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Conceiving New Advanced Technology Business from Research Group Activities at a Japanese Engineering Industrial Organization

Kotaro Nakamura [1)], Makoto Morioka [2)], Youichi Aoki [3)]

1)Japan Advanced Institute of Science & Technology / eCraft Inc.
Former Director of the New Industry Study Subcommittee in the Engineering Advanced Association of Japan (ENAA)

2) Fujitsu Limited

3) Tokyu Construction Co., Ltd.

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Abstract

- Stronger service business orientation and cooperative conceiving of new industries require that technological experts apply management of technology (MOT) beyond organizations boundaries.
- Over the last 16 years the New Industry Study Group (NISG) of the Engineering Advancement Association of Japan (ENAA) has been bringing together experts from different industries and corporations for bi-annual research groups on advanced technologies and business in new emerging industries.
- The authors participated as NISG director or research leader, respectively, in NISG's projects on knowledge-intensive services, electronic-tag(RF-ID) using services, robotized services for care etc., and are currently in positions to pursue innovation leading and managing successful service-design and ICT-infrastructure companies.
- Reflecting on the authors' activities over the years, the paper presents results of MOT collaboration in the course of NISG research and in the authors' own businesses. The study offers valuable insights for fostering "technology and service producers" in multi-client contexts.

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Focusing of This Application Paper

- New Industry Study Group (NISG, one of subcommittee in the R&D planning committee) in a Japanese Engineering Industry organization
  - For the solution service orientation of Eng. Biz.
  - Over the last 16 years on advanced technologies & business in new emerging fields
  - Cooperated by totally 100 people over technological experts from different corporations for bi-annual research team (10-20 people).
- Clarifying the MOT aspect of this cooperation
  - Through the author's activities over the years
  - Present Each research results by MOT approach
  - Show the service cooperative conceiving beyond organization's boundaries

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Japanese Engineering Industry

- ENAA: The Engineering Advancement Association of Japan
  - A NPO of Industrial organization with the support of the METI (Ministry of Economy, Trade and Industry)
  - Engaged in engineering business under the close cooperation with government, academia & industry.
- ENAA vision about Engineering Industries
  - for our sustainable society and advancement for social environment,
  - through the triune functions of
    - high value-added "production",
    - "systemization" of technology and
    - the comprehensive "project mgnt" of the former ones.

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Japanese Engineering Industry

- Members of ENAA: 168 companies (April, 2011)

Category	No. of companies
Engineering (mainly engaged in engineering)	38
Steel and Structure	2
General Construction	29
Shipbuilding/Heavy Machinery	6
Electric/Telecommunication/Instrument	13
Industrial Machinery	14
Consulting/Other	29
General Trading	5
Mining/Oil Refinery/Chemical/Ceramics	17

http://www.enaa.or.jp/EN/about/index.html

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Conventional Engineering Business

- Conventional Japanese Engineering Industries
  - Main business: Engineering, Procurement and Construction (EPC) as a role of General contractor
  - Because of decline of profit ratio since 1990's from local public investment reducing and international tough competitive environment, the change of business style has become to be necessary.
- Towards solution business direction
  - Beyond EPC-centric business, New trends towards Solution-oriented business through comprehensive capability using engineering resource (human, technology, knowledge) and EPC function with partnership of related companies

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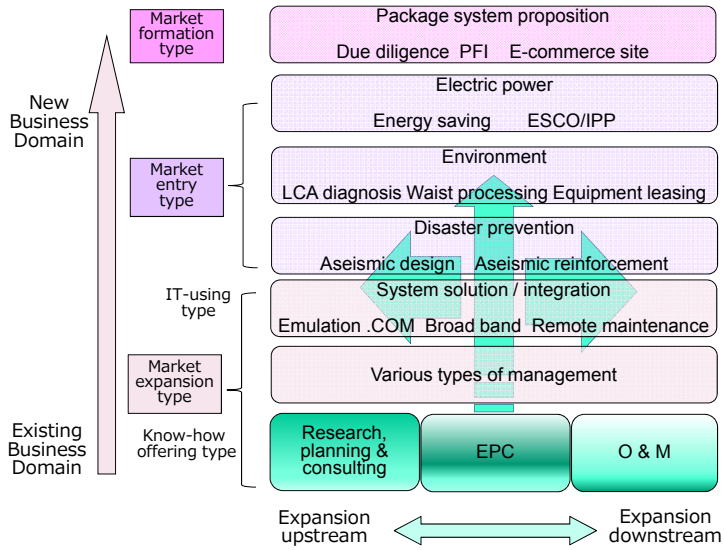
Business Domain Scope of Engineering Industry at 10 years ago



Referred & translated from
ENAA: (2003): "Present situation and future prospects in the servitization of engineering industry(in Japanese).

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1. Introduction: Japanese Engineering Industry
2. Research Activities in a Japanese Industrial Association ENAA
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5. Insight from the MOT perspective

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NISG Research Activities of ENAA

Period(FY)	Research theme	Affiliation of research leader /sub-leader	Participants
1998-1999	Recycling logistics system of consumer durables	HM /GC (2)	10
2000-2001	Regional IT model in the healthcare & welfare field	EM / GC	14
2002-2003	Knowledge intensive engineering service	EM / EI, GC	9
2004-2005	Electronic-tag(RFID) using service	EM/ GC, HM(2)	21
2006-2007	Technology fusion of IT-engineering including service robots	GC / GC	13
2008-2009	Robotics Technology utilization for the safety & security community	GC / GC	9
2010-2011	Robotized service for care & welfare	GC / GC	7
2012-2013	Cloud ICT service including "Big data" "Open data"	EI / GC	9

- The "Research theme" is substantial expression.
- HM: Heavy machineries, GC: General contractors, Engineerings (mainly focused), EI: Electric-ICT
- Number of "Participant" is including research (sub-)leader / director and secretariat

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NISG Study Activities of ENAA

- Participants of NISG
  - Total 92 people (137 people for all NISG)
  - Post level of each affiliation: chief executive, director, manager, principal(mainly director & manager).
  - Department: Engineering Planning, Marketing, Information, R&D.
  - Almost member are engaged in engineering business, based on their technological expertise(Technological Experts).
- Bi-annual research activities (about per month)
  - The 1st FY: Survey of technological trends & market from public information, business professionals & researchers, and field studies
  - The 2nd FY: Discussion about the business outlook through a forecasting of future industry trends.

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Summary of Each Research G.

- (3) Knowledge intensive engineering service
  - Outlooks the possibility of engineering business utilizing the knowledge in "knowledge economy" era, and analyses 40 cases in prospect of qualitative flow of business.
  - Aggregates several business flows of service types such as management / exchange, offering / delivery, agency / mediation, and distribution / settlement and expandable of services through innovation of knowledge & net device layer.
- (4) Electronic-tag(RFID) using service
  - Investigates "business model" & "infrastructure / institutions" in electronic-tag linked by network to innovate existing services and create new services.
  - Develops the outlooks three sectors such as construction/plant engi., health care/ welfare, urban/ accident prevention/ environment using a S-F-M analysis, Delphi method, and Roadmapping technique and shows the need for partnership.

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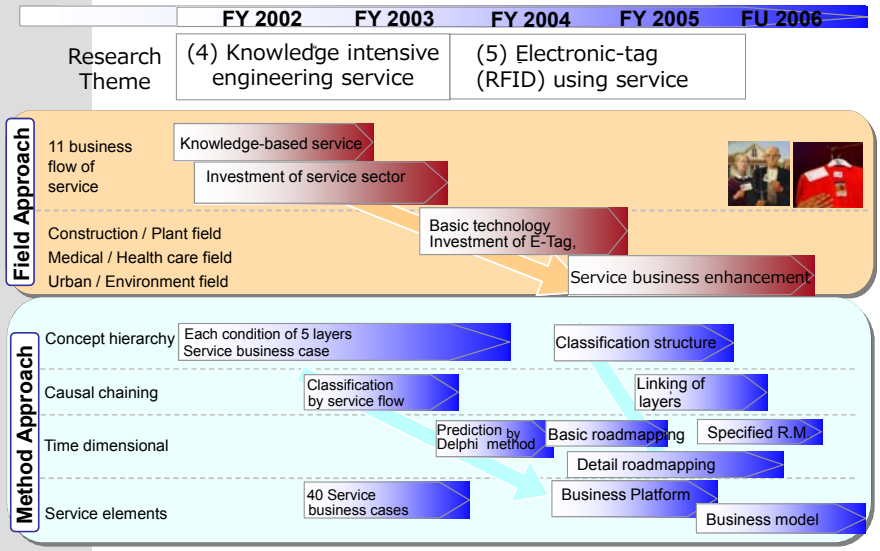
NISG Research Group (3)-(4) in ENAA



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Knowledge Intensive Eng. Business

- Approach & Its Result
  - A original business model analysis used reflected on knowledge science, because "knowledge" was not fully defined in service study 11 years ago.
  - Next Fig. as a typical results of classification of service business cases mapped in the plane by spreading of service usage & service channel
- Refection from Present (to 11years ago)
  - "*A unique multidimensional analysis*" in prospect of people, technology, market, social & business
  - *"With difficulty, but significant research, because this investigation started from the "knowledge usage" has been developed to important theme for engineering solution business."*

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Electronic-tag(RFID) using service

- Approach & Its Result
  - Adopted MOT methods such as Delphi, SFM matrix & roadmapping to pull up each expertise.
  - Developed roadmap for three typical industrial sectors & common detailed roadmap, and business plan for the sectors
- Refection from Present (to 9 years ago)
  - A milestone of "building shared knowledge" for each participants to specialize that for their own use, by setting common service modeling framework in advance
  - Comparing to current condition, a) RFID usage: specific field such as apparel, production mgnt, b) synergy effect of mobile/smartphone, c) remarked regulation & cost issues, to usage delay of open industrial field such as logistics.

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Roadmapping Activities of RF-ID using Service

The Service Roadmapping activities in our industrial Association

作業風景

Temporary Results

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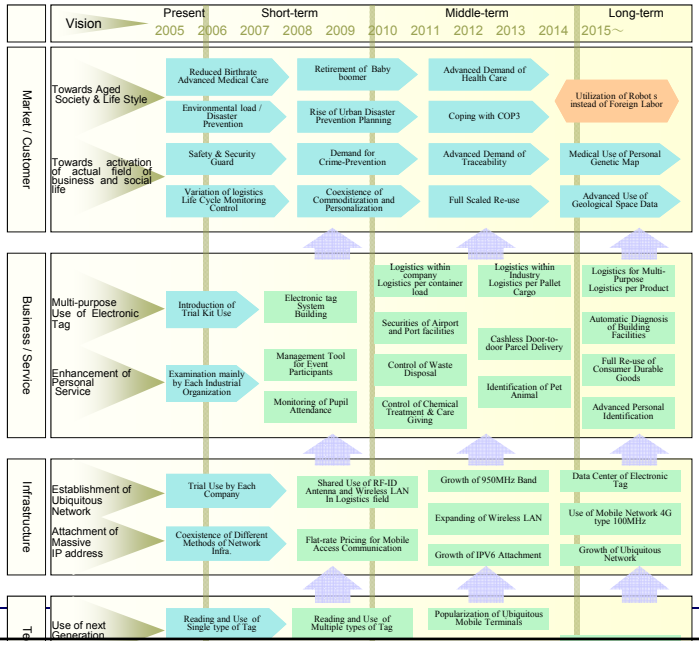
A Basic Roadmap of RF-ID using Service



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An evaluation of Each Research Activity

- The level of each research
  - From customer needs survey level to a detailed business model proposal with business feasibilities
  - Mainly reflected on research leader's intent/way or participants' needs to the activities
- Main representation method of research results
  - Roadmap: detailed level with common work ～ simple level made by individual
  - Business model: business model ontology ～ business flow level
  - Focusing point: from technology trends to "service system" for "customer value"

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Collaboration of Technological Experts

- The cooperation of participants from companies that compete with each other potentially
  - trends to attain not sufficient results because of difficulty in sufficient disclosing of special business views
- Important point for collaboration management
  - Generalizing info from participants to build the relationship of technological trends & market needs rather than special business matter towards mutual knowledge integration
  - Motivating “a bit ahead instead of right now” and “towards a leader in each company to cooperate with each other”, for sharing outcome
  - Providing the opportunity for developing the future partnership beyond organizations that is required for expansion of business conceiving

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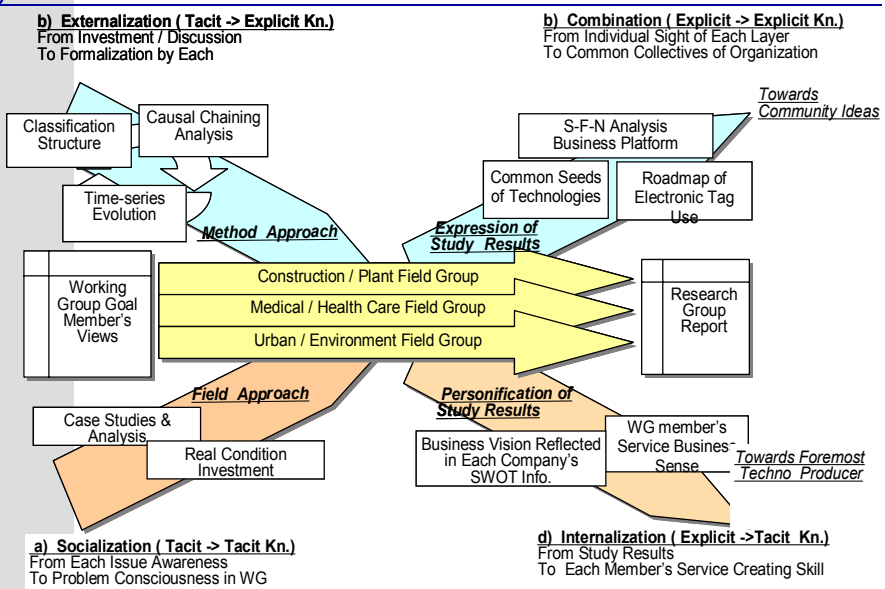
SECI Spiral scheme in Research Activities



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Methodologies & Platform for Partnership

- Understanding & Usage of MOT methodologies Innovation architecture, Business flow, Roadmapping
  - Delphi method, Technology-Market Matrix
- Towards platform for thinking
  - Not only for sharing of technological knowledge, but also for thinking process of service co-creation & human centered design(HCD) for more innovative business idea by focusing on people's thinking, common practice and culture
  - This research has being providing a base for each present business way for some people about 4-5.
  - More advanced research activities will be planned.

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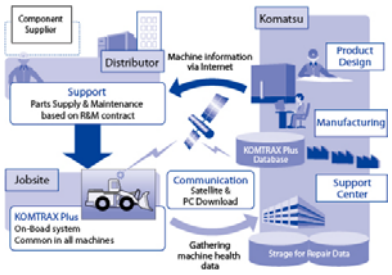
Engineering Towards Infrastructure with Service

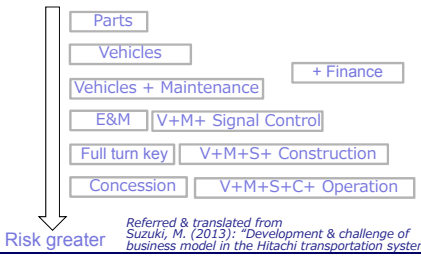
Komatsu business with KOMTRAX
(Komatsu Machine Tracking System)

http://www.komatsu.com/CompanyInfo/profile/product_supports/



Hitachi business towards full turn key
(for British Railway system)

Change of business model



Referred & translated from Suzuki, M. (2013): "Development & challenge of business model in the Hitachi transportation system"

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Conclusion

- This Application Paper:
  - Introduces the research activities cooperated by technological experts from different companies on new technologies & business in emerging fields for a solution engineering business.
  - Clarifies the MOT aspect of this cooperation based on the author's activities such as "knowledge-intensive engineering business/ service" & "electronic-tag using service" as director or leader.
  - Shows present issues about the cooperative conceiving beyond organization's boundaries.
- Implication
  - Contributes to foster "techno & service producers" (Kameoka 2005)in multi-client way such as in industrial organization.

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Appendix.

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Summary of Each Research G.

- (1) Recycling logistics system of consumer durables
  - Considers business simulation & system building around a large-scale reuse center, for reuse market expansion, towards the recycling-oriented economic society.
  - Proposes the efficiency by the e-commerce in the data center and the introduction of dispatch planning system in the logistics system, also, in particular important issues such as penetration into the consumer.
- (2) Regional IT model in the healthcare&welfare field
  - Conceive a public service business model of medical / welfare, to balance customer's satisfaction & provider's interest.
  - Studies on "healthcare support services using IT by consumers" about business models, patentability & engineering: "Primary access channel office (called by PACO), and the possibility net-using health diagnosis & EHR.

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Summary of Each Research G.

- (5) Technology fusion of IT-engineering including in service robotics
  - Considers a fusion use of IT & engineering tech. for enhancing both of convenience & safety of living environment towards spanning the social infrastructure sector.
  - Examines a direction for engineering connecting "technology / system" and "business / service" to overcome the two trade-off relationship, regarding mobility support, care support, and assistance support.
- (6) Robotics utilization for safety & security community
  - Investigates the solution of making mechanism such as engineering by RT towards the safety & security for aging society to identify revision of the tax / law for introducing progress.
  - Studies on RT's roles for human activities in difficult environment, as a body functions assist and needs of disaster response, and on deployment RT element technology to other domains such as medical / nursing care field.

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Summary of Each Research G.

- (7) Robotized service for care welfare
  - Examines the measures for utilizing superiority of eng. companies towards "human-centered innovation" to enter assisted living, to go into the medical/welfare equipment market with total system of RT & operational knowledge.
  - Identifies ensuring safety as an current issue in this business field to confirm the importance of public verification/ evaluation organization from home & abroad survey for creating new market.
- (8) Cloud ICT service including "Big data &Open data"
  - Investigates the current state of cloud service spread about cases of data center business & local governments to recognize cost savings are more important rather than revenue growth.
  - Aggregates the possible approach of the eng. biz. using availability of cloud platform collecting/storing big data in a industrial domain and open data from local government in a smart community.

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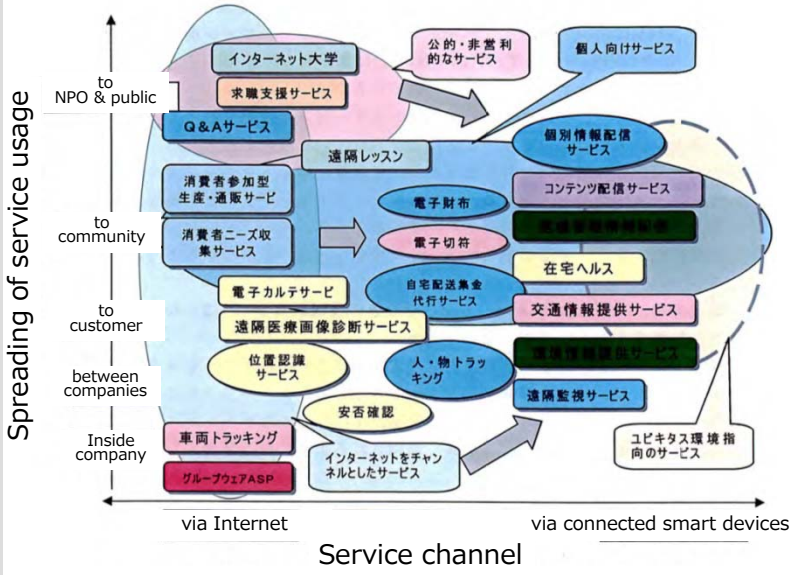
Mapping of Knowledge-int. Business.



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A Detailed Common Roadmap of RF-ID using Service (in Japanese)