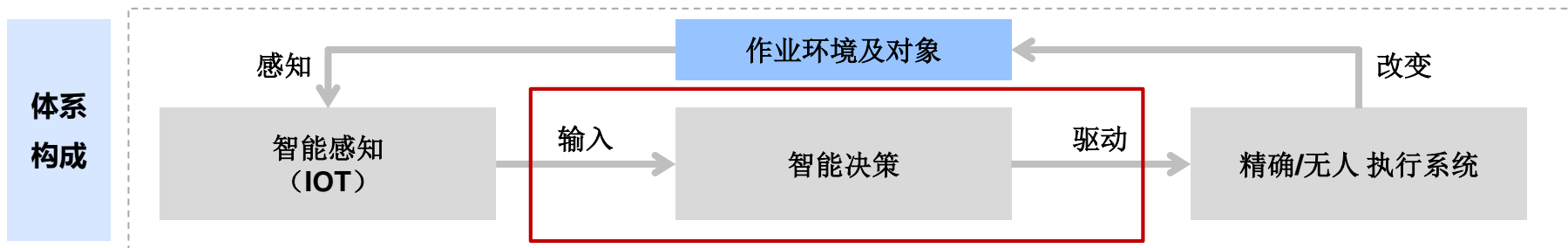
3

物料盘库信息


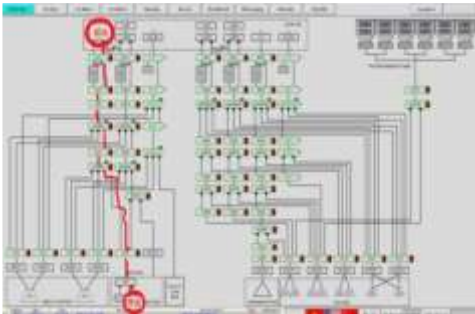



提高效率应对：实例一(智能化原料场)

智能原料场的决策大脑以智能控制、系统仿真验证平台和大数据挖掘三部分为核心，该部分的智能程度决定了全场的智能水平。

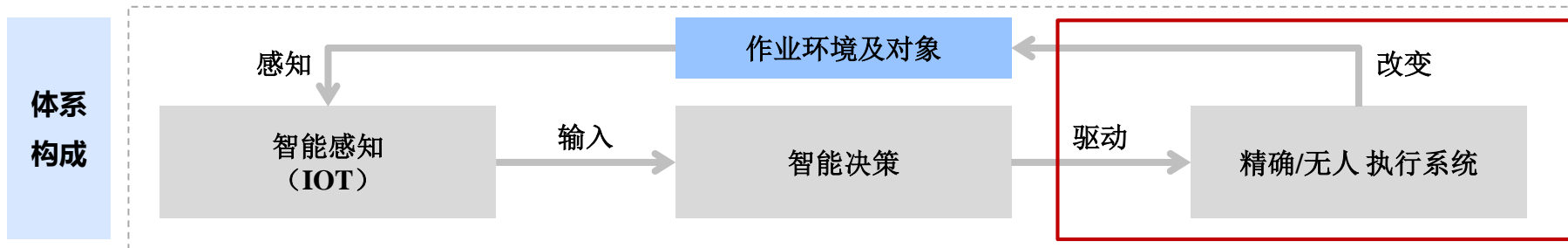


技术构成

 <p>远程及智能控制</p> <ul style="list-style-type: none">现场全景可视化、数字化自动盘库，大幅提升盘库效率智能作业系统自动排产，提升料场利用率根据物料实际情况调度货船进港顺序	 <p>系统仿真验证平台</p> <ul style="list-style-type: none">生产作业模拟，为采购和船期提供依据生产调整预演：工艺变更或者存在故障时，预演生产计划并进行优化	 <p>大数据分析挖潜</p> <ul style="list-style-type: none">基于生产运行数据，挖掘生产运行优化提升潜力点基于历史库存数据，得到不同物料库存的合理水平，优化库存以稳定生产质量下实现铁前原料生产成本最优化，进行数据挖掘
---	--	---

提高效率应对：实例一(智能化原料场)

自动堆取料机是智能原料场的终端执行系统，设备的智能化是减人的基础前提，是原料场智能决策结果得以实施的具体执行机构



技术构成

自动堆取料机

- 自动防碰撞
- 长期稳定作业，高效率
- 保持设备健康运行

消除人工作业不确定因素，有效提升存储空间，

- 堆间距完全相同
- 每垛堆高整齐划一
- 料堆两侧留空宽度一致

提升单位面积的堆存能力：提高物流储存环节单位面积的堆存能力，最大限度发挥土地的利用价值越来越成为物流环节中不可忽视的焦点。

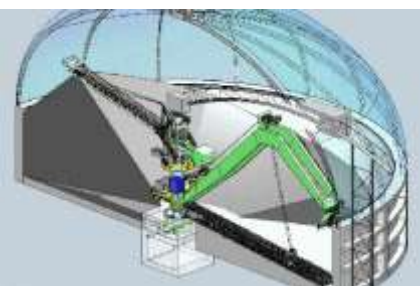
不同形式环保料场设计提升单位面积堆存能力

C型封闭料场



- **优势**
 - 通过挡墙分堆提高堆高，单位面积贮存能力较高
 - 可实现全无人化操作

D型封闭料场



- **优势**
 - 通过挡墙分堆提高堆高，单位面积贮存能力较高
 - 可实现全无人化操作

E型封闭料场



- **优势**
 - 通过筒仓提高堆高，单位面积贮存能力较高
 - 可实现全无人化操作

ECIA贮配一体化料场



- **优势**
 - 通过挡墙分堆提高堆高，单位面积贮存能力较高
 - 可实现贮配一体
 - 可实现智能化生产

提升储料用地少

- 储料能力增加**1-2**倍、减少**60%**左右用地、投资最优解决方案

增值服务：和所有的消费产品一样，更快捷的服务、更个性化和多样化的服务，通过整合更多的资源，使终端客户获得越来越好的体验，构建新的合作关系

未来创新的矿石服务商业模式

● 构建流通环节和终端用户的信息联动机制和平台

- 搭建矿石供应商和需求的信息交互机制和平台，稳定的渠道
- 以降低钢铁终端企业库存时间为目标的物流管理体系

● 提供多样化的矿石交付服务和产品

- 依据终端客户的个性化需求，提供多样化的产品服务
- 在流通环节中分担矿石供应商和终端钢铁企业的部分工作内容，提高效率，降低成本
- 多样化的流通金融服务支持

● 以降低高炉综合成本为核心的增值服务

- 有针对性提供钢铁终端企业需求的近终型矿石产品
- 不但是销售矿石产品，还能够帮助终端钢铁企业用好矿石的增值服务

构建不同的合作关系，**服务改变贸易**



共同合作，开创更美好的2018年！

中国冶金科工集团

肖鹏，xiaopeng@mcc.com.cn





Challenges and Opportunities in the Process of Iron Ore Circulation

China Metallurgical Group Corporation

Saturday, January 27, 2018, Beijing

Confidential & Proprietary

It is prohibited to use the information without authorization of MCC

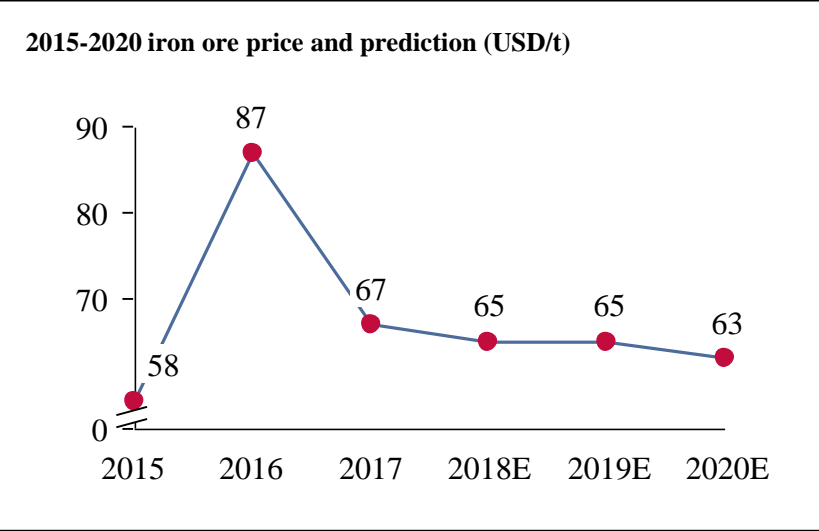
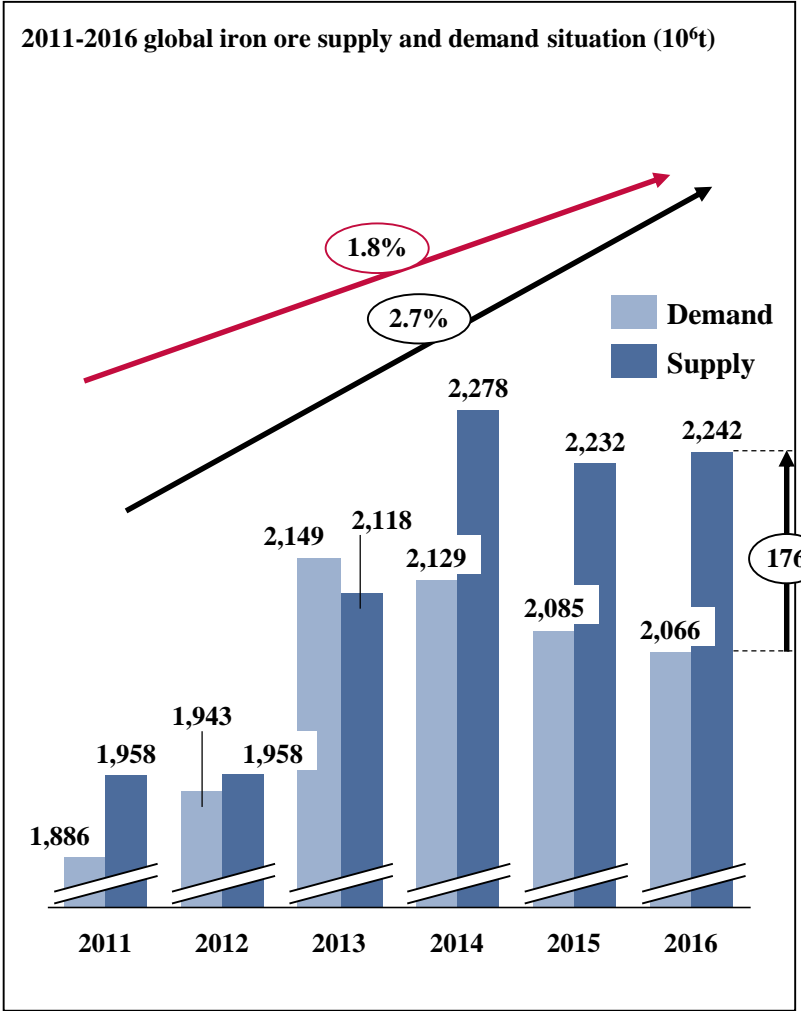


C ONTENTS

- 1** Preface
- 2** Challenges in the process of iron ore circulation
- 3** Opportunities in the process of iron ore circulation



In previous five years, growth rate of global iron ore supply has been greater than rate of market demand. Considering the reality of supply exceeding demand of iron ore and future development tendency, competition pressure in supply side of iron ore will increase step by step. What this report mainly discusses about is that, under such a major background, whether it is available to establish mechanism and platform preferably benefiting supply and demand side in links of iron ore circulation, and main challenges as well as opportunities in future circulation links.



C ONTENTS

1 Preface

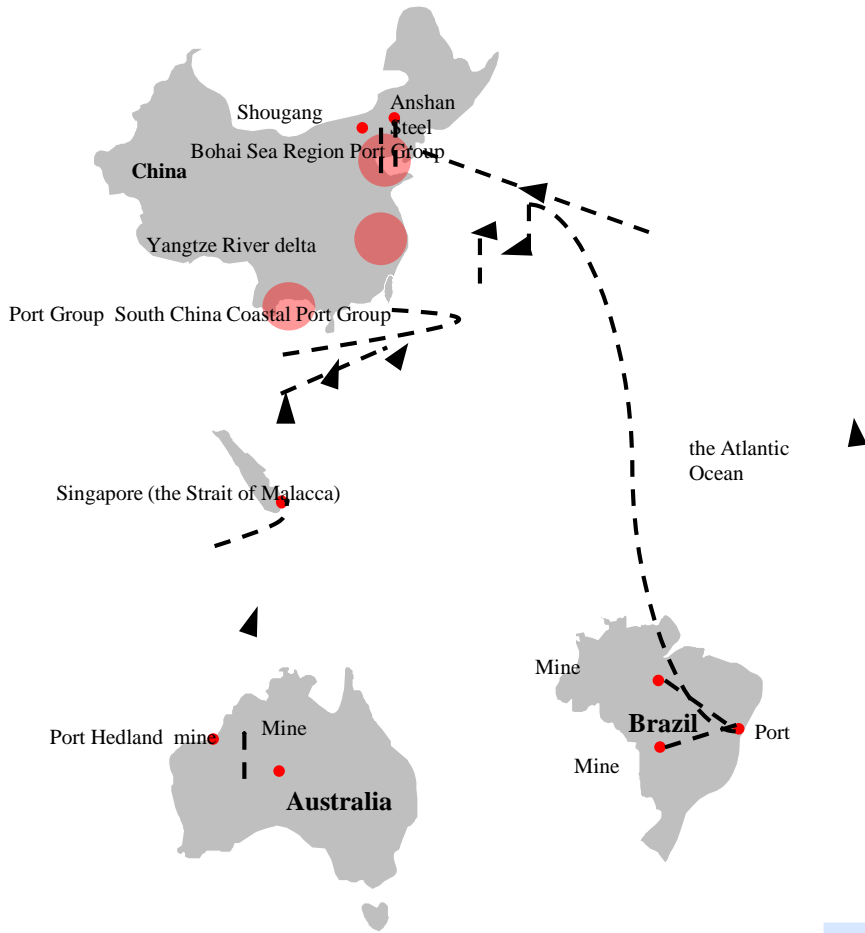
2 Challenges in the process of iron ore circulation

3 Opportunities in the process of iron ore circulation

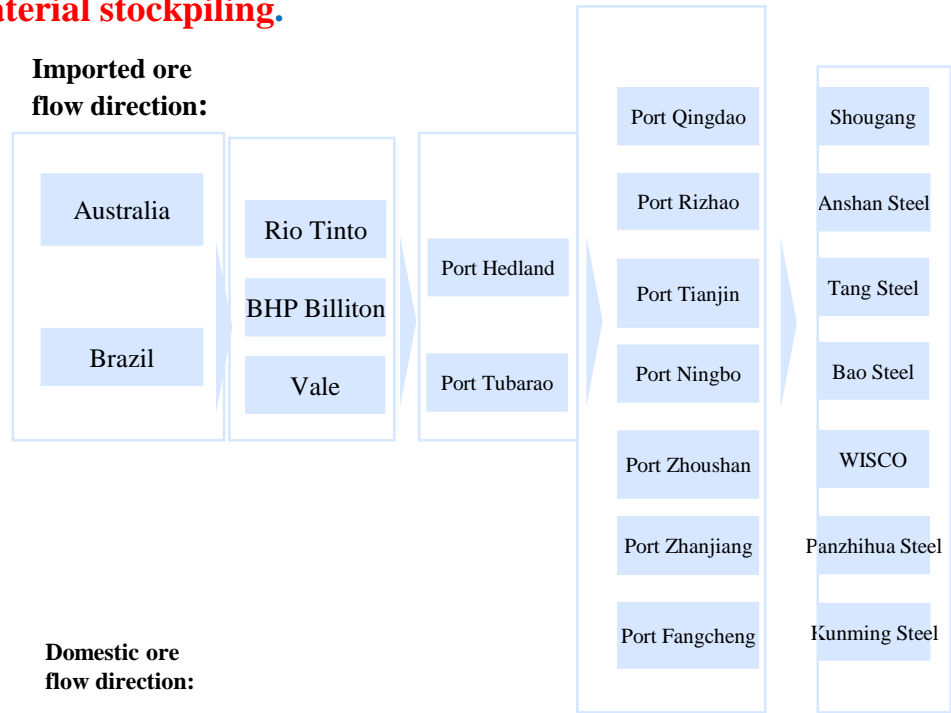


Circulation links of iron ore : Setting the demand of iron ore in China as example, nearly 90% was mainly imported by sea in 2017, which was mainly imported from Australia and Brazil, and circulation mainly included the following links: mine stockpiling, exporting country port stockpiling, sea transportation, importing country port stockpiling, iron and steel enterprise ore raw material stockpiling.

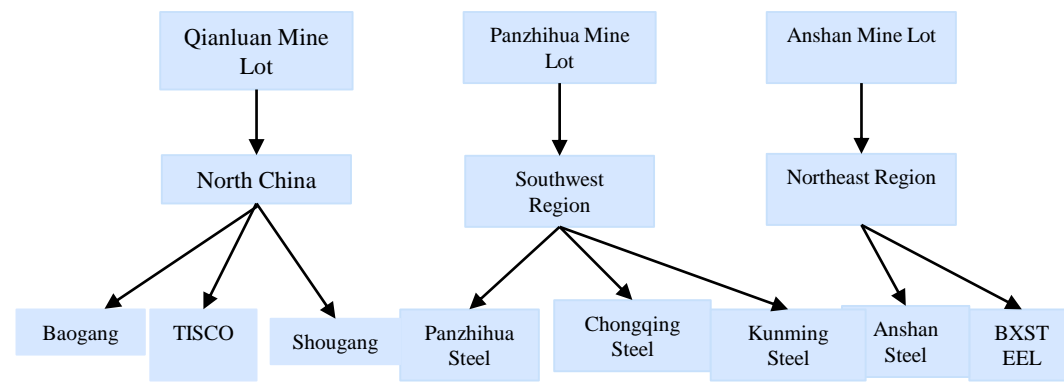
Transportation routes of ore imported from Australia and Brazil to China



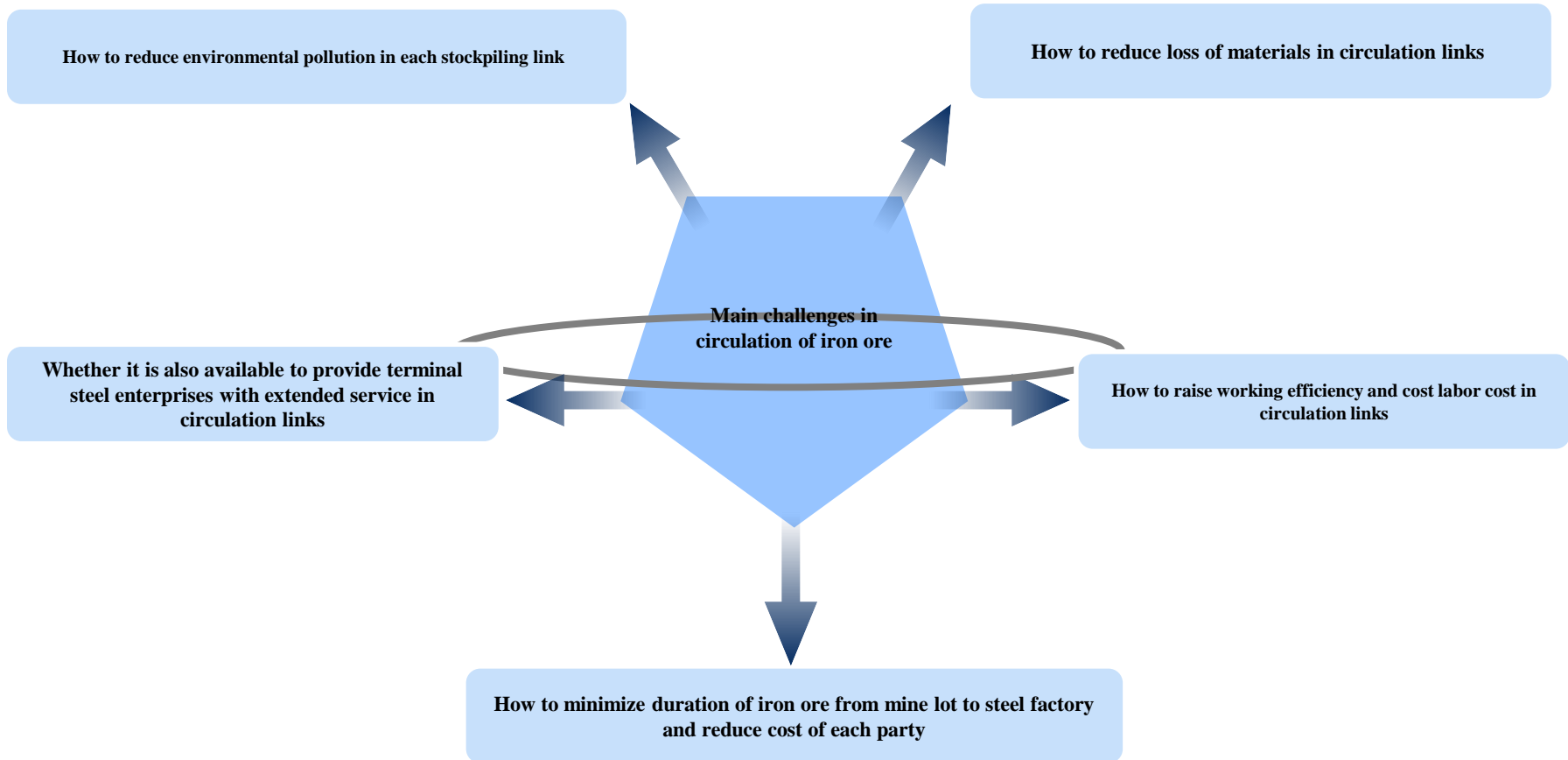
Imported ore flow direction:



Domestic ore flow direction:



In face of the future, main challenges in circulation links of iron ore mainly focus on **environment pressure**, how to **reduce cost** in circulation links of iron ore, how to provide more convenient **services** for the end users, etc.



Environmental pressure: In the process of storage, transfer and transportation of iron ore, environmental pollution is a common problem. Therefore, in the process of logistical circulation of iron ore, there will be also increasing pressure on environmental protection. It can be foreseen that strict control over dust pollution in circulation links of iron ore will certainly become compulsory requirement of environmental protection law.

1

Storage



2

Transfer



3

Processing



4

Transportation



Increasing
environme
ntal
protection
pressure



Material loss in circulation links: Gale, rain wash, transfer and transportation, etc. in the process of transit shipment and reshipment of ore raw material will result in loss of ore raw material. On an annual basis, material loss in circulation links will be considerable .

Wharf storage yard causes material loss of 0.2%-0.5% due to weather condition



Steel factory storage yard causes material loss of 0.5%-2% in the process of transit shipment and transportation, etc.



- Weather conditions such as gale, rain wash, as well as transit shipment, reshipment, transportation, etc. will result in loss of ore raw material

Demand of raising efficiency and reducing cost: In logistic links of iron ore, there is still great potential to be excavated for raising working efficiency and reducing labor cost, especially in storage and blending links of iron ore

A great deal of forklift operation is still in operation for raw material stockpiling, which has low efficiency and large space for improvement



Application of intelligent technology provides technical support for raising efficiency



Demand of boosting turnover efficiency: It takes about 100 days or even longer duration from exploitation of iron ore to final firing process in steel factory, and it is beneficial to all interested parties to minimize duration of circulation links

Mine



Mine→ Port of Exporting Country



Port of Exporting Country



Sea Transportation (Exporting Country→China)



- **0.5-1 day**
 - Mine production is generally arranged according to the order, and there is no overstock of iron ore almost

- **1-2 day**
 - Mode of transportation from the mine to the port of exporting country is generally fixed

- **7-20 day**
 - The port of exporting country may exist waiting for goods consolidation, port transfer, etc.

- **40-45 day**
 - Sea transportation is largely subject to climate, freight and other factors, and the voyage schedule is irregular

Port of Importing Country



Port of Exporting Country →Enterprise stock yard



Enterprise stock yard



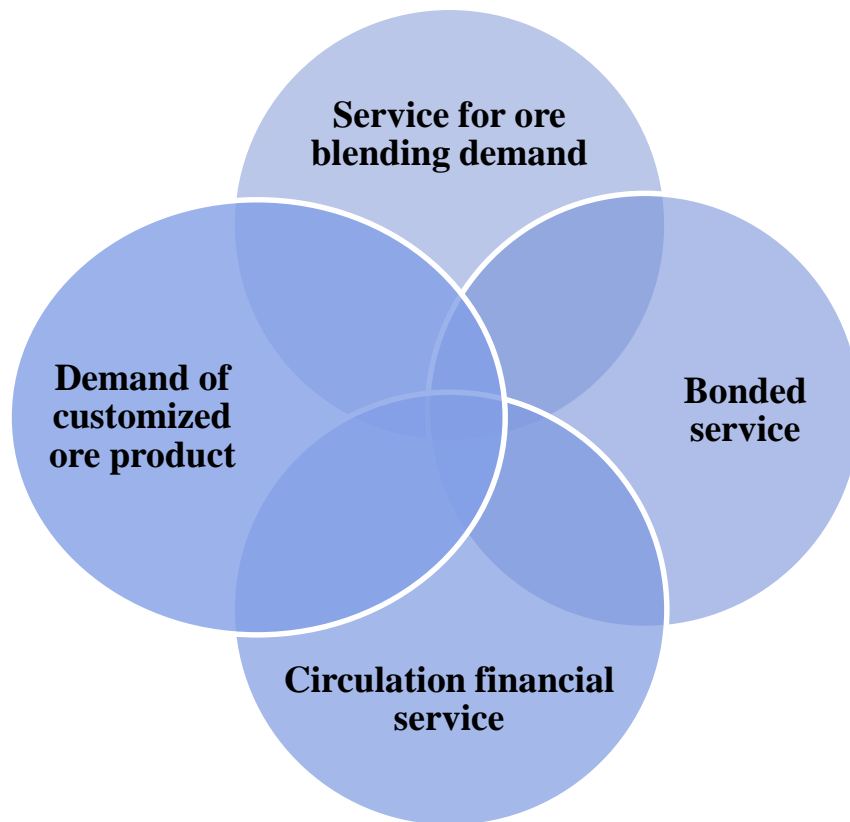
- **10-60 day**
 - There may be problems such as insufficient berth, site or loading and unloading capacity in the **port of importing country**

- **1-5 day**
 - Different transportation modes such as railway, road or inland river are adopted due to uncertain position of steel factory

- **7-20 day**
 - Enterprises with different incoming material transportation modes have different storage periods of raw material



Demand of value-added service: Ore suppliers and final steel enterprises also propose demand for more and more services such as blending service, bonded service, financial service, customization service in terms of circulation links of iron ore.



C ONTENTS

1 Preface

2 Challenges in the process of iron ore circulation

3 Opportunities in the process of iron ore circulation



Measures to deal with dust pollution: In circulation links of iron ore, the proven technology has been applied in storage and transfer process, which has considerable effect in dramatically reducing environmental pollution and material loss. Currently, most technologies have been required for the compulsory standard in steel enterprise, and other circulation links will also be put on the agenda in the future.

Mechanical application in environment-friendly stock yard and various kinds of dust prevention measures

- **Mechanical application in transfer process** - head cleaning transfer integrated product package, efficient and environment-friendly chute, sealed feed channel, compound buffer bed and multi-function roller set, etc.
- **Mechanical application in storage process** - overhead environment-friendly stacker, handling trolley for cleaning machines and tools in stock yard, sealing valve for microscler storage, etc.
- **Various dust control measures**- adopting efficient cleaning, multiple sealing, controllable flow diversion, centralized dust suppression, spillage control and automatic recovery, etc.

Test dust



Application effect of environment-friendly stock yard



- **Reduction of over 90% dust emission**
- **Reduction of 90% spillage in transportation**
- **Extension of 50% of life of transportation and transfer device**
- **Reduction of about 20% of smashing rate for bulk material**
- **Reduction of about 60% workload of environment maintenance**

Measures to improve efficiency: Boosting automatic and intelligent level in storage and turnover link of iron ore, reducing labor cost and improving working efficiency will also become one of important competitiveness for iron ore circulation links in the future, and the case of successful application of relevant technology has also occurred.

Implementation effect of domestic enterprise B

Reduction of personnel after implementation of intelligence in raw material yard			
	Operator	Production management personnel	Total
Automatic management modes	60	6	66
Intelligence Phase I	20	4	24
Intelligence Phase II	6	4	10

Remarks: A small amount of reclaimers fail to receive unmanned transformation

Reduction of cost

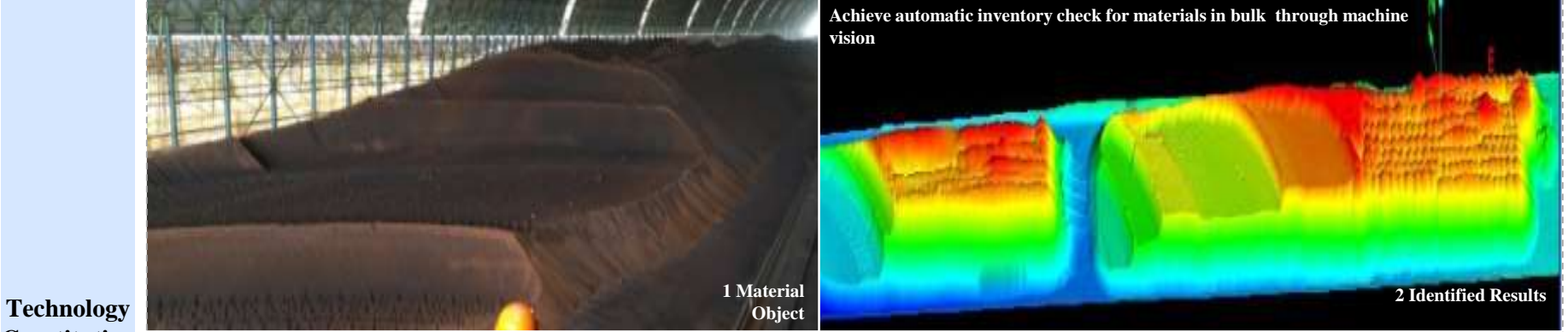
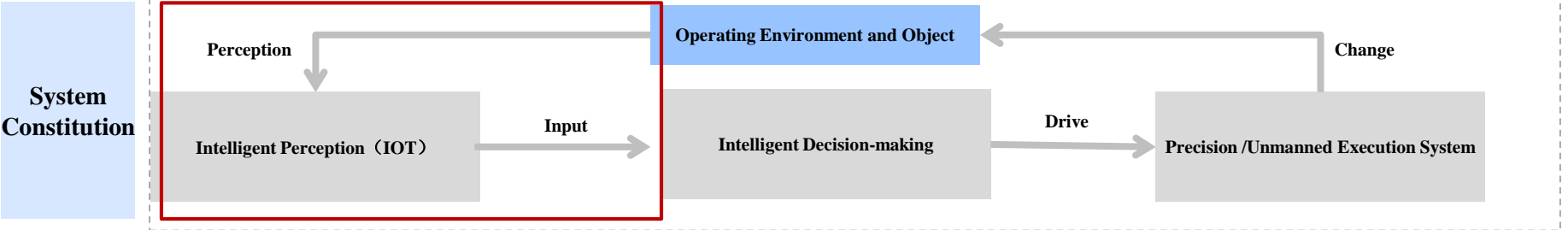
- Reduction of **~60%** for vacancy rate of sealing-tape machine
- Reduction of **3%-5%** for overall energy consumption

Improvement of overall efficiency

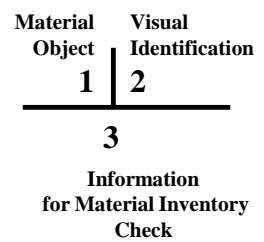
- Improvement of **10%-20%** for use ratio of stock yard
- Improvement of **~90%** for efficiency of inventory verification - inventory optimization
- Reduction of **~60%** for outage factor caused by sudden failure

Measures to improve efficiency: Case 1 (intelligent stock yard)

Identifying position, volume and other information of materials in bulk intelligently through machine vision, which provides information input for automatic inventory check and intelligent scheduling, and is the foundation for intelligence of the whole yard



料号	料名	体积	起始位置	结束位置
1	A-1	45,011	0.000	18.000
2	A-2	1110,726	18.000	64.000
3	A-3	559,039	64.000	91.000
4	A-4	4129,862	91.000	161,463
5	A-5	224,607	161,463	204.000



Measures to improve efficiency: Case 1 (intelligent stock yard)

Intelligent control, system simulation verification platform and big data excavation are the cores of decision-making brain of intelligent raw material yard, the intelligent degree of which determines the intelligent level of the whole yard.

System Constitution

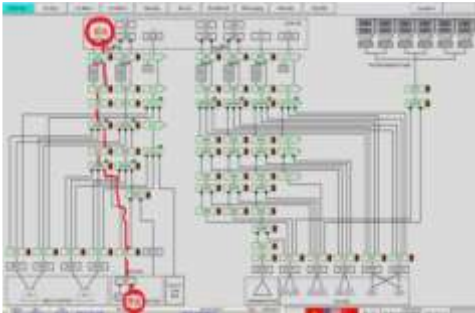


Technology Constitution



Remote and Intelligent Control

- Visual and digital overall view for the site
- Automatic inventory check to raise inventory check efficiency considerably
- Automatic production scheduling of intelligent operation system to promote utilization ratio of stock yard
- Schedule the sequence of cargo ship's arrival at port based on practical condition of material



System Simulation Verification Platform

- Production operation simulation to provide basis for purchase and sail schedule
- Rehearse of production adjustment: In case of process change or failure, to rehearse the production plan and to optimize it



Big Data Analysis and Potential Excavation

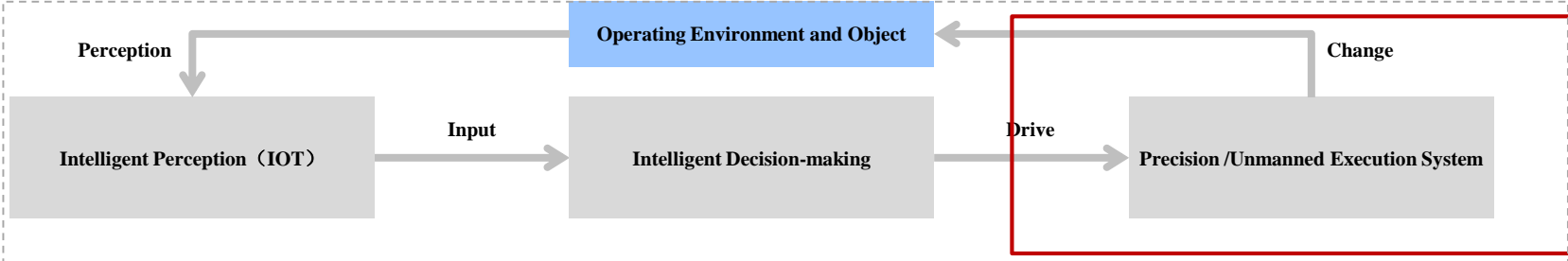
- Excavate the potential point for production operation optimization and improvement based on production operation data
- Achieve reasonable stock level for different materials and optimize the stock based on historical stock data
- Achieve cost optimization for raw material before iron making and excavate the data while stabilizing the production quality



Measures to improve efficiency: Case 1 (intelligent stock yard)

Automatic stacker and reclaimer are terminal execution system of intelligent raw material yard, and intelligence of device is the premise for reduction of personnel and specific actuator to implement the intelligent decision-making result of raw material yard

System Constitution



Technology Constitution



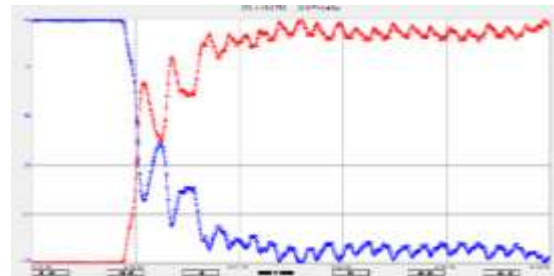
Automatic stacker and reclaimer

- Automatic collision resistance
- Long-term stable operation with high efficiency
- Maintain proper operation of device



Eliminate uncertain factors of manual operation to improve storage space effectively,

- Exactly identical stack interval
- Uniform height of each stack
- Uniform reserved width between two sides of material stack



Improve stockpiling capacity of unit area :Improving the stockpiling capacity of unit area in the logistics and storage link, and the maximization of utilization value of land, has increasingly become a non-negligible focus in logistical links.

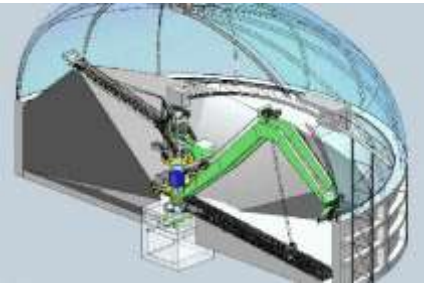
Different forms of design for the environment-friendly stock yard promotes the the stockpiling capacity of unit area

C-shape sealing stock yard



- **Advantage**
 - Raise pile height by division with barricade, to enhance the storage capacity of unit area
 - Realize completely unmanned operation

D-shape sealing stock yard



- **Advantage**
 - Raise pile height by division with barricade, to enhance the storage capacity of unit area
 - Realize completely unmanned operation

E-shape sealing stock yard



- **Advantage**
 - Raise stack height through silo to enhance the storage capacity of unit area
 - Realize completely unmanned operation

ECIA Integrated storage and distribution yard



- **Advantage**
 - Raise pile height by division with barricade, to enhance the storage capacity of unit area
 - Achieve integrated storage and distribution
 - Achieve intelligent production

Add material storage with fewer land

- Add material storage capacity by 1-2 times, reduce about 60% land, and invest for the optimum solution



Value-added services: Just like all other consumption products, providing more rapid service, more customized and diversified service, and integrating more resources, to enable the end customers to acquire better and better experience and to establish new cooperation relationship.

Future innovative commercial mode for ore service

● **Establish information linkage system and platform for circulation links and end users**

- Set up information interaction system and platform for ore suppliers and demand, and stable channel
- Logistics management system aiming for reducing the stock time of end steel enterprises

● **Provide diversified ore delivery services and products**

- Diversified product services based on customized demand of end users
- Share partial working contents of ore suppliers and end steel enterprises in circulation links to improve efficiency and reduce cost
- Diversified circulation financial services support

● **Value-added service centering on reducing the comprehensive cost of blast furnace**

- Provide near terminal ore products demanded by end steel enterprises with pertinence
- Sell ore product and help end steel enterprises to utilize value-added service of ore

Establish different cooperation relationships to change the trade with the service





Create a better 2018 via mutua cooperation!

China Metallurgical Group Corporation

Xiao peng: xiaopeng@mcc.com.cn

