A Process Model of IT-enabled Slack Resource Redeployment: Lessons from Digital Transformation at XCMG

Published at MIS Quarterly Executive

北京航空航天大學 BEIHANG UNIVERSITY
经济管理学院 SCHOOL OF ECONOMICS AND MANAGEMENT

Motivation

- As economy slows down, more and more **resources become slack** (IBM 2012, 邱海峰 2016). Slack resources are defined as resources that **exceed the needs to produce necessary outputs** (Bourgeois 1981).

- Slack resources are **expensive to maintain** and their **value deteriorates fast** over time (George, 2005)

- Slack resources also **raise managerial issues**, for example **breeding inefficiency** (Tan and Peng 2003) and **retarding market responses** (Mishina et al. 2004)

- Slack redeployment is not an easy task. Absorbed by the existing operations, slack resources are both **difficult to discover** (Voss et al. 2008) and **difficult to move around for productive use** (Love and Nohria 2005)

Motivation

- IT plays an important role in slack redeployment
  - Because of its capacity in circulating and processing resource information, **IT facilitates the discovery of slack resources** (Davenport 1998)
  - Because of its capacity in permeating organizational boundaries and connecting disparate business processes, **IT facilitates the mobilization of slack resources** (Volkoff et al. 2005)

- Despite its implications, **few IS research has explored** how to use IT to redeploy slack resources

- IT-enabled slack redeployment can be **more effective than downsizing**, the dominant approach recommended by existing slack resource research (e.g. Love and Nohria 2005, Mellahi and Wilkinson 2009). Downsizing merely removes excess resources, but **does not address the fundamental issue behind slack resources**

RQ: How do organizations use IT to redeploy slack resources?

Case Selection: XCGM

Summary of XCMG Background	
Full Name	Xuzhou Construction Machinery Group
Founded	1988 based on Hoisting Machinery and later expanded based on several M&A
Industry	Construction Machinery Manufacturing; Discrete Manufacturing
Products	Hoisting Machinery, Loaders, Road Machinery, Excavators, Concrete Machinery, Drilling Machinery, Bridge Construction Machinery, Heavy Trucks, Fire-fighting Machinery, Sanitation Machinery, and et al.
Product Nature	Products are complex, each consisting of on average 10,000 components; products are highly customized, each product is manufactured in small lots, and sold at high prices
Scale (2011)	66 Billion RMB in revenue (10.6 billion USD) 5.4 Billion RMB in profit (870 million USD) Ranks China's largest and world's 4th largest manufacturer of construction machinery

Reasons to choose XCMG:

- Manufacturing firms, especially the discrete ones, tend to have a more complex supply chain and a higher level of slacks (Tan and Peng 2003)
- Larger firms tend to have a higher level of slack resources than smaller ones (Shafman et al. 1988)
- Broadly scoped changes tend to fare better than narrowly scoped initiatives when coming to slack redeployment (Love and Nohria 2005)

Case Selection: XCGM

Internal reasons:
- Fragmented operations
- Fragmented IT systems

Hoisting Machinery

Founding member
Founded in 1989
Revenue[1] : 23 Billion
ERP: Oracle EBS
Online: 1999

Road Machinery

Founded in 1978
Acquired by XCMG in 2006
Revenue: 3.5 Billion
ERP: Fourth Shift
Online: 2009

Bulldozers

Founded by XCMG in 2006
Revenue: 7.5 Billion
ERP: Ufida NC
Online: 2004

XCMG

Concrete Machinery

Founded in 1980
Acquired by XCMG in 1994
Revenue: 4.7 Billion
ERP: Ufida U8
Online: 2007

Excavators

Founded in 1980
Acquired by XCMG in 1991
Revenue: 850 Million
ERP: Kingdee K/3
Online: 2008

External reasons:
- Sales decline
- Competition from western counterparts

"Construction machinery sales dropped by 50% in the first quarter of 2009" Chinese Mechanical Engineering Society

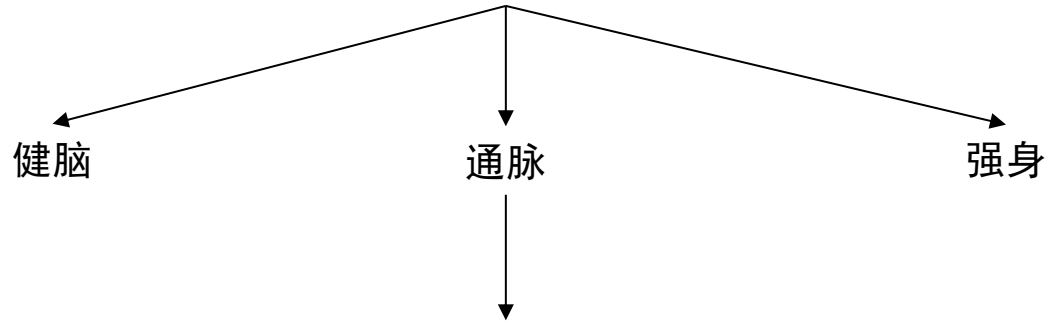
CAT

KOMATSU

[1] All revenue numbers are based on 2008 data and expressed in RMB

Digital Transformation at XCMG

“In terms of size, we are almost on par with international counterparts, but in terms of managerial practice, we lag far behind. ***The financial crisis is an opportunity****, since* ***it gives us a buffer to carry out big changes*** *and close the gap” --- CEO, 2009*



总体管理目标

“本次项目应该在遵循统一设计、统一规划、统一标准和统一流程的原则下，建立一个统一、高效的企业全价值链的管理平台。”

纵向管理目标

“建立全面的集团战略经营管控模式，整合集团内部各个子分公司的资源，以实现集约经营和资源优化配置。”

横向管理目标

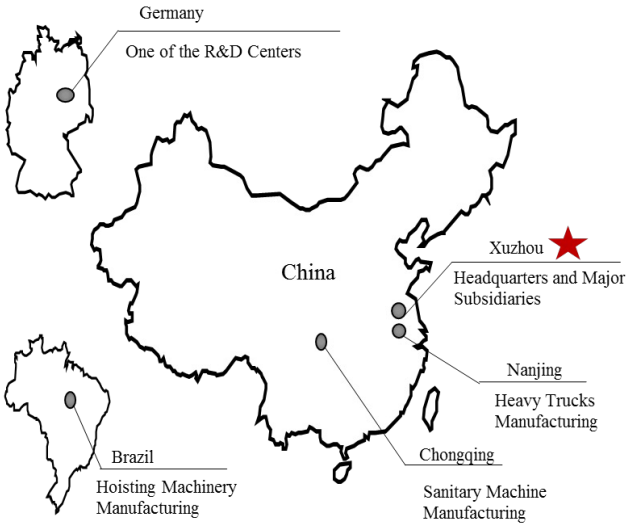
“建立覆盖业务全价值链，产品全生命周期及客户订单全过程的业务运营和支撑体系，以提高经营效率和整体运营能力。”

Digital Transformation at XCMG

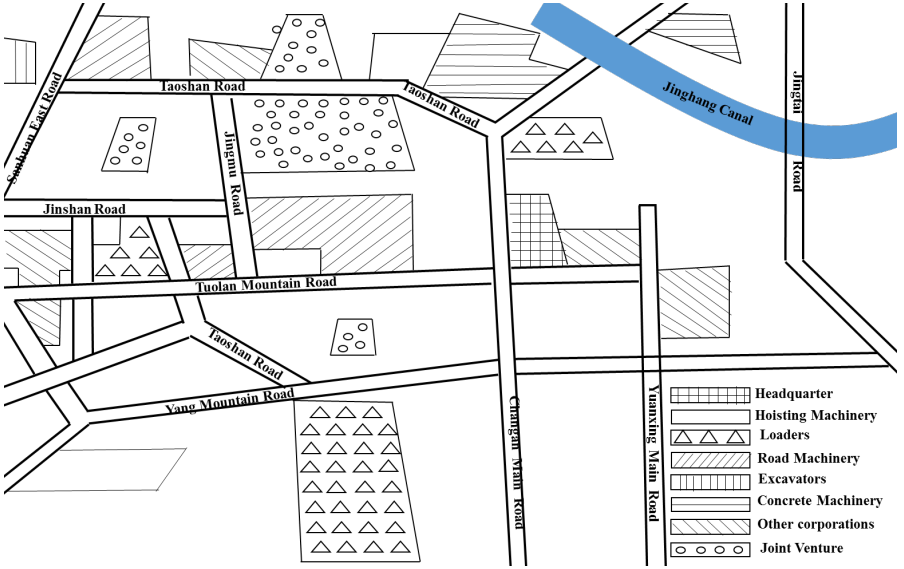
Three Examples of Slack Resources		
	Before Transformation	**After Transformation**
Financial Capital e.g., liquid assets and cash	Established subsidiaries often had excessive capital that are not in productive use. For example, in hoisting machinery, **it was common to find over 100 million capital sitting on the bank account**. At the same time, **young subsidiaries were short of capital and needed to take high-interest** loans from the bank	Excess capital was mobilized to subsidiaries that needed them and the remaining was invested into various financial products. The capital utilization rate of the organization increased from **36.2% to 48.6%.** Hosting machinery, for example, earned over **3 million/year** from redeploying excess capital
Production Materials e.g. parts and raw materials	Because of the reduced sales and production, many production materials became slack. For example, in hoisting machinery, **there were 5-million worth steels imported from Netherland** sitting idle in the warehouse and were about to rot. Many of these **production materials could be shared across subsidiaries**	Excess production materials were mobilized to subsidiaries that needed them. In the first year, the company saved over **240 million RMB** on procurement by redeploying excess materials across subsidiaries. The material turnover rate increased from **65% to 85% and warehouse space reduced by 41.3%**
Production Capacities e.g., machine tools and assembling lines	Because of the reduced sales orders, many production capacities became idle. For example, in loaders, **there were 30% capacities idle.** Many of these production capacities could be shared across subsidiaries, because the components they produced were used across subsidiaries	Excess production capacities were mobilized to either other subsidiaries or partners that needed them. Production capacity utilization rate increased from **75% to 84%.** Loaders, for example, by taking orders from its western competitors, redeployed its idle assembling lines

Digital Transformation at XCMG

Global Presence of XCMG



Layout of XCMG's headquarters and major subsidiaries at Xu Zhou's Industrial Zone



上系统之前，离的只有五百米，冗余资源不能共享；上了系统，相距太平洋，冗余资源可以共享。

Methodology

Position and Number of Interviewees				
	Role	1st Interview (2013 May)	2nd Interview (2014 Sep)	Total
Business Side	Senior Manager (e.g. CFO, Sales and Support VP)	2	1	3
	Middle-level Managers (e.g. Production and Procurement Managers)	7	1	8
	Junior Staff (e.g. Production and Procurement Operators)	3	2	5
IT Side	Senior Manager (e.g. CIO)	1	1	2
	Middle-level Managers (e.g. FICO Module Manager)	9	3	12
	Software Developer	9	2	11
Total		31	10	41

We **first asked general questions about slack redeployment** in the digital transformation. Then, **we identified three examples of slack resources** (e.g. financial capital, production facilities, and material inventories) and delved into each of these three examples.

Methodology

Informants (Business Side)	# Sessions
Chief Financial Officer	1
Vice President, Sales and Support	2
Financial Manager, Loaders	1
Procurement Manager, Loaders	1
Production Manager, Loaders	1
Procurement Manager, Road Machinery	2
Production Manager, Road Machinery	1
Sales Manager, Hoisting Machinery	1
Support Manager, Hoisting Machinery	1
Procurement Operator, Loaders	1
Production Operator, Loaders	1
Warehouse Operator, Road Machinery	1
Sales Representative, Hoisting Machinery	1
Support Representative, Hoisting Machinery	1

Informants (IT Side)	# Sessions
Chief Information Officer	2
Program Manager, Headquarters IT	2
FICO Module Manager, Headquarters IT	1
PP Module Manager, Headquarters IT	1
MM Module Manager, Headquarters IT	1
SD Module Manager, Headquarters IT	1
PLM Module Manager, Headquarters IT	1
IOT Module Manager, Headquarters IT	1
Director, Hoisting Machinery IT	2
Assistant Director, Hoisting Machinery IT	1
Director, Loaders IT	2
Director, Road Machinery IT	1
FICO Module Developer, Headquarters IT	1
PP Module Developer, Headquarters IT	1
MM Module Developer, Headquarters IT	1
SD Module Developer, Headquarters IT	1
Developer 1, Hoisting Machinery IT	1
Developer 2, Hoisting Machinery IT	1
Developer 1, Loaders IT	1
Developer 2, Loaders IT	1
Developer, Road Machinery IT	1

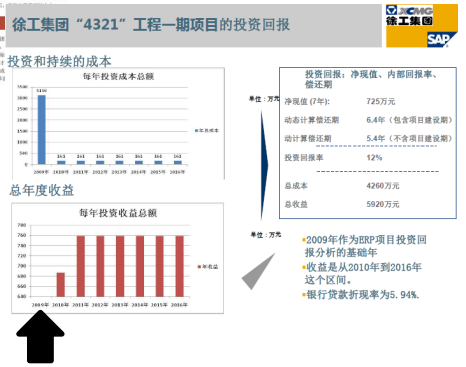
Acronym explanation
FICO: Financial Accounting and Controlling
PP: Production Planning
MM: Material Management
SD: Sales and Distribution
PLM: Product Lifecycle Management
IOT: Internet of Things

Methodology

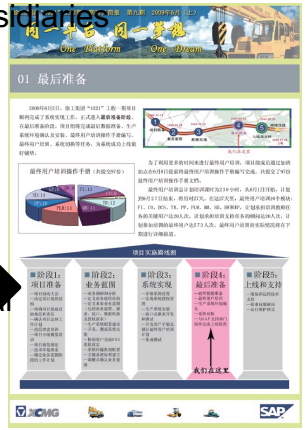
- External archives: Trade magazines, related to both construction machinery and enterprise informationization
- Internal archives: Internal presentation slides, bi-weekly journals, SAP analysts' reports

A sample report from a trade magazine related to construction machinery (2009). This report covers the topic of XCMG's innovation practices

A sample report from a trade magazine related to enterprise informationization (2011). This report covers the topic of how XCMG uses ICT to integrate resources across subsidiaries



A sample slide from CIO's presentation to top management. This slide delineates core modules of the ERP and auxiliary modules integrated to the ERP



A sample report from XCMG's internal bi-weekly journal, on 2009 May (Part 1), Issue 7. This report updates the status of the project, lists major achievements in the last two weeks, and proposes major task in the next two weeks

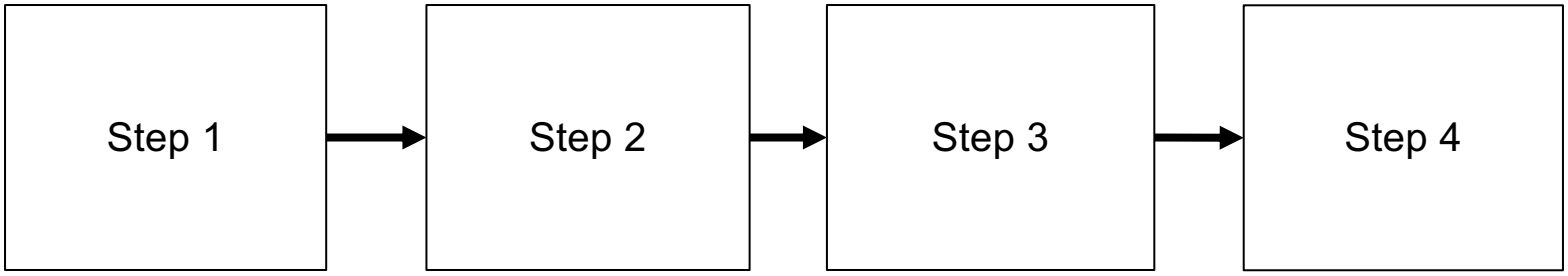
A sample slide from SAP analysts' reports. This report analyze the total cost, return and ROI of XCMG's ERP implementation

Methodology

Source and Number of Archives				
Role		Number of Files	Number of Pages	Number of Words (Rough Estimation)
External Archives	Trade magazine related to construction machinery	12	18	27,000
	Trade magazine related to enterprise informationization	16	24	36,000
Internal Archives	Internal presentation slides	7	96	9,600
	Bi-weekly journals	20	160	160,000
	SAP analysts' reports	3	54	5,400
Total		58	352	238,000

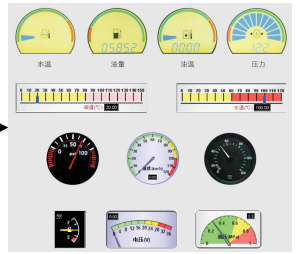
"The four-phase model is a very good summary of what we did. I could associate with each of the four phases" --- CIO

Four-phase Process Model for IT-enabled Slack Redeployment



Step 1: Track

Step 1: Track Resources	
	Key Activities
Financial Capitals	• Record the financial capital using the **same standard** • Track financial capitals in **real time**
Production Facilities	• Decide the standard for recording production facilities • Record production facilities using the same standard • Track production facilities using **smart sensors**
Material Inventories	• Decide the standard for recoding material inventories • Record material inventories using the same standard • Track materials inventories **using QR codes**



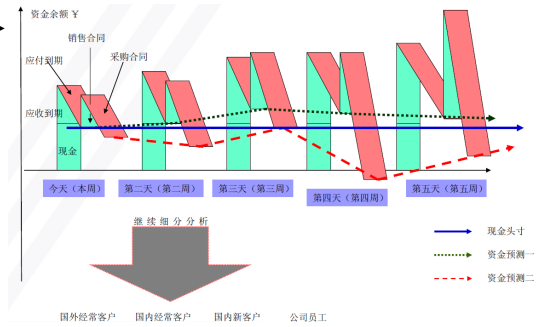
生产线机床实时监控

原材料标签管理

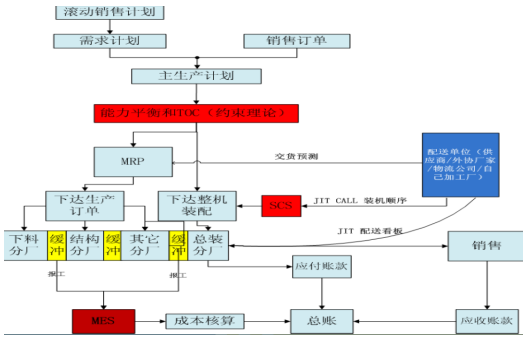
Step 2: Discover

Step 2: Discover Slack	
	Key Activities
Financial Capital	• **Integrate** accounting with business functions that affect the supply and demand for financial capitals, e.g. sales and procurement • **Analyze** the integrated data to determine the demands for financial capitals and slack in the capitals
Production Facilities	• **Integrate** production with business functions that affect the demand for production facilities, e.g. sales and warehouse • **Analyze** the integrated data to determine the demands for production facilities and slack in the facilities
Material Inventories	• **Integrate** procurement with business functions that affect the demand for materials inventories, e.g. sales and design • **Analyze** the integrated data to determine the demands for material inventories and slack in the inventories

*"When people talk about BI, they think about mining customer data. BI is much more than that. **We need analytical capabilities in every corner of our operations**." --- Production Module Manager*



资金头寸及流动性预测

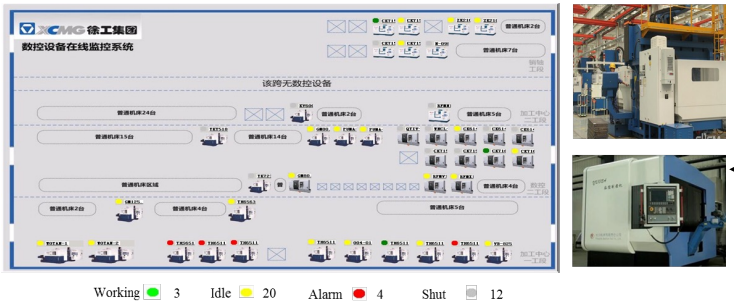


基于约束理论的平衡模块

Step 3: Collect

Step 3: Collect Slack	
	Key Activities
Financial Capital	• Create a **central treasure department** • Collect excess capital into a **central capital pool** • Create a dashboard to discover internal sharing opportunities
Production Facilities	• Create a **central production department** • Collect excess production facilities into a **virtual production pool** • Create a dashboard to discover internal sharing opportunities
Material Inventories	• Create a **central procurement department** • Collect excess materials into a **virtual material pool** • Create a dashboard to discover internal sharing opportunities

可调度资金池 Dashboard



生产机床 Dashboard

Step 4: Dispense

Step 4: Dispense Slack	
	Key Activities
Financial Capital	• Deploy excess capital to internal subsidiaries that need them • Deploy excess capital into the financial market • Create **an internal banking system** to facilitate the deployment
Production Facilities	• Deploy excess facilities to internal subsidiaries that need them • Deploy excess facilities to external parties that need them • Create **a production outsourcing system** to facilitate the deployment
Material Inventories	• Deploy excess materials to internal subsidiaries that need them • Deploy excess materials to external parties that need them • Create **an internal procurement system** to facilitate the deployment

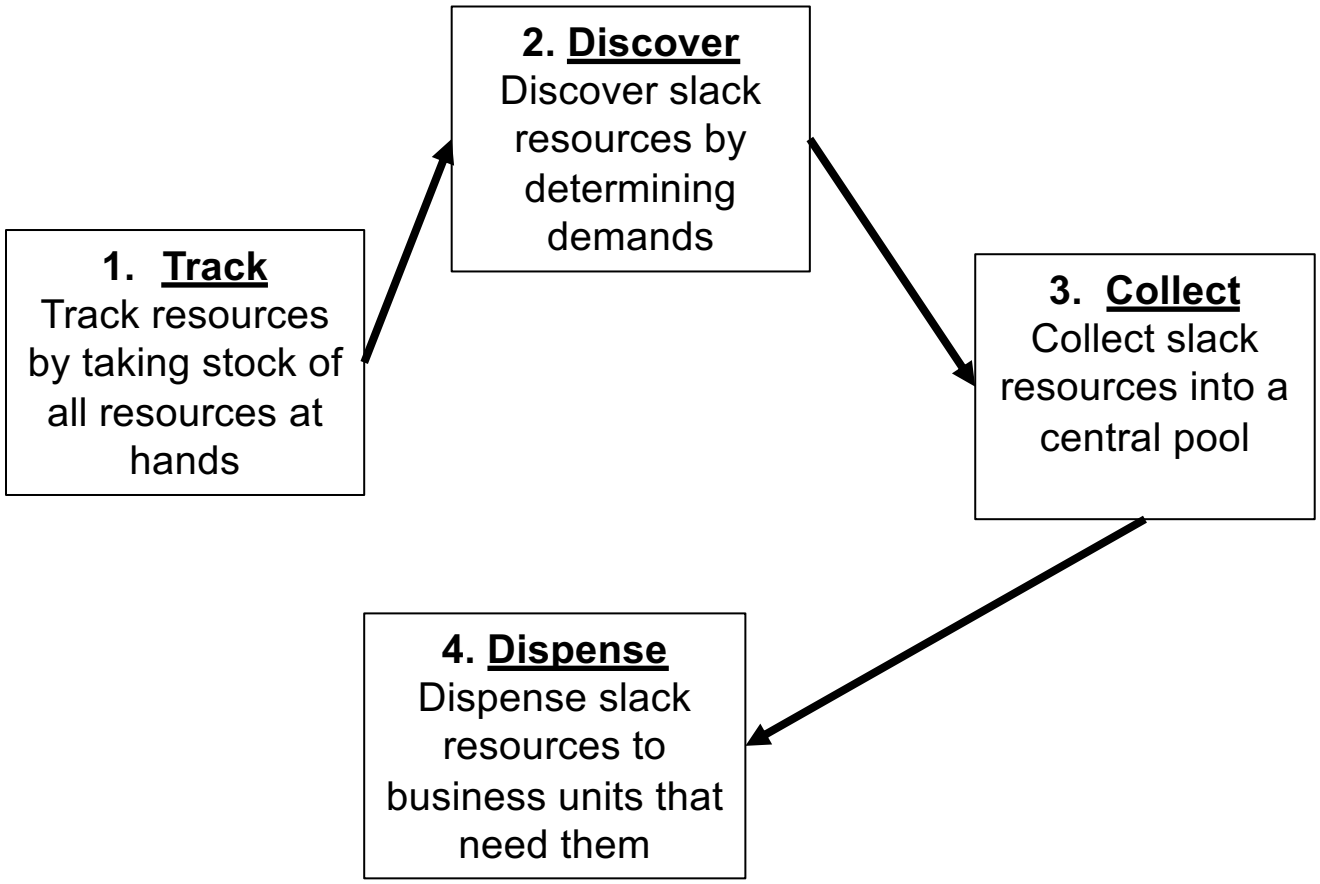
*"When people talk about **shared economy**, they think of Uber. Traditional companies like us do that a lot. Companies in the construction machinery industry use many standard parts, and **there are plenty of opportunities to share these parts.** " --- A Procurement Manager*

*"International competitors start to expand in the local market, but for a while, their production capacities cannot catch up. **They are keen on using our facilities and outsourcing some productions to us**, especially the low-end product lines" --- A Production Manager*

Summary

Table 2: Three Examples of IT-enabled Slack Redeployment				
	Phase 1: Track	Phase 2: Discover	Phase 3: Collect	Phase 4: Dispense
Financial Capitals e.g., liquid assets and cash	Record financial capitals using the same standard; monitor financial capitals in real time	Integrate finance with business functions that affect the demands for financial capitals, e.g., procurement and sales; analyze the integrated data to determine the demands and identify the slack components	Collect excess capitals into a central capital pool; establish an investment company to manage the pool	Build an internal banking system to lend excess capitals to internal borrowers and invest excess capitals into the financial market
Production Facilities e.g., machine tools and assembling lines	Determine the standard for recording production facilities; record production facilities using the same standard; monitor production facilities using smart sensors	Integrate production with business functions that affect the demands for production facilities, e.g., sales and warehouse; analyze the integrated data to determine the demands and identify the slack components	Collect excess facilities into a virtual facility pool; establish a central production department to manage the pool	Build a leasing system to lease excess facilities to both internal and external users
Material Inventories e.g., parts and raw materials	Determine the standard for recoding material inventories; record material inventories using the same standard; monitor material inventories using QR codes	Integrate procurement with business functions that affect the demands for materials inventories, e.g., sales and design; analyze the integrated data to determine the demands and identify the slack components	Collect excess materials into a virtual material pool; establish a procurement company to manage the pool	Build an internal procurement system to sell excess materials to internal users

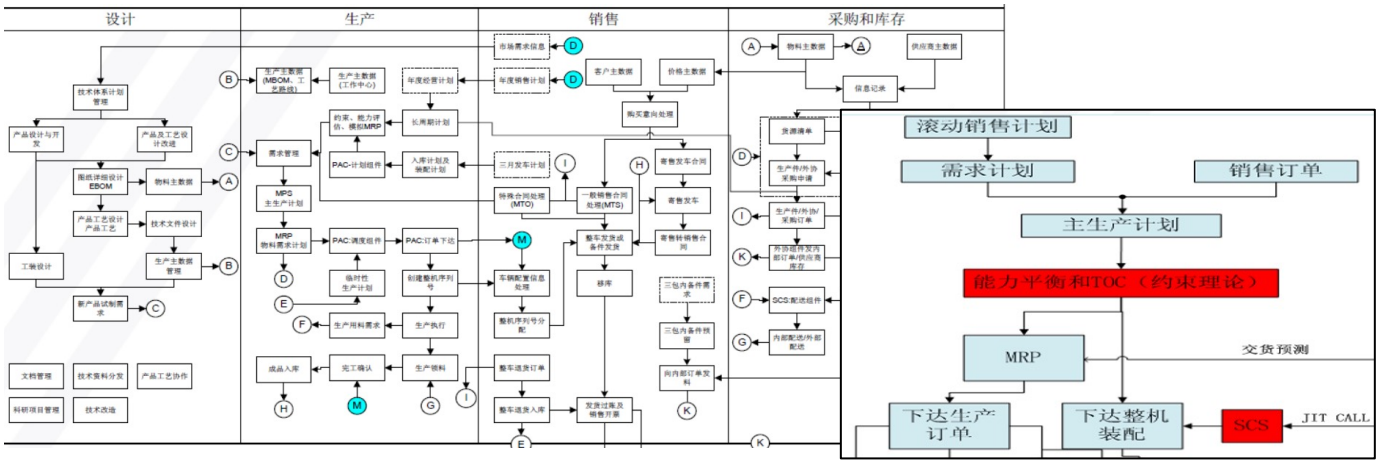
Four-phase Process Model for IT-enabled Slack Redeployment

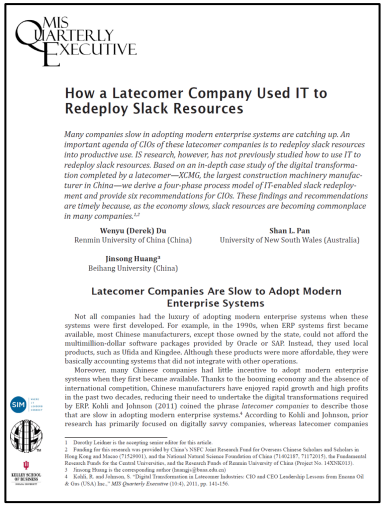


Recommendations to CIOs

- R1: Don’t let IT systems and IT staff become the cause of slack resources
- R2: Track resources by digitally recording and monitoring them
- R3: Discover slack resources by integrating and analyzing cross-functional data
- R4: Collect slack resources by establishing a central pool and an orchestrating agent
- R5: Dispense slack resources by creating internal and external markets

精益制造模块




MIS QUARTERLY EXECUTIVE

How a Latecomer Company Used IT to Redeploy Slack Resources

Many companies slow in adopting modern enterprise systems are catching up. An important agenda of CIOs of these latecomer companies is to redeploy slack resources into productive use. IS research, however, has not previously studied how to use IT to redeploy slack resources. Based on an in-depth case study of the digital transformation completed by a latecomer—XCMG, the largest construction machinery manufacturer in China—we derive a four-phase process model of IT-enabled slack redeployment and provide six recommendations for CIOs. These findings and recommendations are timely because, as the economy slows, slack resources are becoming commonplace in many companies.[1]

Wenyu (Derek) Du
Renmin University of China (China)

Shan L. Pan
University of New South Wales (Australia)

Jinsong Huang[2]
Beihang University (China)

Latecomer Companies Are Slow to Adopt Modern Enterprise Systems

Not all companies had the luxury of adopting modern enterprise systems when these systems were first developed. For example, in the 1990s, when ERP systems first became available, most Chinese manufacturers, except those owned by the state, could not afford the multimillion-dollar software packages provided by Oracle or SAP. Instead, they used local products, such as Ufida and Kingdee. Although these products were more affordable, they were basically accounting systems that did not integrate with other operations.

Moreover, many Chinese companies had little incentive to adopt modern enterprise systems when they first became available. Thanks to the booming economy and the absence of international competition, Chinese manufacturers have enjoyed rapid growth and high profits in the past two decades, reducing their need to undertake the digital transformations required by ERP. Kohli and Johnson (2011) coined the phrase *latecomer companies* to describe those that are slow in adopting modern enterprise systems.[4] According to Kohli and Johnson, prior research has primarily focused on digitally savvy companies, whereas latecomer companies

1 Dorothy Leidner is the accepting senior editor for this article.
2 Funding for this research was provided by China's NSFC Joint Research Fund for Overseas Chinese Scholars and Scholars in Hong Kong and Macao (71529001), and the National Natural Science Foundation of China (71402187, 71720115), the Fundamental Research Funds for the Central Universities, and the Research Funds of Renmin University of China (Project No. 14XNB021).

3 Jinsong Huang is the corresponding author (huangjs@buaa.edu.cn).

4 Kohli, R. and Johnson, S. "Digital Transformation in Latecomer Industries: CIO and CEO Leadership Lessons from Encana Oil & Gas (USA) Inc.," *MIS Quarterly Executive* (10:4), 2011, pp. 141-156.

- 徐工集团通过**实施ERP系统，提升了管理能力和运营效率**，跻身世界一流装备制造企业
- ERP实施过程中**梳理的300余个关键流程，被称为 “企业的DNA”**

- **约束理论下的精益制造模块世界领先**
- SAP 出价6千万购买这一模块

“几代徐工人总结的经验，国家的资产，多少钱也不能卖”

- 徐工集团信息化领导委员会副主任

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