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Research article

Implementation of telecommunications cross-industry collaboration through agile project management

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ABSTRACT

The telecommunications service provider (TSP) strategy for collaborating with the industry that utilizes the Internet of Things (IoT) is an excellent opportunity to overcome digital disruption. TSP serves only human-type customers, thus constructing new business processes for the IoT, a non-human customer base, is a challenge to be addressed. Some large companies that are transforming business processes face difficulties in using the strategic framework for reasons such as ineffective management of organizational change, internal resistance, technical issues, and conflicts between frameworks and business needs. The enterprise architecture (EA) is a comprehensive strategic framework that involves company analysis, design, and solution implementation. This study examines transformation project implementation based on the EA model as a prototype, from business strategy to practice, using the concept of three intersections among project management, strategic management, and business processes. Thus, the aims of this study are to develop a method for implementing a telecommunications cross-industry collaboration project with an IoT-based company, and heuristic implementation of the method as a research initiative in producing an EA model as a project prototype. The development of the proposed methodology requires the dynamic systems development method (DSDM) as the agile foundation, including pre-project, feasibility, business study, functional model, design and build, and implement. The implementation phase proposes a transformation strategy that addresses company elements: 22 at business layer, 6 at application layer, 4 at technology layer, and 15 relationships, to be executed by the company in order to increase the company's competitive value.

1. Introduction

Telecommunication service providers (TSPs) have identified the increasing use of the Internet of Things (IoT) in the cross industry as an exclusive opportunity to provide internet connectivity services and network devices. The adoption of IoT in companies is causing industries to become more competitive in the industrial era 4.0. The use of IoT in company operations should be in accordance with certain technical conditions and business process requirements (Habib and Tenhunen, 2017; Sun and Ansari, 2018). In addition, companies should adjust their capabilities, resources, and competencies to enable the use of these new technologies.

In the infrastructure of telecommunication, mobile phones owned by human customers are connected with TSP services. Each TSP customer has a pre-paid, post-paid, or hybrid service with different service characteristics. In addition to satisfying the communication needs of human customers, TSPs also serve non-human customers, which communicate materially with the TSP infrastructure in the form of IoT devices. Although both human customers and IoT devices are technically supported by the existing infrastructure, TSPs have business processes suited for only human customers.

Human customers are served through a customer service interface, virtual assistance, head office, mobile apps, and online customer care, and can communicate with TSPs through a highly mature business process. In contrast, an IoT-based company does not have suitable business processes for communication with TSPs; they are served by TSPs through one interface—a project manager. Therefore, coordination across organizations within a complex TSP corporate structure is ineffective. Thus, TSPs must develop an entirely new business process for their IoT-based customer domain, which is the focus of this research.

TSPs must acquire new telecommunication capabilities to serve IoT-based institutions and companies. This is indicated by the red text in Figure 1, which shows a gap in IoT connectivity. To fill this gap, an enterprise architecture (EA)-based strategy is needed. EA is a framework

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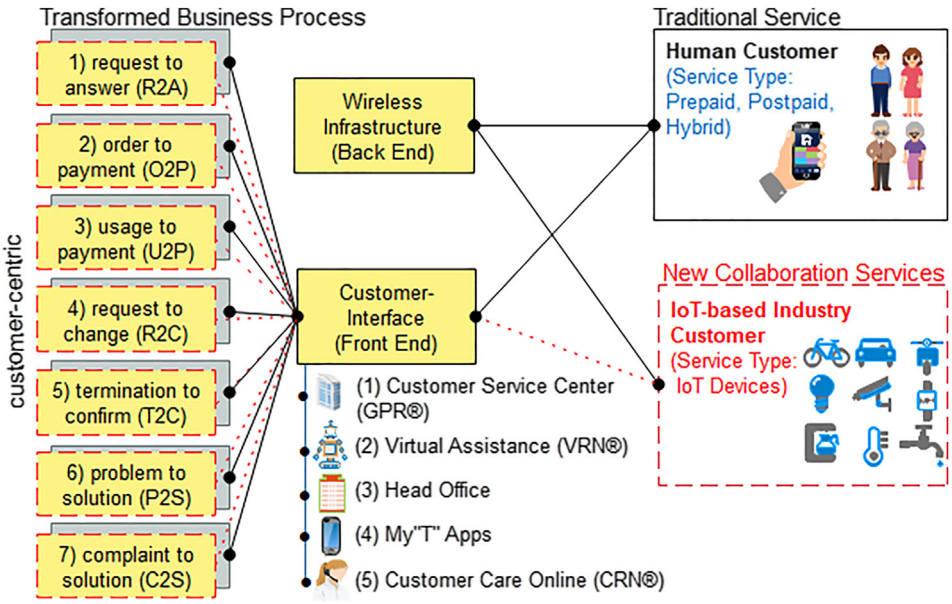

Figure 1. Customer-centric business process in a new collaboration with IoT-based industry.

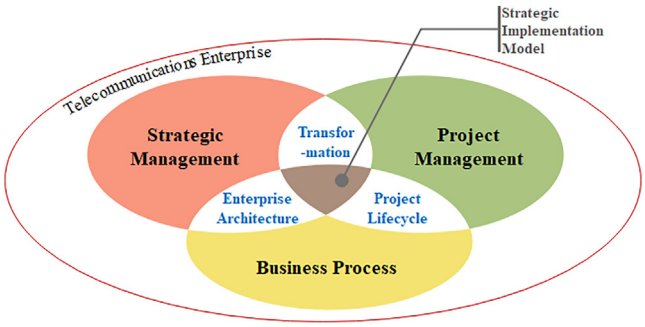

Figure 2. Conceptual model: intersection Venn diagram of strategic implementation.

that supports corporate, business, and information systems strategies by providing a representation of an organization's current capabilities and enabling the desired results to be achieved (Abunadi, 2019). EA can be used in complex situations as it allows for interoperability, client orientation, and flexibility and facilitates communication, decision-making support, and development of migration strategies (Gong and Janssen, 2020). In addition, business processes based on an EA strategy can enable companies to achieve strategic objectives and produce better organizational results (Šaša and Krisper, 2011).

Performing business process transformation within a company is challenging because redefining a new customer base is crucial for the company's value chain. The necessary changes involve a comprehensive corporate environment, stakeholders, corporate organizations, and actors in multi-directorates in the organization. The behavior of employees should also change in line with the fundamental changes implemented. It is necessary to employ a complex approach to transform complex business processes. According to (Wysocki, 2019), project management practitioners have observed that most of their projects that are classified as complex are better suited for the agile project management (APM) approach than other approaches.

The business process transformation project considered in this study uses the APM methodology. APM can address the problem of frequent cancellation of multiple projects because of long delays in providing solutions, which has been experienced by several businesses in the past (Bennett and Bowen, 2018). In addition, APM produces higher-quality results than traditional project management projects do (Wysocki, 2019), because of the higher client involvement, which means that the client can see earlier parts of the project in the form of deliverables and has the opportunity to adjust accordingly.

The research conceptual model based on the interaction between the three concepts (see Figure 2)—project management through APM, strategic management using a corporate strategy model in the form of an EA, and the project cycle for defining business processes in telecommunications companies. Based on these three concepts, APM with a dynamic

Table 1. DSDM principles.

Focus on the business needs	Projects exist to serve business needs in a timely manner. Establish an understanding of business goals and priorities, and ensure support and commitment from stakeholders.
Deliver on time	Consider that the time (and quality and cost) is fixed, scope is the only variable of the project.
Collaborate	Commitment and mutual engagement. The principle of removing institutional barriers (e.g., team sharing locations, forming a "one team" culture).
Never compromise on quality	Establish quality expectations, compliance requirements, and overall validation. Quality should not be sacrificed for other project variables (e.g., cost, time).
Incrementally build from the company's foundations	The project life cycle model can be used in feasibility studies and for establishing a solid foundation for project viability.
Develop iteratively	Prohibit overloading of specifications (e.g., design considerably in advance) and emphasize experiential learning. Practices must be adaptive and must embrace change.
Communicate continuously and clearly	Use communicative practices (e.g., regular meetings, workshops, modeling, and visualization) that place a considerable emphasis on direct experience and human interaction (e.g., written specifications).
Demonstrate control (use appropriate techniques)	Show control in project governance. Planning is multi-level adaptive, and there are deliverables in tracking progress. Perform agile tracking and reporting (e.g., burndown charts, team boards) as an open, adaptive, people-centered artifice.

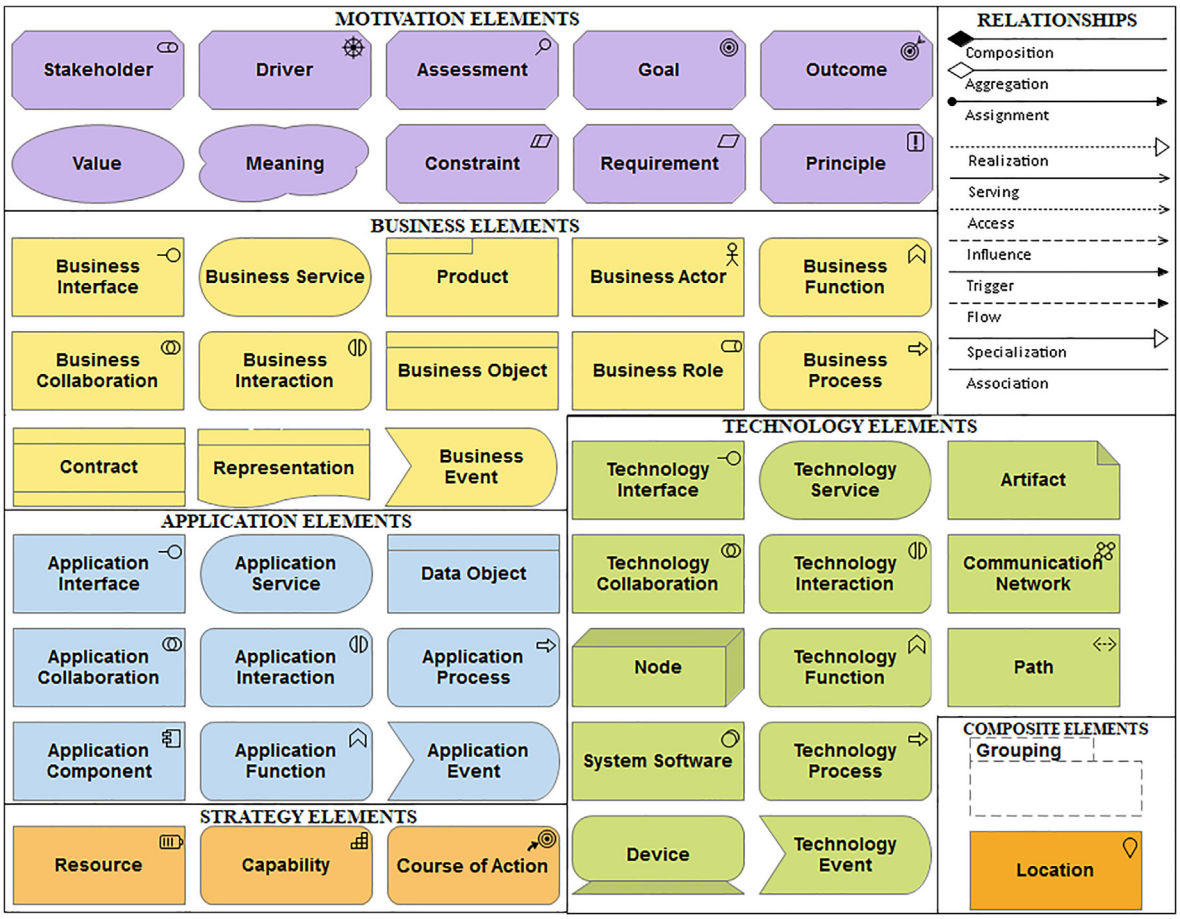

Figure 3. ArchiMate notations for EA.

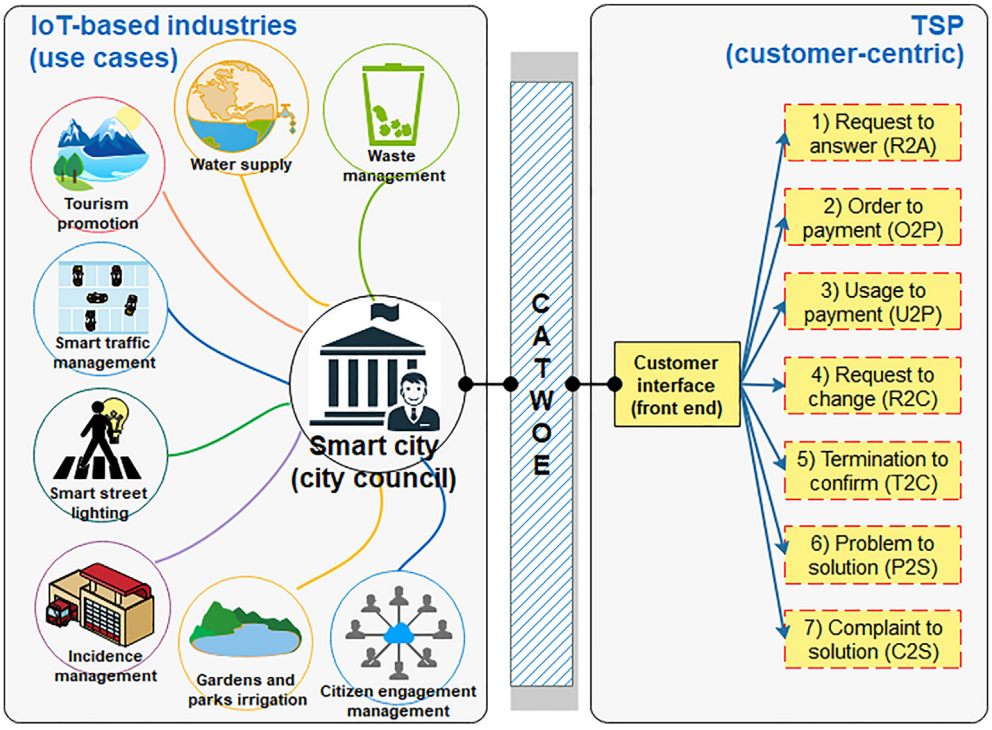

Figure 4. CATWOE concept as a permeable wall for business process collaboration: IoT-based industries and TSP.

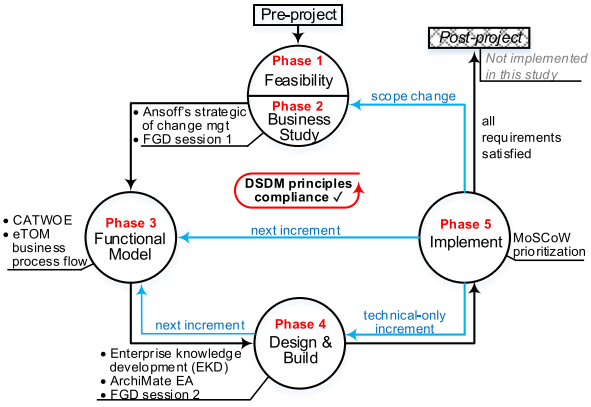

Figure 5. The DSDM lifecycle for business process transformation project.

systems development method (DSDM) cycle can be used to manage business process transformation projects in companies. In such a cycle, some activities to model the EA of a business process act as a prototype for organizational changes implemented using the enterprise knowledge development (EKD) method. Using a query on the Scopus database in mid-2020 with the keywords "agile project management," "enterprise architecture," and "business process," it was observed that no study had addressed these issues together.

The novelty of this research lies in the use of APM for business process transformation projects, using a combination of DSDM and EKD methods to develop an EA as a prototype for implementing changes in TSPs. The new telecommunication business process resulted in the development of a new strategy for TSPs to manage non-human customers through cross-industry collaboration with IoT-based companies.

The paper contribution is the proposed project management method (to be used for TSP organizations towards transformation), and heuristic implementation of the method as a research initiative, to prove that the proposed method. Hence it is succeeded in producing an EA model as a prototype of the transformation project implementation. This

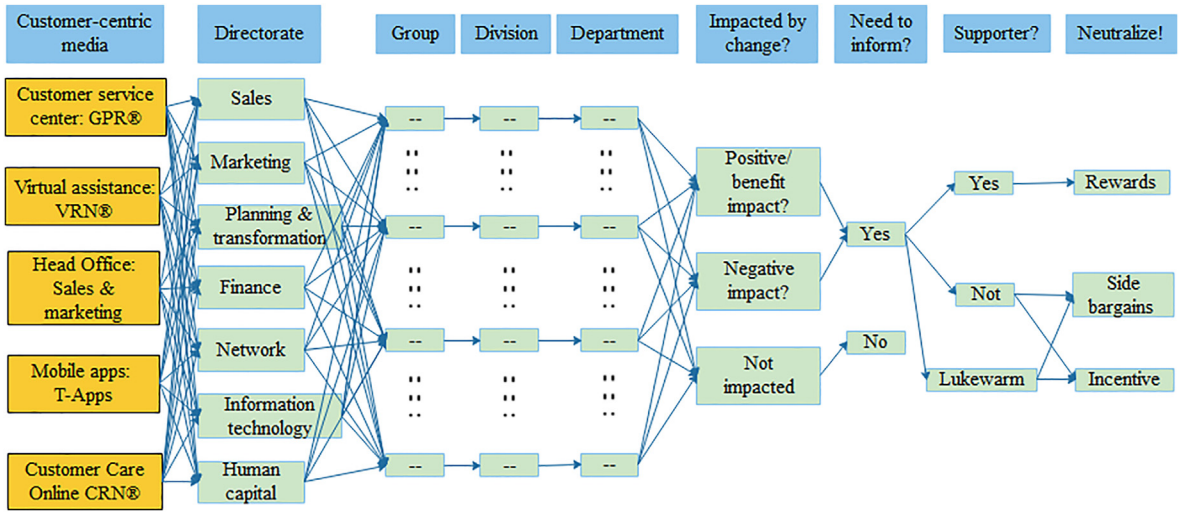

Figure 6. Cultural resistance map.

Progress meeting objectives:
- Project status and timeline
- Introduce current status of project architecture design and implementation plan
- Provide high-level roadmap for architecture implementation
- Introduce detailed architecture implementation approach

Participant	• Solution Architect • Owners of all affected architecture layers • Functional experts either involved in or affected by architecture design and implementation
Frequency	• During Design: Monthly • During Implementation: Biweekly
Preparation	• Invitation • Input for agenda • Distribution of agenda • Minutes of meeting MoM
Agenda	• Planning and milestones • Achievements & Next activity • Action Plan and Issue List

Figure 7. Project organization chart (high-level).

Progress meeting objectives:
- Project status and timeline
- Introduce current status of project architecture design and implementation plan
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- Introduce detailed architecture implementation approach

Participant	• Solution Architect • Owners of all affected architecture layers • Functional experts either involved in or affected by architecture design and implementation
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Figure 8. Project regular review meeting.

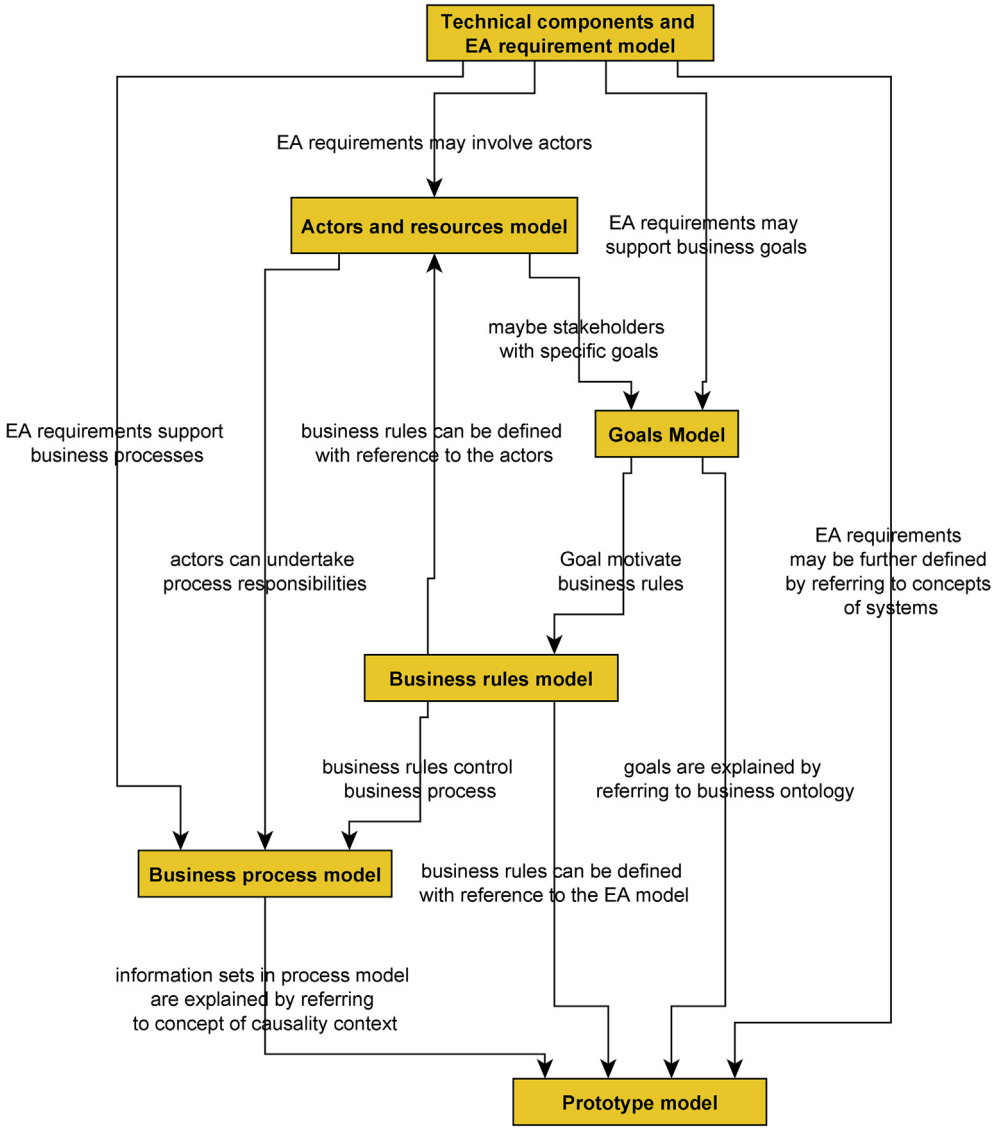


Figure 9. EKD enterprise modeling for EA model (prototype) development.

Table 2. eTOM process flow (Czarnecki and Dietze, 2017).

Process Domain	Use Cases	eTOM Process Flow
Customer-Centric	Request information	*"request to answer" (R2A)*
	Buy a product	*"order to payment" (O2P)*
	Using the product	*"usage to payment" (U2P)*
	Change existing contracts/service	*"request to change" (R2C)*
	End the existing contract/service	*"termination to confirmation" (T2C)*
	Report a technical problem	*"problem to solution" (P2S)*
	Report a commercial complaint	*"complaint to solution" (C2S)*

implementation model is an interpretive of the company's business process transformation strategy in a real context.

2. Related work

EA is a holistic strategy to improve the alignment between business and information technology (IT) in an enterprise (Nikpay et al., 2017). The EA field has developed in the past 40 years, rooted in management disciplines, engineering, and information systems. This is a result of the necessity for company integration, whereby companies are viewed as a processing system for information and materials, which interact with their environment through a permeable border (Bernus et al., 2016).

Academics and practitioners have proposed several frameworks and methodologies to develop an EA strategy model that includes the open-group architectural framework development method known as TOGAF-ADM (The Open Group, 2018), the Department of Defense Architectural Framework DoDAF, EA planning, federal EA, and soft system-based methodologies (Dachyar et al., 2020).

Previous research on the implementation of the EA strategic model (Lehman et al., 2011) involved the use of cognitive mapping organizational change strategies as an underlying foundation for planning and decision-making (Nikpay et al., 2017). developed an EA implementation methodology based on information extracted from semi-structured interviews with EA practitioners. Another researcher (Zapata et al., 2019) proposed a business model for project implementation based on sentiment analysis.

EA can be considered an application of enterprise systems science. It is important to demonstrate how EA-based approaches function in a multi-disciplinary setting in a company (Faria et al., 2018). For successful EA implementation, it is necessary to understand how successful companies adapt to EA methodologies in practice. From a dynamic perspective of architectural implementation, the transformation from the current state to the target state is determined by solution design. However, in most cases, the entire design and implementation is performed in a cross-functional project (Czarnecki and Dietze, 2017; Leyh et al., 2017; Mazhar et al., 2018), where there is always a gap between the initial "intended" scope and the present-day EA scope in practice. Research (Bernus et al., 2016; Mazhar et al., 2018) has revealed that the EA scope no longer necessarily involves a single element, but rather a socio-technical system. EA frameworks should be considered from related business, economic, social, and ecological perspectives (Bernus et al., 2016), such that they can represent the stakeholder's specific concerns.

2.1. Strategic change management

The most important problem in company change management, is the behavioral resistance to change in cross-functional and multi-disciplinary companies. "*A strategic social architecture change is seeking, flexible, and loosely structured, while the operations architecture is change-resistant, efficiency-seeking, and highly structured*" (Ansoff et al., 2019). It is crucial to analyze the behavior of change resistance inside a company.

The change implementation involves institutionalizing a new strategy that requires a cumulative capability to perform changes from an ad-hoc until business process is systematically transformed. Strategic diagnosis is a systematic approach to determine the changes to be effected in a company's strategy and the internal capabilities required to ensure success in future (Ansoff et al., 2019). A company should proceed to launch a platform, design the change process, protect the process from conflict with operations, incorporate "implementability" into the process, manage the ongoing process, institutionalize the new strategy, and institutionalize strategic responsiveness. The change should ensure that the aforementioned aspects are accommodated in the project management.

2.2. Agile project management

A study on the telecommunication practice of strategic model implementation (Czarnecki and Dietze, 2017) found that development

Table 3. Themes in the FGD thematic analysis.

No	*Codes**	*Themes*
1	Customer (IoT-based industry) communication channel.	R2A, O2P, R2C, T2C, P2S, C2S
2	Managing contacts of a new customer (smart city).	R2A
3	Feasibility study team to manage the request.	R2A
4	Technical documentation on IoT device connectivity.	R2A
5	The new activation to be accommodated immediately.	O2P
6	The growth capacity able to provide the additional traffic load request.	O2P
7	The customer (IoT-based industry) service usage record.	U2P
8	Managing the rating and billing scheme.	U2P
9	Managing the bill payments and receivables.	U2P
10	Ability to receive and process the service request, the CRM.	R2C
11	Tracking the service order progress.	R2C
12	Checking the billing status, before the termination process.	T2C
13	Ability to receive and process the termination request.	T2C
14	Termination of customer/service can increase network capacity.	T2C
15	Mobile apps T-Apps show the problem status by real-time.	P2S
16	Managing the problem report.	P2S
17	Managing the Service Level Agreement (SLA).	P2S
18	Managing the problem from internal network monitoring reports, though integrated operation center (IoC).	P2S
19	Managing the industry report complaint.	C2S
20	Managing customer satisfaction.	C2S

Table 4. CATWOE analysis for R2A.

CATWOE	"Request to Answer"
C, Customers	City council, concession representative: waste management representative, water supply representative, etc.
A, Actors	Customer service center (GPR®) staff, Customer care online (CRN®) agent.
T, Trans-formation Process (**Proposed**)*	**Industrial communication channel based on IoT:** • Provides the customer service center (GPR®) interface for a smart city when the smart city representation team (verified customer) visits the GPR® office; • Provides the customer care online (CRN®) interface for a smart city (for self-service); • The smart city representative can seek information pertaining to the product catalog; • The smart city representative initiates the high-level business requirements to be followed up. **Managing contacts of a smart city:** • Registering of the new customer type: IoT; • Each IoT-based company (smart city) has a unique customer ID that distinguishes existing customers; • Customer unique ID can be referred to the new MSISDN prefix number, separate from the existing (human) prefix number. **Feasibility study team to manage the request:** • Sources the internal expert team to support the customized request in terms of product specifications. • Provides an internal revenue forecast assessment and RoI that conjugates the advanced infrastructure investment management. • Offers the smart city solution proposal with detailed smart city investment BoQ, KPI, and terms of payment. **TSP meets requests for technical documentation on IoT device connectivity:** • Supply of the product catalog; • Service legal agreement (SLA) and quality of service QoS network usage by IoT devices; • The infrastructure is capable of guaranteeing SLA.
W, World View.	Managing new opportunities with the existing resources and constraints.
O, System Owners	The sales directorate in the TSP company.
E, Environ-ment and its limitations (**constraints**)	Quick time to offer (catalog, proposal, and installation expanded capacity), number of new customers (per product), customer request vs. causes over commit offers, ability to offer seamless services, standardization vs. individual offers, product complexity, quick requested handling time, how to measure customer satisfaction, availability of relevant information, availability of products and services at customer location, availability of contact center and channel office.

(planning) and implementation of an architecture solution is essential for obtaining benefits from solution designs inspired by comprehensive international project management standards, for example, the PMI (Project Management Institute, 2017) and PRINCE2® (Axelos, 2017). The requirement for global project management concept is reinforced by the opinion of (Ansoff et al., 2019) regarding the inclusion of project management in the company planning module of "corporate capability design" to ensure that the company's new EA designs can be realized.

According to (Markiewicz, 2011), the essence of strategy implementation is the transition of a "dead" system model (there is a strategic plan) to a "living" system model. The organization aims to achieve established strategic objectives through rational resource management. The transition requires changes in the static organizational structure and in the behavior of the employees, and requires creativity, innovation, and perception of the organization. The transition requires an orderly and systematic approach based on an efficient communication system. The

Table 5. CATWOE analysis for O2P.

CATWOE	"Order to Payment"
C, Customers	•City council, concession representative: waste management representative, water supply representative, etc. •City council appoints the finance department in charge of bill payment, according to the contract agreed on.
A, Actors	Mobile apps T-Apps managed by the marketing team, IT operation staff (IoT expert), network operation staff (IoT expert).
T, Trans-formation Process **(Proposed)***	**The communication channel for customer order:** •The smart city representative can seek information about the available service to be purchased/activated; •Purchase/activation can be conducted via self-service. **The new activation to be accommodated immediately:** •A dedicated person in charge (PIC) from network and IT directorate to manage the request; •An application service to support the IoT (device and SIM card) massive activation is ready; •An IoT end-to-end test service prior to ready-to-use; •New customer ID verification and recording in the billing system, typed as non-human. **The growth capacity able to provide the additional traffic load request:** •Network expansion may be raised because of a requirement in the internal company; •Capacity forecasting of IoT-based industry.
W, World View.	Manage customers from the industry, with the existing resources and constraints. Capacity forecast.
O, System Owners	Marketing directorate of TSP company.
E, Environ-ment and its limitations **(constraints)**	Pricing/rating that needs to be redefined, very short time between the agreement of the contract and the service usage (TTC: Time to customer), timely delivery of various product elements, ability to offer seamless products, reliability, availability of company resources (for example IT team, network team, team representation in the field, business partners, etc.).

Table 6. CATWOE analysis for U2P.

CATWOE	"Usage to Payment"
C, Customers	City Council appoints the finance department in charge of bill payment, according to the agreed contract.
A, Actors	Mobile apps T-Apps managed by the marketing team, IoT invoice verification team.
T, Trans-formation Process **(Proposed)***	**The IoT-based industry service usage record:** •The invoice declares the service usage information per IoT device according to the agreed contract (price plan), whether it is based on volume, usage, or a flat price. •Provides a real-time billing usage interface for the smart city. **Managing the rating and billing scheme:** •Payment based on volume, usage, or particular mechanism; •Billing information being accessible toward customer IoT, depending on the price plan. **Managing the bill payments and receivables:** •The invoice information is verified prior to the submission to avoid customer complaints. A dedicated team ensures the invoice record for the IoT-based industry; •The invoice is sent on time and automatically to the customer through e-mail or as a physical copy; •A new definition of product lifecycle: idle, active, suspend, disable, pool, etc. •An alert to be sent to the customer because of late payment; •An alert to be sent to the customer prior to the service termination because of the late payment.
W, World View.	Manage customers from the industry, with the existing resources and constraints.
O, System Owners	Marketing directorate of TSP company.
E, Environ-ment and its limitations **(constraints)**	Accurate and timely invoices, monitoring SLA and QoS, collection of service usage records, how SLAs should be achieved, how consistency of tariff configurations should be maintained, transparency in marketing activities related to customer billing.

purpose of changing from a strategic program to a project is to appoint a person to be responsible for the transition, with the attribution of functions and competencies to provide the necessary autonomy and agility (Alami, 2016).

In the project environment, the methodology is considered a defined process that documents a series of steps and procedures involving a series of integrated tasks, techniques, tools, functions, responsibilities, and milestones, through which the project develops, concludes, and is successfully delivered (Castro Silva et al., 2018). The most important aspects of implementation are quality, speed, and cost reduction, which can help companies to find any problem and achieve improvements without any delay (Dachyar and Sanjiwo, 2018).

According to research by (Castro Silva et al., 2018) on the methodology or standards followed, 88% of project managers manage their projects using PMBOK; however, a majority (42%) of them use their own intervention methodologies, which are tailored to the characteristics and needs of their organizations. The more experienced project management organizations use methods derived from APM methodologies, which allow flexibility in project management (Joslin and Müller, 2015). Compared with other methods, such as waterfall methods, the agile quality approach is more customer-centric, is based on collaborative leadership, and provides greater business value in performance measurement (Kisielnicki and Misiak, 2017).

In this study, an APM based on DSDM is proposed for business process transformation in a telecommunication company. The DSDM is an agile practice best suited for complex systems, and projects with dynamic, "uncertain", and nonlinear characteristics (von Rosing et al., 2015). The framework involves determining the cost, quality, and time in advance and then using a formal scope of priority to satisfy the constraints (Project Management Institute, 2017). The DSDM reduces cost and time

Table 7. CATWOE analysis for R2C.

CATWOE	"Request to Change"
C, Customers	City council, concession representative: waste management representative, water supply representative, etc.
A, Actors	GPR® staff, CRN® agent, IT operation staff (IoT expert), network operation staff (IoT expert), Integrated Operation Center (IOC) Staff
T, Trans-formation Process **(Proposed)***	**Industrial communication channel based on IoT:** •TSP provides the interface of the GPR® for a smart city when the smart city representation team (verified customer) visits the GPR® office; •TSP provides the CRN® interface for the smart city (for self-service). **Ability to receive and process the service request:** •The CRN® self-service as a part of the CRM application needs to be upgraded to manage the new type of customer; •Customer call agent behind the CRN® (24 × 7 on-call support) can manage the service request from a smart city; •GPR® staff can manage the service change request; **GPR® staff tracks the service order progress and communicates with smart city representative and technical expert:** •Monitoring the change as requested by the customer; •Conveying the billing charge for the change.
W, World View.	Manage change request, with the existing resources and constraints.
O, System Owners	The related directorate of the TSP company.
E, Environ-ment and its limitations **(constraints)**	How side effects of the changes made can be avoided, how the difficulty level of the changes made should be categorized, very short time between change requests and service usage, how changes to the various product elements should be made, period from termination, time taken to handle change requests/orders, ability to deliver seamless services, opportunities for cross- or up-selling.

Table 8. CATWOE analysis for T2C.

CATWOE	"Termination to Confirm"
C, Customers	City council, concession representative: waste management team, water supply team, etc.
A, Actors	GPR® staff, IoT expert (IT and Network)
T, Trans-formation Process **(Proposed)***	**IoT-based industry communication channel:** •Provides the GPR® interface for a smart city when the smart city representation team (verified customer) visits the GPR® office; •Termination should ensure no issues with previous payments. **Ability to receive and process the termination request:** •GPR® staff (in the GPR® office) can manage the service termination; •Conveying the billing charge for the termination process among the IT operation staff (IoT expert), and Network operation staff (IoT expert) to support the customer/service termination; •The customer/service termination activity may increase network capacity.
W, World View.	Manage termination request, with the existing resources and constraints.
O, System Owners	The related directorate of the TSP company.
E,Environ-ment and its limitations **(constraints)**	Measurement of customer satisfaction, cycle time between request termination and switch-off/removal, termination period, time taken to handle requests, ability to provide seamless service, ability to analyze customer reasons for requesting termination, ability to turn customer termination requests into opportunities/cancellations.

and improves quality from the start and uses the MoSCoW priorities, which were developed by Dai Clegg (Clegg and Barker, 1994). MoSCoW prioritization consists of (M)ust Have, (S)hould have, (C)ould Have, and (W)on't Have to adjust the project deliverables to satisfy the time constraint (Agile Business Consortium, 2019).

In the DSDM agile methodology, the prototype technique is widely used. This technique is adopted to ensure effective communication between stakeholders, whether from different parts of the business, different organizations, or different cultures (Cadle et al., 2014). The DSDM has eight principles (Table 1) that define the mindset and behavior required for a successful project team (Girvan and Paul, 2017; Moran, 2015).

2.3. Telecommunication business process

A comprehensive telecommunication operational mapping framework that is globally employed is the enhanced telecom operations map (eTOM) (ITU, 2007; TMForum-Transformation, 2019). Cross-industry

Table 9. CATWOE analysis for P2S.

CATWOE	"Problem to Solution"
C, Customers	•City council, concession representative: waste management representative, water supply representative, etc.; •The IOC department monitors TSP network services.
A, Actors	GPR®, virtual assistance (VRN®), IT Operation Staff (IoT expert), network operation staff (IoT expert), T-Apps, IOC staff.
T, Trans-formation Process **(Proposed)***	**Industrial communication channel based on IoT:** •TSP provides the CRN®, GPR®, and VRN® interface for smart city; •CRN® agent, GPR® staff, and VRN® can distinguish the problem and complaint report; •Customer call agent behind the CRN® (24 × 7 on-call support) can manage the problem report from a smart city; •The GPR® staff (in the GPR® office) can manage the problem report from a smart city. **Mobile apps T-Apps show the problem status:** •Ability to observe the dashboard: problem report and resolve handling progress status **Ability to manage the customer problem report:** •Based on unique customer ID, high-level problem description logging, problem contact representative; •The report problem is based on the customer ID that distinguishes existing customers; •TSP has the internal technical operations team to carry out problem resolution and problem reporting; •Trouble ticket (TT) problem management for cross industries is operated via CRM. **Ability to manage the SLA:** •IOC has the commercial/production service monitoring dashboard for IoT-based customers; •Monitor and escalate problems to avoid penalties; •Dedicated PIC from IoT as a single point of contact (SPOC) for communication with the smart city representative and internal operation team. **Ability to manage the IOC report problem:** •Connected network of smart city is realtime monitored by the network monitoring service platform; •IOC staff can raise an internal TT; •The internal operation team follows up on problem resolution as well as report, until closes the TT; •Initiate reporting the problems currently occurring in the network to the smart city team.
W, World View.	Manage customers from the industry, with the existing resources and constraints.
O, System Owners	The related directorate of the TSP company.
E, Environ-ment and its limitations **(constraints)**	Readiness of contact center office and channel lines, quick response time after trouble/incident, quick time to solution/conclusion, readiness ratio of level resolution (level 1 to 4), how to measure the customer satisfaction, how to manage the customer relationship, utilize the relevant information for continuous improvement, problem persistent elimination.

Table 10. CATWOE analysis for C2S.

CATWOE	"Complaint to Solution"
C, Customers	City Council
A, Actors	CRN® agent, GPR® staff, Smart City Citizen.
T, Trans-formation Process **(Proposed)***	**Industrial communication channel based on IoT:** •TSP provides the CRN® and GPR® interface. •CRN® agent and GPR® staff can diffesrentiate the incoming report of problem and complaint. **Ability to manage the customer report complaint:** •Smart city complaints based on customer ID, that distinguish existing customers; •The marketing or solution team: maintain on problem resolution, problem report, decision to provide a discount, even escalate the complaint; •A PIC being available to communicate with smart city representatives. **TSP ability to manage customer satisfaction:** •Dedication marketing PIC, as a SPOC, to communicate with smart city representative. **Managing the complaint report through social media:** •The citizen can report the complaint through the TSP's official social media channel.
W, World View.	Manage customers from the industry, with the existing resources and constraints.
O, System Owners	Marketing directorate of the TSP company.
E, Environ-ment and its limitations **(constraints)**	Readiness of contact center office and channel lines, quick response to complains, quick solution/conclusion, the ratio of level resolution availability (level 1 through 4), how to measure customer satisfaction, how to manage customer relationship, utilize the relevant information for continuous improvement, persistent complaint elimination.

collaboration would involve industries that utilize IoT as new (non-human) customers for telecommunication enterprises. This study utilizes eTOM as a telecommunication framework on the customer-centric domain of business process development and implementation.

The development of an EA for cross-industry collaboration is supported by the ArchiMate 3.0 language. EA enables qualitative architectural analysis of business processes for a more efficient eTOM, which is the basis for optimizing business operations (Šaša and Krisper, 2011). The ArchiMate model language offers advantages, the integration concepts of technological behavior, which can be used to describe the behavior of the interconnected sensors and devices that constitute the IoT ecosystem (Josey et al., 2016), as shown in Figure 3.

Business processes are related to holistic systemic activities among the human business activities, applications, and technology used in a

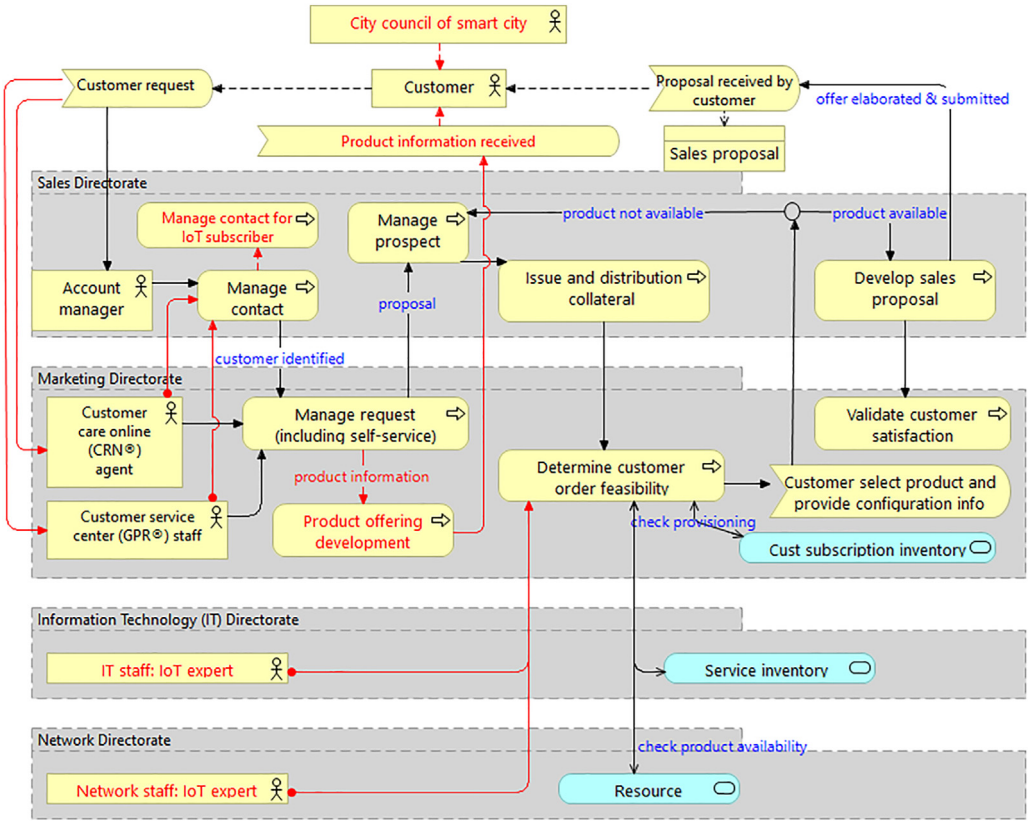


Figure 10. Business process of "request to answer."

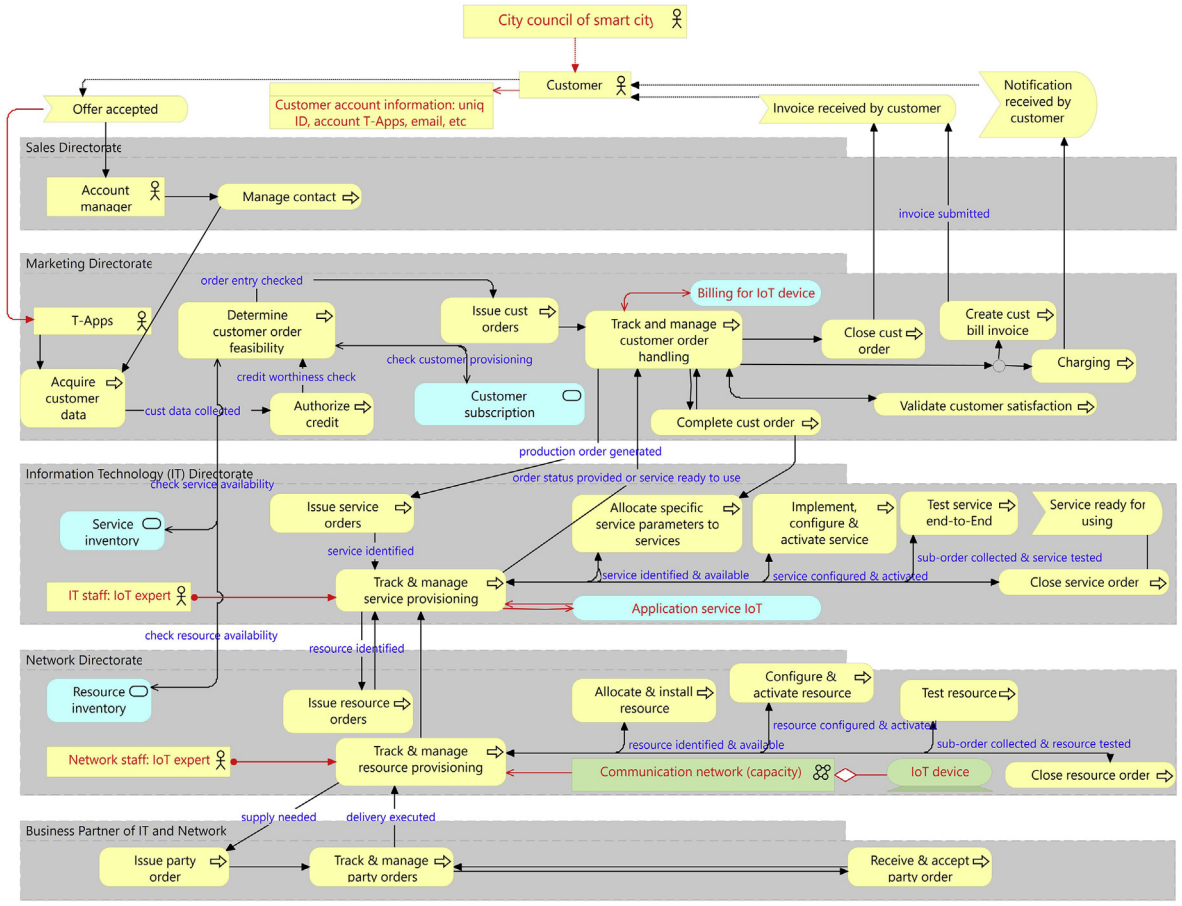


Figure 11. Business process of "order to payment."

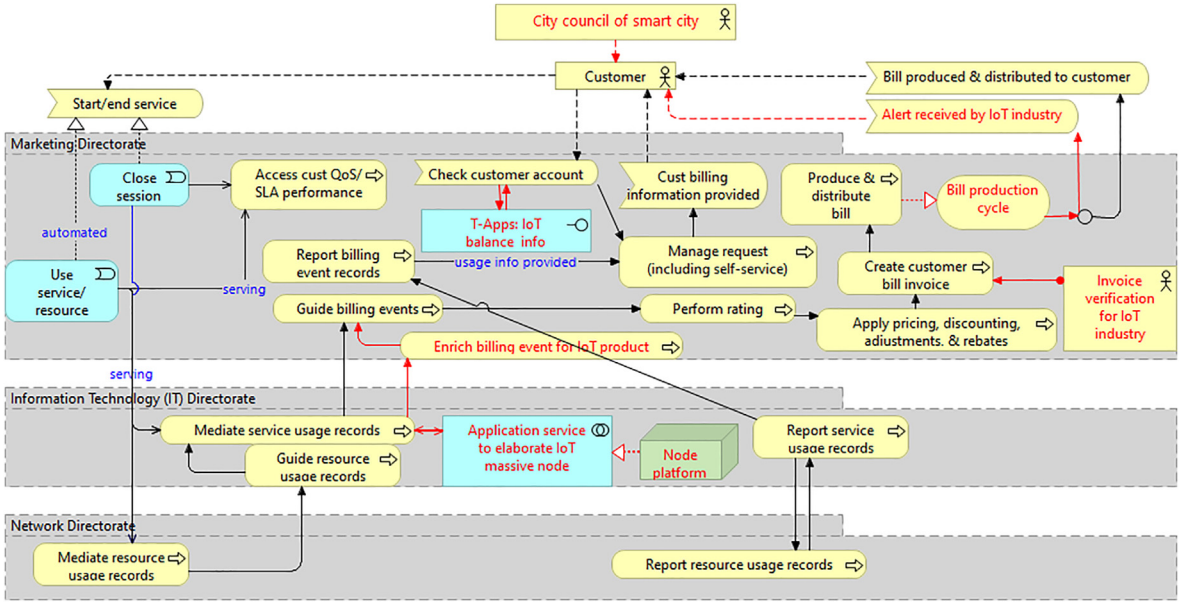


Figure 12. Business process of "usage to payment."

TSP. The potential solutions for transforming the business process require a qualitative approach that is modeled using the EKD method. EKD is an enterprise modeling approach that supports creativity and quality in information systems and business development (Stirna and Persson, 2018). In this study, EKD was used for modeling in an ArchiMate EA model.

3. Methodology

This study focused on cross-industry collaboration using a corporate strategy based on APM that involved changing current business processes in a company. Business processes are related to holistic systemic activities among human business activities, applications, and technology in a

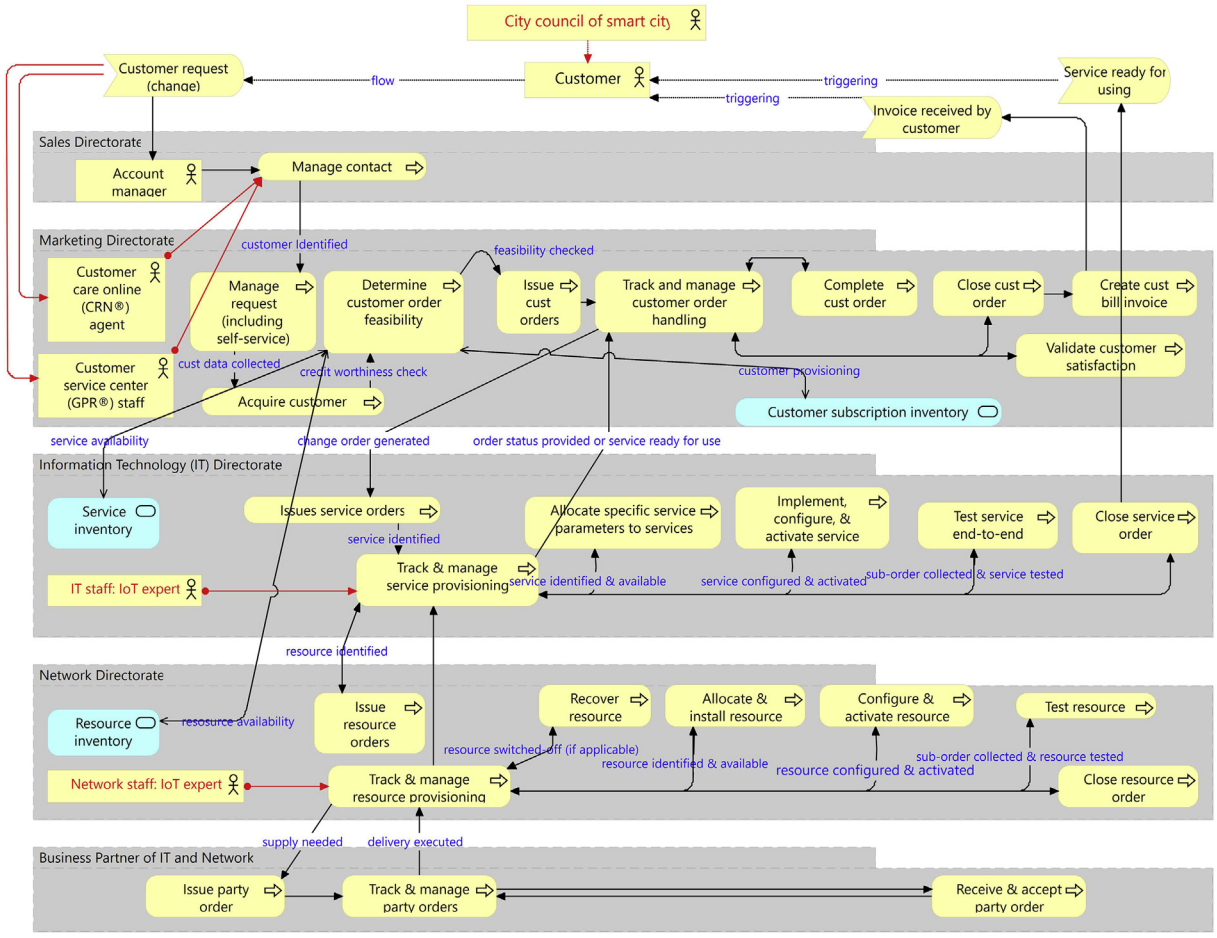


Figure 13. Business process of "request to change."

TSP. This research is qualitative and considers social constructivism knowledge. The basic principle of constructivism is that reality is socially, culturally, and historically constructed (Bloomberg and Volpe, 2018). Researchers understand social phenomena from a specific context perspective by using business process best practices of telecommunication company eTOM as value-bound, so that the investigation process is maintained in the context of telecommunications organization.

The potential solutions for business process transformation require a qualitative approach supported by a combination of APM and EKD methods. The APM method used herein is based on the DSDM for telecommunications business practices supported by eTOM. DSDM is used to identify the existing practices in the company and to develop solutions based on models, methods, and instantiation (solution prototypes).

The development of the proposed methodology requires the dynamic systems development method (DSDM). An agile project management methodology consists of several stages, including pre-project, feasibility, business study, functional model, design and build, and implement. Methods that support research, are embedded in the stages within the DSDM framework, in order to answer the needs and challenges of each stage. The methodology is intended to serve as a generally accepted framework based on the principles of DSDM research, rather than to focus on the nuances of researchers' views of DSDM; to this end, a consensus-building approach is employed to produce a methodological design. Building consensus is important to ensure that researchers base DSDM on well-accepted elements.

Experts involved in business processes in the telecommunication industry were consulted for this study. The primary data were obtained through in-depth interviews with experts from TSP companies following the FGD scheme. The FGD obtained the strategy diagnosis detail, by discussing the research instrument to capture the current business process practice in the company. To ensure data reliability and establish the level of confidence, the data were sourced from employees qualified as experts based on their position, role, experience, and knowledge. The experts were senior-level TSP employees with more than five years of experience in jobs in the strategic enterprise domain. In accordance with the Non-Disclosure Agreement provided by the TSP, this report does not mention the name of any company or expert who was involved in the FGD. Thus, the TSP considered in this study is designated as "T."

Data retrieval through the FGD method produces voice recordings that contain raw discussion information or verbatim information. For the purposes of analyzing the FGD content using thematic analysis methods (Braun and Clarke, 2013), then the FGD verbatim needs to be transcribed using the orthographic method. The main purpose of performing orthographic transcription is to obtain the entire recorded words spoken. Includes non-semantic sounds, indecision, repetition, error voice, pauses, laughter, etc.

Thematic analysis is a method for analyzing focus group discussion (FGD) content, in which researchers systematically code and develop themes. The coding method used is Data-derived codes and researcher-derived codes. This method generates a summary code from the FGD transcript content. This method produces latent code by analyzing semantic meaning, through the concepts (theoretical frameworks and knowledge) brought by the researcher to identify implicit codes in the data. When a certain concept, topic, or problem is found, it will help to be used as a central organizing concept for a theme (Braun and Clarke, 2013).

The smart city use cases are sourced from SmartSantander a leading smart city project in northern Spain. It has broad urban applicability and represents a exhaustive documentation reference as a smart city pilot

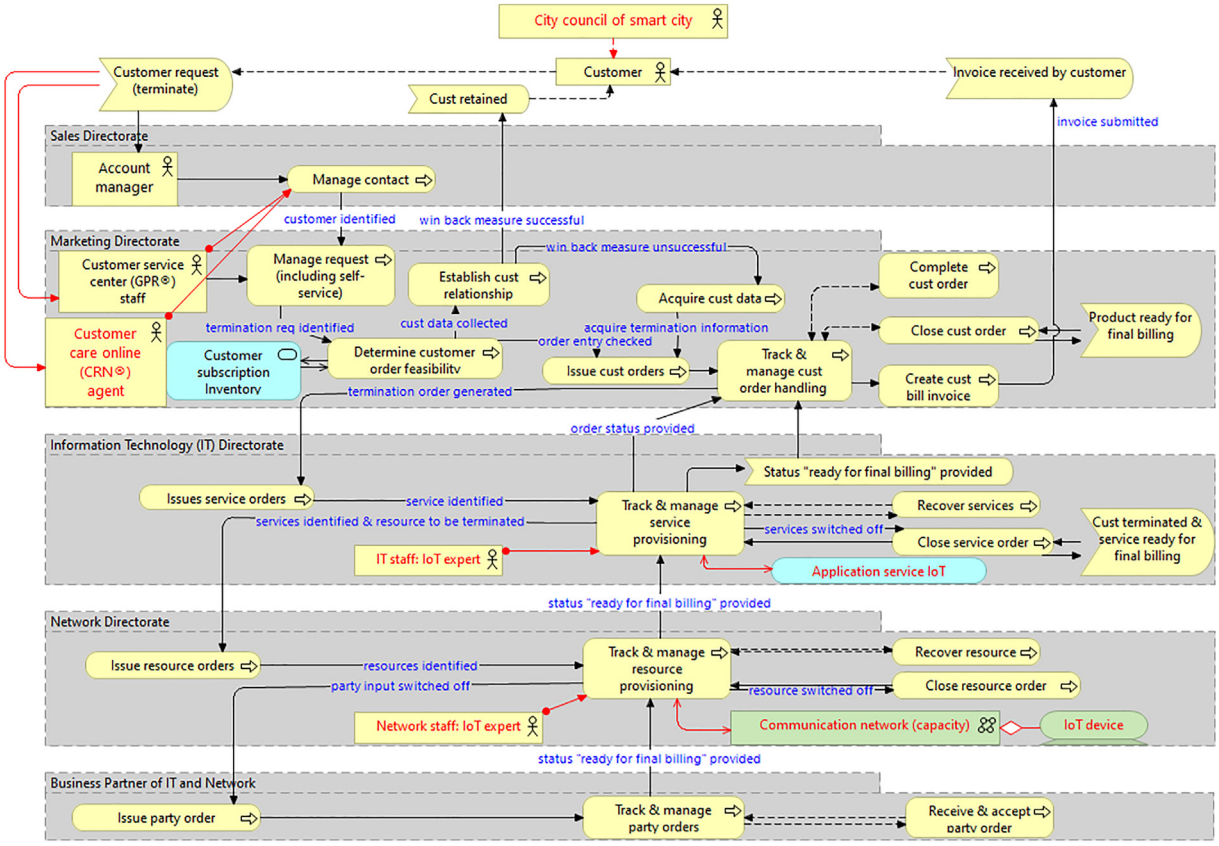


Figure 14. Business process of "terminate to confirm."

project throughout the world, particularly in Europe (Galache et al., 2013; Hernández-Muñoz et al., 2011).

CATWOE is a method or analysis technique to expand thinking about a particular problem or situation to be solved, by understanding it from a stakeholder perspective and its impact as a result of business changes that will occur (Cadle et al., 2014). The research proposes CATWOE to be used as a permeable wall to understand the relationships among IoT-based industries (smart city use cases) from the seven TSP business processes (Figure 4). By using the CATWOE tool, the codes of each business process theme are analyzed as the central concept of the problem that has been obtained from the FGD data in phase 2.

4. Results and discussion

4.1. Overview of the proposed transformation method

Design research is managed using a combination of the DSDM and APM lifecycle, as described in Figure 5. The combined DSDM model was proposed by researchers for TSP companies to perform business process transformation projects to enable collaboration with IoT-based industries as new (non-human) customers. DSDM is managed based on its principles, and the cycle involves collaboration with various methods, including CATWOE (customer, actor, transformation, world view, systems owner, environment), eTOM, focus group discussion (FGD), and EKD, for business process transformation projects in TSP companies.

The execution of business process changes in a company requires detailed partitioning of the entire planned transformation program. Before the execution of the lifecycle, it must be ensured that the eight DSDM principles are adhered to. The transformation begins with a pre-project and ends with a post-project. The pre-project phase refers to inculcating business values that are in line with the business objectives. The pre-project involves identifying the background requirements for changing business processes in a TSP, preparing the project for the customer domain, and clearly defining goals for managing IoT-based industry customers. The challenge or problem in this phase is how the top management of the TSP company actively responds to the turbulence that is being experienced, understands the opportunity to remain competitive through cross-industry collaboration (with IoT-based companies), and explore the business requirements as a basis for achieving these opportunities.

The post-project involves assesses whether the benefits of the new business process are in accordance with the business expectations. Because the implementation of the proposed framework and its results could not be confirmed in the study, discussion of the post-project phase is beyond the scope of the study.

Phase 1 involves assessing the feasibility, background, opportunities, and business needs before undertaking a business process transformation project. This phase includes determining whether a business process change project is feasible from a technical perspective and is cost-effective from a business perspective. This study does not discuss technical and business calculations in project feasibility, because they are highly dependent on the company finances, which is beyond the scope of this study. The challenge at this stage is how to define "business requirements in detail" through the scope of work (SoW), mapping employees who resist change, and mobilizing support for change. The difficulty at this stage is how to communicate properly between different roles in complex organizations. This communication problem is managed through interview, discussion and meeting methods.

In phase 2 understands and approaches the problems that exist in telecommunications enterprise systems, defines the domain of customer-centric business processes in operational activities. The challenge at this stage is to find the project rationale for business processes in telecommunications companies. Ansoff's strategy of change was applied as an exploratory method with reference to guidelines (Ansoff et al., 2019) for change management strategies in a company. In addition, an FGD session is conducted to solve problems and analyze TSP companies with respect

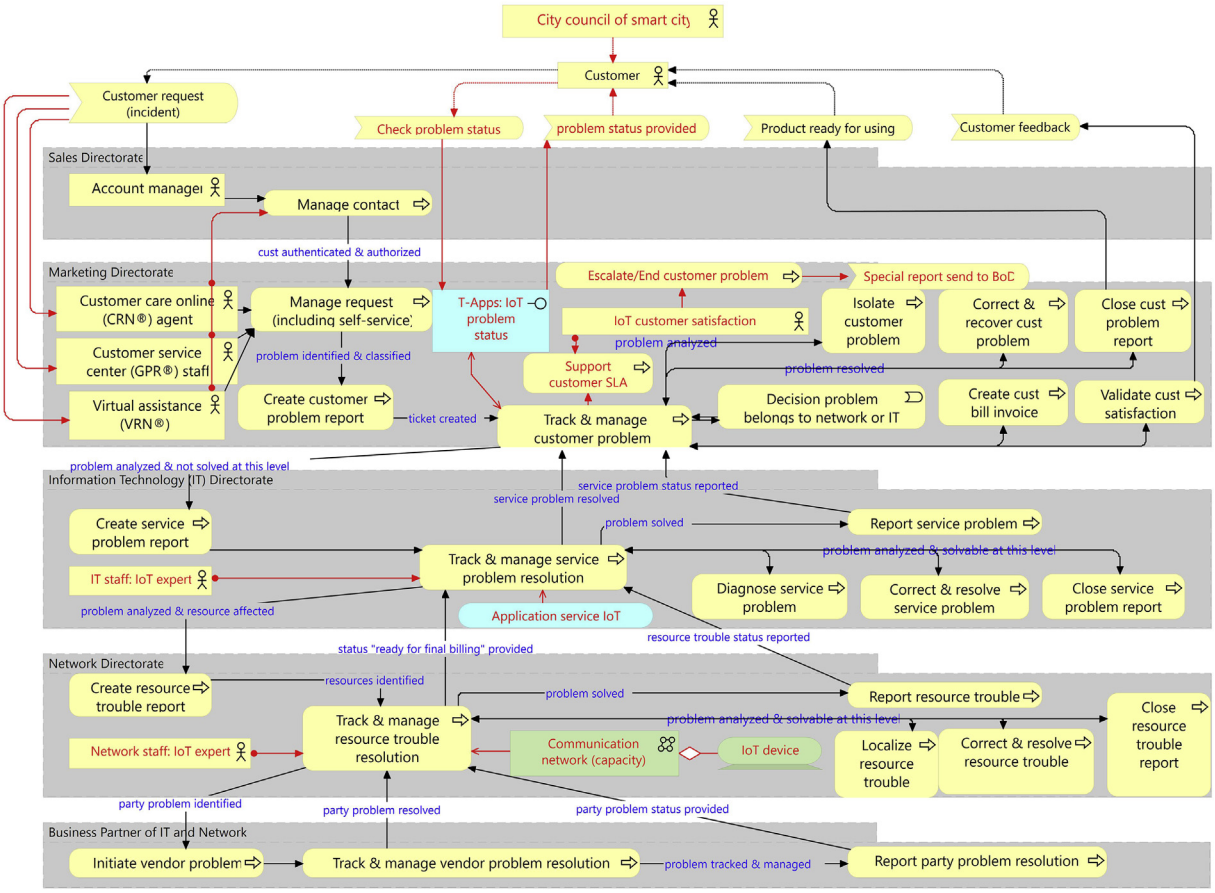


Figure 15. Business process of "problem to solution."

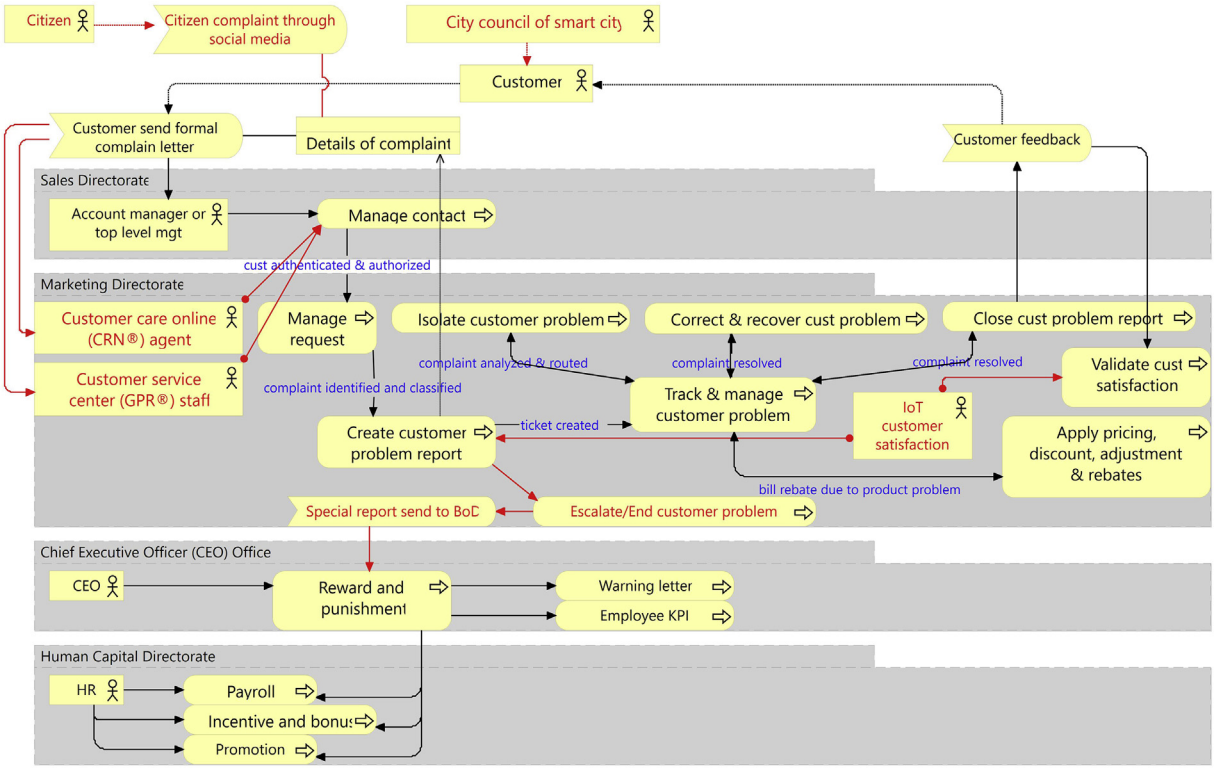


Figure 16. Business process of "complaint to solution."

Table 11. Overview of the EKD method sub-model.

EKD	Goals model	Business rules model	Actors and resource model	Business process model	Technical components and requirement	Prototype model
Focus	TSP vision and strategy, from viewpoint of business requirement	Modeling policy and rules.	Enterprise organization structure	TSP business operations	The needs of ArchiMate EA systems.	Business ontology
Issue	What is the organization attempting to achieve or avoid and why?	What are the business rules? How do they support TSP goals?	Who/what is responsible for goals and process?	What are the business (sub) processes? How is information processed therein?	What are the EA business requirements? How do they interact?	What are the phenomena addressed in the sub-models?
Compo-nents	CATWOE.	Business rule.	How do actors interrelate across organizational directorates?	eTOM ABE through activity decom-position levels 2, 3, and 4	EA elements of business, application, technology, grouping.	ArchiMate relation: flow, triggering, assignment, serving, realization.

to changes in business processes (customer domains) for collaboration with the IoT-based industry.

In phase 3 of the functional model, the project team was iteratively developed considering high-level requirements, to demonstrate functionality of new business process collaboration. Customers, actors, transformations, world views, owners, environmental constraints (CATWOE), and aggregate business entity (ABE) were defined based on the flow of eTOM best practices to determine the eTOM business processes to be used in the customer-centric domain. CATWOE is an analytical tool to expand thinking about a particular problem or situation to be solved, by understanding it from a stakeholder perspective and the impact that will arise as a result of business changes that may occur. CATWOE is an important tool for researchers, especially when first thinking about a problem, or when trying to come up with a solution.

Phase 4 involves design and iterative development to create a business process prototype. This is a research challenge on how to design a strategic model with appropriate enterprise modeling techniques in the form of EA, where EA supports the company in representing organizational capabilities and enables the company to achieve its goals. The study uses enterprise modeling guidelines, the EKD method for generating EA model using ArchiMate notations. In phase 4, a second FGD session is conducted to design business processes by means of confirmation, redesigning, and capturing real problems in the TSP. EKD is a method for modeling a business or enterprise concept that helps companies gain creativity and quality in information systems and business development. The EKD defines its modeling process as a set of design guidelines for expressing the company's model, based on participatory variables (six specific organizational aspects) and the specific language notation rules used in modeling.

Phase 5 involves implementing and analyzing the EA prototype as a baseline for operations in the company. The challenge at this stage is how to analyze the EA strategy model that has been obtained, into the actual implementation or execution stages in the company. DSDM-based agile project management uses project implementation tools, through scheduling and priority. In this phase, timeboxing and priority development with MoSCoW are implemented, the process is modeled in more detail from a technical perspective, and workshops are conducted for convergence of accurate solutions to suit the business needs.

4.2. Pre-project

Every project starts with a business need that forms the background of a collaboration strategy between TSPs and the IoT-based industry. In this case, a smart city is an IoT-based industry. A business requires a concrete operational transformation strategy to develop capabilities in telecommunications activities that consider IoT companies as new non-human customers. Expectations in terms of business profits include several new customers registering their companies using IoT in TSPs. This raises all the related business process transformation in the company, by proposing a project management approach.

4.2.1. Project background

The project background is generally based on the company's financial statements in the annual report, which have a relatively flat value on income, in addition the use of basic services such as SMS and voice are relatively flat. On the other hand, the use of mobile telecommunications equipment in using telecommunications infrastructure is widespread.

The aforementioned problem is discussed in the shareholders' meeting or as part of the company's strategic. The current customer model indicates the same situation, highlighting the need for innovations in the customer-centric domain. Possible innovations include using the IoT device as a new telecommunications customer. However, this requires planning based on the ongoing business processes.

Business process transformation, particularly designing and implementing an appropriate and comprehensive strategy, is discussed by multiple top business management companies. The transformation must

Table 12. Business element EA.

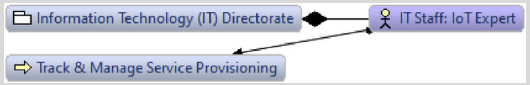
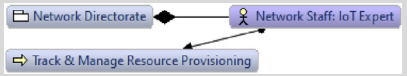
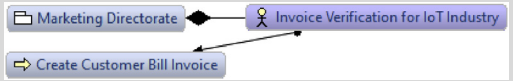
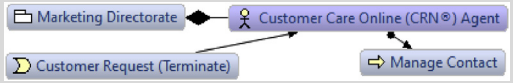
Business Actor	
A.1	Name: Business Actor: City Council of Smart City  •Remark: This city council is a representation of the new smart city customer. City councils are actors who appear in all business processes and lead the smart city. •Business Processes: R2A, O2P, U2P, R2C, T2C, P2S, C2S.
A.2	Name: Business Actor: IT Staff: IoT expert  •Remark: This transformation involves allocation of new human resources at the IT directorate, where IT staff fulfill the role of IoT product experts. These staff members are the subject matter experts (SMEs) who support the feasibility study of the needs of new customers, and assist in analyzing the technical capabilities and prospects of IT to support these services. •Business Process: R2A. •Impact: Employment/Human Resources.
A.3	Name: Business Actor: Network Staff: IoT expert  •Remark: This transformation involves allocation of new human resources at the network directorate, where network staff fulfill the role of IoT product experts. These staff members are the SMEs who support the feasibility study of the needs of new customers, and assist in analyzing the capabilities and technical prospects of the telecommunications infrastructure network to support these services. •Business Process: R2A. •Impact: Employment/Human Resource.
A.4	Name: Business Actor: IT Staff: IoT Expert  •Remark: This transformation involves allocation of new human resources at the IT directorate, where network staff fulfill the role of IoT product experts. These staff members are the SMEs who support tracking and management of the IT domain regarding the provision of customer activation or customer change/termination (SIM cards) and mass activation of IoT service packages. •Business Processes: O2P, R2C, T2C. •Impact: Employment/Human Resources.
A.5	Name: Business Actor: Network Staff: IoT Expert  •Remark: This transformation involves allocation of new human resources at the network directorate, where network staff fulfill the role of IoT product experts. These staff members are the SMEs who support tracking and management of the infrastructure network regarding the provision of customer activation or customer change/termination (SIM cards) and mass activation of IoT service packages. Such experts also manage network infrastructures related to IoT capacity. •Business Processes: O2P, R2C, T2C. •Impact: Employment/Human Resources.
A.6	Name: Business Actor: Invoice verification for IoT industry  •Remark: This transformation involves allocation of new human resources in the marketing directorate, involving the role of verifying new customer (smart city) invoices before they are sent to the customers. •Business Process: U2P. •Impact: Employment/Human Resources.
A.7	Name: Business Actor: CRN® agent  •Remark: Previous CRN® agent actors did not have a role in terminating specific customers or services from new customers (smart city). This transformation allows for such a process to be performed through CRN® media, whereby customer needs are addressed by agents online 24 × 7.

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Table 12 (*continued*)

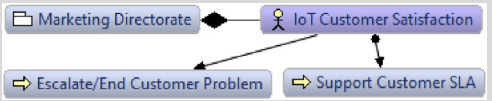
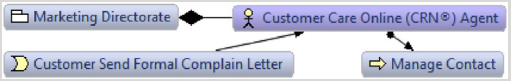
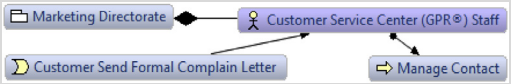
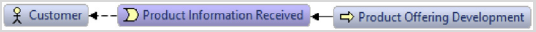
	•Business Process: T2C. •Impact: Additional job description.
A.8	Name: Business Actor: IoT Customer Satisfaction  •Remark: This transformation involves allocation of new human resources in the marketing directorate, "IoT Customer Satisfaction," involving the role of support customer SLA (a role which is always maintained so that companies do not undergo any penalties), as part of which certain escalations are initiated to end customer problems (smart city). •Business Process: P2S, C2S. •Impact: Employment/Human Resources.
A.9	Name: Business Actor: IT Staff: IoT Expert  •Remark: This transformation involves allocation of new human resources at the IT directorate, where IT staff fulfill the role of IoT product experts. These staff members are the SMEs who manage to solve IoT problems. •Business Process: P2S. •Impact: Employment/Human Resources.
A.10	Name: Business Actor: Network Staff: IoT Expert  •Remark: This transformation involves allocation of new human resources at the network directorate, where network staff fulfill the role of IoT product experts. These staff members are the SMEs who manage to solve IoT problems. •Business Process: P2S. •Impact: Employment/Human Resources.
A.11	Name: Business Actor: CRN® agent  •Remark: Previous CRN® agent actors did not have a role in addressing customer complaints (smart city). This transformation allows for such a process to be performed through the CRN® media, whereby customer complaints and needs are addressed by agents online 24 × 7. •Business Process: C2S. •Impact: Additional job description.
A.12	Name: Business Actor: GPR® staff  •Previous GPR® staff actors did not have a role in addressing customer complaints (smart city). This transformation allows for this process to be performed through the media of GPR® via direct visitation of GPR® offices at specific locations. •Business Process: C2S. •Impact: Additional job description.
Business Event	
A.13	Name: Business Event: Product information received  •Remark: This transformation allows new customer candidates (smart cities) to receive information regarding the product catalog of IoT device connectivity services or receive information (high-level) regarding the general feasibility of a TSP company in terms of addressing the service needs. Information provided here is expected to continue to assist customer requests for proposals or confirmations of service purchases until an agreement is reached. •Business Process: R2A. •Impact: Catalog, proposal draft, or installation manual.
A.14	Name: Business Event: Alert Received by IoT Industry

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Table 12 (*continued*)

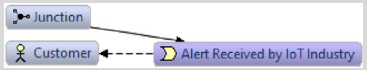
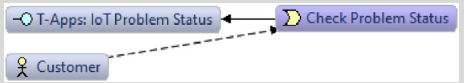
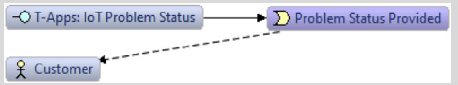
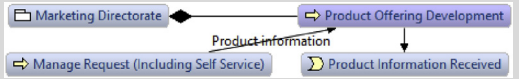
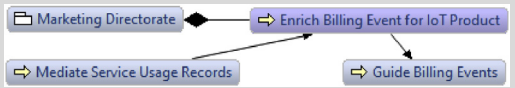
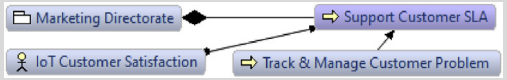
	 •Remark: This transformation allows new customers (smart city) to receive an early notification: an alert is sent because of a late payment or prior to a specific termination according to the current lifecycle status. There exists a particular lifecycle definition that applies to IoT products, as well as the impact of the "Bill Production Cycle" business service. •Business Process: U2P. •Impact: Notifications through certain media.
A.15	Name: Business Event: Verify problem status  •Remark: This transformation allows new customers (smart cities) to be able to verify the status of the problems they have reported. •Business Process: P2S. •Impact: T-Apps application changes, status problem notifications.
A.16	Name: Business Event: Problem status provided  •Remark: This transformation allows new customers (smart cities) to be able to receive a status update regarding problems they have reported. •Business Process: P2S. •mpact: T-Apps application changes, status problem notifications.
Business Process	
A.17	Name: Business Process: Manage Contact for IoT Subscriber  •Remark: This transformation provides a new contact management scheme for IoT-based corporate customers. Usage of a unique customer ID is recommended here (possibly in the new MSISDN prefix format), which differentiates smart city customers from others (human customers). •Business Process: R2A. •Impact: CRM application changes.
A.18	Name: Business Process: Product Offering Development  •Remark: This transformation involves a new business process wherein general customer solution requests are processed in a short time post communication between the customer and the CRN® agent or GPR® staff. Service offerings can include catalogs, draft proposals, or installation manuals based on project practices and previous project experiences. •Business Process: R2A. •Impact: Catalog documents, draft proposals, or installation manuals.
A.19	Name: Business Process: Enrich Billing Event for IoT Product  •Remark: This transformation enables processing of the billing of new IoT (smart city) service usage data in the marketing directorate. •Business Process: U2P. •Impact: Changes to CRM and billing applications.
A.20	Name: Business Process: Support customer SLA  •Remark: This transformation involves specific processes that support customer SLAs. This is important because SLAs are a part of the guarantee provided by the company's business wing (smart city) such that the company can continue to perform its business operations with IoT, through Ensure Customer SLA Capability, Proactive Performance Monitoring, and Monitor and Report on SLA capability. •Business Process: P2S. •Impact: Employment/Human Resources.

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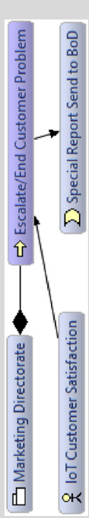
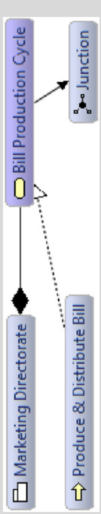
Table 12 (*continued*)

A.21	Name: Business Process: Escalate/End Customer Problem  •Remark: This transformation allows marketing employees of the "IoT Customer Satisfaction" role to escalate problems or customer complaints (smart city) to initiate high-level resolution by sending a special report to the BoD. •Business Processes: P2S, C2S. •Impact: Special reports on customer problems (smart city).
Business Service	
A.22	Name: Business Service: Bill Production Cycle  •Remark: This transformation defines a new lifecycle for a smart city customer. If a customer enters a period of transition from active to grace, certain notifications should be sent. •Business Process: U2P. •Impact: Billing application changes and definition of lifecycle.

be considered as a real project to ensure that the new business processes can be implemented with minimal costs and changes. Ultimately, the transformation can significantly increase company's earnings and improve subsequent annual reports (financial statement).

4.2.2. Opportunity

The widespread use of IoT devices in the current industry ecosystem is crucial for successful transformation projects involving the utilization of IoT opportunities. For example, cloud technology, application/content hosting, data storage platforms, partner information systems, and operational aids require reliable internet access and broad coverage to reach the end user on the operator's network. Telecommunication operators can charge users for using data pipelines and special operations that guarantee the internet connectivity of the IoT-based industry; thus, operators can enable access to the IoT network for several IoT-based companies.

Operators can charge certain premium rates because they are the only ones to provide a certain service (internet distribution in a wide coverage as a unique capability of the operator). This will represent a fundamental change in the functioning of the new telecommunications market in the future. In addition, this change can contribute to making companies Industry 4.0-capable, enabling them to provide profitable, high-quality service through collaboration with telecommunications operators.

4.2.3. Business requirement

The company's needs are the foundation for the emergence of new business values, which is the reason for projects being delivered. The business process transformation project realization is through making the right prototype design of the company. Then, based on the enterprise architecture design, the business process transformation can be carried out on each of company organization's elements appropriately. Through top management commitment, the TSP company must direct the focus toward the new objectives and strategies. This is essential for smooth transformation and successful development and implementation of architectural solutions. In general, the business requirements are as follows:

- Increase the number of customers that can be reached by telecommunications operators via the participation of non-human customers in the form of equipment/machinery, including certain IoT ecosystem units from IoT companies.
- Create a new source strategy and income scheme for telecommunications operators.
- Redefine the EA model of the TSP such that it can be a major player in the Industry 4.0, particularly in the public service sector.

Adequate communication is a critical factor for the success of a transformation project, particularly in cross-matrix organizations in TSPs. Creating and implementing a strategy requires a set of resources that can ensure that every stage is managed.

4.3. Phase 1: feasibility

4.3.1. Strategic diagnosis

By exploring the business needs of projects with high scope levels more explicitly, a project with a low scope level is created. In addition, comprehensive documentation, packaged as the scope of work (SoW), elaborates on the scope of the project to serve as a reference for the project to be systematically executed by the project team from start to finish. The SoW acts as a guide and boundary determined by key project think tanks such as project managers, business analysts, and solution architects.

The SoW contains the goal of corporate architecture strategies that will be designed from a practical perspective; it is necessary to define a new business process and then apply the strategic framework within the company. In this phase, the appropriate project management processes,

Table 13. Application element EA.

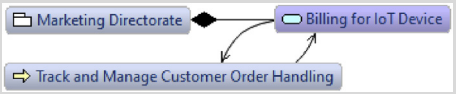
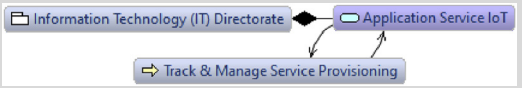
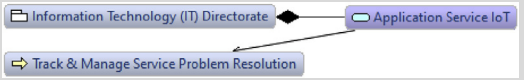
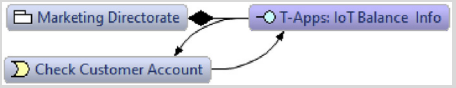
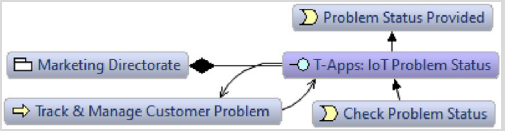
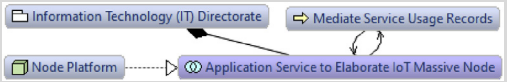
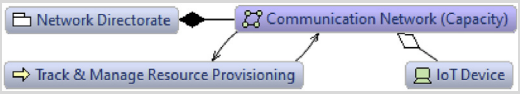
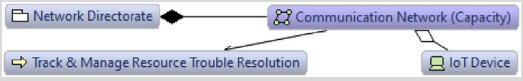
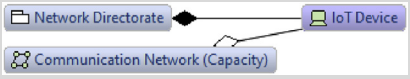
Application Service	
B.1	Name: Application Service: Billing for IoT Device  •Remark: This transformation allows for changes in the TSP's enterprise billing application to manage requests for new IoT customer types. •Business Process: O2P. •Impact: Changes to CRM and billing applications.
B.2	Name: Application Service: Application Service IoT  •Remark: This transformation allows for changes in the TSP corporate billing application to manage the provisioning of service activations/terminations for new IoT customer types within the IT infrastructure. It involves the business support system (BSS) application. •Business Processes: O2P, T2C. •Impact: Changes to CRM and billing applications.
B.3	Name: Application Service: Application Service IoT  •Remark: This transformation allows for changes in the TSP's corporate billing application to manage IoT customer problem-solving within the IT infrastructure. It involves the BSS application. •Business Process: P2S. •Impact: Changes to CRM and billing applications.
Application Interface	
B.4	Name: Application Interface: T-Apps: IoT Balance info  •Remark: This transformation allows new customers (smart city) to obtain balanced information on service usage in real time. •Business Process: U2P. •Impact: T-Apps application changes.
B.5	Name: Application Interface: T-Apps: IoT Problem Status  •Remark: This transformation allows new customers (smart cities) to be able to monitor the actual status of resolution of problems reported by then, ensuring that the TSP's efforts to resolve them are reasonable. •Business Process: P2S. •Impact: T-Apps application changes.
Application Collaboration	
B.6	Name: Application Collaboration: Application Service to elaborate IoT massive node  •Remark: This transformation allows for changes in the TSP corporate billing application to mediate service usage data records for each new customer (smart city). The service usage data are obtained from the node platform that accommodates all IoT devices. It involves the BSS application. •Business Process: U2P. •Impact: Changes to CRM and billing applications.

Table 14. Technology element EA.

Technology Comm Network	
C.1	Name: Technology Communication Network  •Remark: This transformation allows for changes in the TSP corporate network to manage the provisioning of service activation/termination for new IoT customer types in the network infrastructure. It involves the operations support system (OSS) application. •Business Processes: O2P, T2C. •Impact: Provision of supporting IoT infrastructure or changing the current network configuration.
C.2	Name: Technology Communication Network  •Remark: This transformation allows for changes in the TSP corporate network to manage problem-solving for IoT customers in the network infrastructure. It involves the OSS application. •Business Process: P2S. •Impact: Provision of supporting IoT infrastructure or changing the current network configuration.
Technology Device	
C.3	Name: Technology Device: IoT Device  •Remark: Through this transformation, IoT devices can be managed in the TSP corporate network. •Business Processes: O2P, T2C, P2S. •Impact: Network capability.
Technology Node Platform	
C.4	Name: Node Platform  •Remark: In this transformation, a large number of IoT devices can be managed through a platform further described under IT applications. It involves the BSS application. •Business Process: U2P. •Impact: Changes to CRM and billing applications.

inputs, tools, techniques, outputs, and lifecycle phases should be selected prior to managing a project.

4.3.2. Preparing the political/cultural resistance map

By means of preparation of a political/cultural resistance map, the feasibility should be ensured to account for the political/cultural environment being a supportive climate for implementing the change. In this regard, the following steps should be taken.

- Eliminate misperceptions and exaggerations by explaining the company's needs/opportunities and the beneficial consequences of changes to company performance. Groups/individuals who are expected to resist need special attention, but the entire organization should nonetheless be informed.
- Eliminate or reduce fear and anxiety by explaining the relevant aspects to groups/individuals who are positively or negatively affected by the change/transformation.
- Use the political information from the map to build a pro-change force base, as follows:
  a. As far as possible and within the time available, apply changes to the power structure, which will increase the strength of the change;
  b. Form a coalition of individuals who will benefit from the change. In particular, seek to enlist potential supporters who are 'lukewarm';
  c. Offer a reward for support of the change;
  d. Neutralize key incidences of potential resistance through side bargains and incentives.

All departments in each directorate that use the customer-centric media should be mapped accordingly to prepare the political/cultural resistance map, as shown in Figure 6. The goal is for this mapping to obtain information and reassure individuals/groups regarding the project during implementation.

4.3.3. Mobilize political support for change

Mobilize political support according to the initiative under Ansoff's strategic management system. In the feasibility phase, it is important to build a project launching platform that draws political support. The platform is meant to showcase a new telecommunication branding style oriented toward collaboration with the IoT-based industry. The new branding of the company can be executed in several ways, such as by changing the company motto to accommodate the overall strategy of the new business area—for example, "connecting everything," "digital provider for all," "internet for everything," or something as simple as "IoT cellular provider."

4.3.4. Identify and mobilize relevant talent

The top management in charge of the transformation should be presented as the project steering committee within the project organization, which is the sponsor that initiates the project's strategic and political driving forces. The project steering committee needs to appoint a project executive headed by a project manager, who is under the coordination line of the steering committee. The project manager is an internal employee of the company who has been properly selected.

A project manager is generally a member of the planning and transformation directorate or an external business process consultant

Table 15. Connection element EA.

Triggering Relation	
D.1	Customer Request → Customer Care Online (CRN®) Agent •Remark: CRN® is an available medium of communication with customers. This transformation allows new customers (city councils) to perform request/inquiry activities through CRN® media that serve their needs, which are addressed by agents online 24 × 7. •Business Process: R2A. •Impact: additional job description.
D.2	Customer Request → Customer Service Center (GPR®) Staff •Remark: GPR® is an available medium of communication with customers. This transformation allows new customers (city councils) to perform request/inquiry activities through the GPR® media by visiting GPR® offices at specific locations. •Business Process: R2A. •Impact: additional job description.
D.3	Offer Accepted → T-Apps •Remark: T-Apps is an available medium of communication with customers. This transformation in the O2P business process allows new customers (city councils) to perform order activities or activate certain services through the T-Apps mobile media by downloading the application from Google Play® and inputting their account information. •Business Process: O2P. •Impact: changes to the T-Apps application, adding pages for smart city customer users.
D.4	Customer Request (Change) → Customer Care Online (CRN®) Agent •Remark: CRN® is an available medium of communication with customers. This transformation allows new customers (city councils) to perform change activities through CRN® media that serve their needs, which are addressed by agents online 24 × 7. •Business Process: R2C. •Impact: additional job description.
D.5	Customer Request (Change) → Customer Service Center (GPR®) Staff •Remark: GPR® is an available medium of communication with customers. This transformation allows new customers (city councils) to perform change activities through the GPR® media by visiting GPR® offices at specific locations. •Business Process: R2C. •Impact: additional job description.
D.6	Customer Request (Terminate) → Customer Service Center (GPR®) Staff •Remark: GPR® is an available medium of communication with customers. This transformation allows new customers (city councils) to terminate customer activities or certain services through the GPR® media by visiting GPR® offices at specific locations. •Business Process: T2C. •Impact: additional job description.
D.7	Customer Request (Incident) → Customer Care Online (CRN®) Agent •Remark: CRN® is an available medium of communication with customers. This transformation allows new customers (city councils) to report technical problems through CRN® media that serve their needs, which are addressed by agents online 24 × 7. •Business Process: P2S. •Impact: additional job description.
D.8	Customer Request (Incident) → Customer Service Center (GPR®) Staff •Remark: GPR® is an available medium of communication with customers. This transformation allows new customers (city councils) to report technical problems through the GPR® media by visiting GPR® offices at specific locations. •Business Process: P2S. •Impact: additional job description.
D.9	Customer Request (Incident) → Virtual Assistance (VRN®) •Remark: VRN® is an available medium of communication with customers. This transformation allows new customers (city councils) to report technical problems through official TSP virtual assistance media such as social media, Line®, website, and WhatsApp®. •Business Process: P2S. •Impact: Additional job description.
Assignment Relation	
D.10	Customer Care Online (CRN®) Agent → Manage Contact

(*continued on next page*)

Table 15 (*continued*)

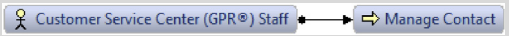
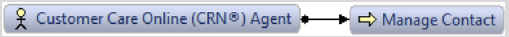
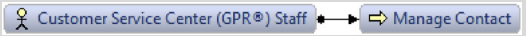
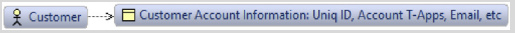
	•Remark: Previously, contacts could only be managed by an account manager (AM). This transformation allows CRN® agents to assign contact management to existing customers at TSP companies, assign contacts as prospective customers, or add a new customer after the IoT-based industry company approves the proposal. It also enables customer changes/terminations (smart cities) for customers who currently have an account or use a service. •Business Processes: R2A, R2C, T2C. •Impact: CRM application changes, specifically the CRN® interface.
D.11	 •Remark: Previously, contacts could only be managed by an AM. This transformation allows GPR® agents to assign contact management to existing customers at TSP companies, assign contacts as prospective customers, or add a new customer after the IoT-based industry company approves the proposal. It also enables customer changes/terminations (smart cities) for customers who currently have an account or use a service. •Business Processes: R2A, R2C, T2C. •Impact: CRM application changes, specifically the GPR® interface.
D.12	 •Remark: Previously, contacts could only be managed by an AM. This transformation allows CRN® staff to assign customer contact management related to customer problem reporting requirements (smart city). •Business Process: P2S. •Impact: CRM application changes, specifically the CRN® interface.
D.13	 •Remark: Previously, contacts could only be managed by an AM. This transformation allows GPR® staff to assign customer contact management related to customer problem reporting requirements (smart city). •Business Process: P2S. •Impact: CRM application changes, specifically the GPR® interface.
D.14	 •Remark: Previously, contacts could only be managed by an AM. This transformation allows VRN® staff to assign customer contact management related to customer problem reporting requirements (smart city). •Business Process: P2S. •Impact: VRN® application changes.
Access Relation	
D.15	 •Remark: This transformation enables smart city, after a new TSP customer has examined the agreement/confirmation process, to receive information about the customer account, Uniq ID, or T-Apps Account via the registered e-mail. The output of this access relation is to support D.3. •Business Process: O2P. •Impact: E-mail is sent by humans or machines.

Table 16. Architecture Impact on each Process using MoSCoW.

Impact	Process ID	M	S	C	W
Employment/Human Resources	A.2, A.3, A.4, A.5, A.6, A.8, A.9, A.10, A.20				V
Additional job desc	A.7, A.11, A.12, D.1, D.2, D.4, D.5, D.6, D.7, D.8, D.9	V			
Catalog, proposal draft, or installation manual	A.13, A.18			V	
Notifications through certain media	A.14			V	
T-Apps application changes, problem status notifications	A.15, A.16			V	
Changes to CRM and billing applications	A.17, A.19, B.1, B.2, B.3, B.6, C.4	V			
Special reports on customer problems (smart city)	A.21		V		
Billing application changes and defining the lifecycle	A.22	V			
T-Apps application changes	B.4, B.5,	V			
Provision of supporting IoT infrastructure or changing the current network configuration	C.1, C.2	V			
Network capability	C.3	V			
Changes to the T-Apps application, adding pages for smart city customer users	D.3	V			
CRM application changes, specifically the CRN® interface	D.10, D.12		V		
CRM application changes, specifically the GPR® interface	D.11, D.13	V			
VRN® application changes	D.14			V	
E-mail is sent by humans or machines	D.15			V	

recruited by the company. However, in this case, the best recommendation for transforming businesses is to internally find a project manager because of two important aspects: (1) an internal individual knows the company's circumstances, intricacies, and complications better than an external party would, and (2) he/she can better mitigate the cultural resistance of individuals who are associated with the transformation but are against it. Naturally, these managers must be internal employees with experience across divisions, and necessarily those who are already at middle to senior levels. Cross-division expertise is critical because a project activity such as this would redefine each division of the company.

Transformation involves the organization chart and communication level between the project executor and the company organization that will lead the change. The project organizations involve the company directorate and its related subordinates, as shown in Figure 6. The high-level project organization chart is shown in Figure 7.

The project manager, along with the business team, should create a strategic diagnosis that is addressed by the new launching platform over the course of the company rebrand, and the operational resource awareness regarding the new company should be focused.

4.3.5. Select an appropriate approach to the realities of timing, resistance, and power

In project management, the initial milestone for formal project implementation is a kick-off meeting, which is to be attended by all relevant stakeholders and serves as the inaugural meeting between the project team and the client, convened to present the project SoW, team project contacts, roles, communication models, and project planning activities/milestones. This information must be displayed with sufficient detail to ensure that the project team members understand the extent of work required to be completed.

The objective of the kick-off meeting is to ensure that all project stakeholders receive relevant information from the project manager, who is responsible for the project, and the program sponsor (top management), who is responsible for the transformation. In addition to the project manager being appointment, all project organization members have new responsibilities and roles attached to their positions (formally accepted at the kick-off meeting). At the end of the kick-off meeting, the entire project organization must provide their signatures as part of the attendance list and approval of the minutes of meeting (MoM).

There are several essential deliverables determined in the kick-off meetings, including the MoM, program objectives, work breakdown structure, roles and responsibilities, project plan, expected deliverables, potential risks, and communication (escalation rules).

The use of specific operational project management tools/templates needs to be introduced and agreed upon, such as project progress reporting (format, receipt times, recipient emails), activity lists, risk and issue registers, action plans, regular review meetings (weekly, biweekly, monthly, etc.) as shown in Figure 8, and the particular focuses of ad-hoc meetings (see Figure 9).

4.4. Phase 2: business study (Foundations)

The foundation discusses the business rationale for the project, the potential solutions the project will present, and the manner in which the development and delivery of the solutions will be managed. The customer-centric domain is obtained from an end-to-end outlook that begins and ends with the customer (see Table 2).

In this regard, interviews and workshops with experts from different layers of the architecture (i.e., strategy, processes, data, applications, and network infrastructure) are essential to gain transparency regarding strengths and weaknesses. Obtaining external help for diagnosis is also a concern because this makes it necessary to assign a solution architect who can describe the business process sketch thoroughly. Therefore, external help is frequently needed to assist development of project design

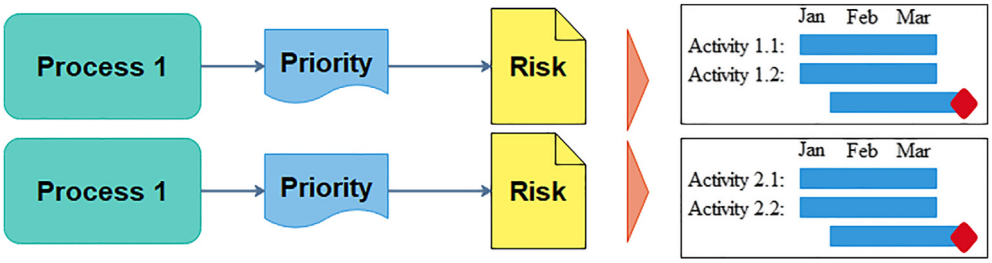


Figure 17. Process implementation approach. Inspired by (Czarnecki and Dietze, 2017).

solutions in terms of making a behavioral, systemic, and strategic diagnosis and to build a realistic platform for change.

Based on the central concept that organizes data extracts, the analysis uses themes (the seven customer-centric telco business processes) as a central concept in the overall content of the FGD. The mapping code and themes are shown in Table 3.

4.5. Phase 3: functional model

For this research to be applicable to telecommunication collaboration, SmartSantander was used. This platform has eight use cases displayed in the business model canvas, sourced from secondary data, for architectural investigations intended to be combined in the unity of the project ecosystem services to present a smart city toward the TSP.

In architecture diagnostics, the transformation process exposes new telecommunication business processes of the future toward IoT-based industry customers. The human telecommunication activities defined through eTOM's business processes are structured, and the interrelationships between the business processes that support the IoT ecosystem are obtained through the CATWOE analysis, as in Tables 4, 5, 6, 7, 8, 9 and 10.

The problem's "central concept" is presented as the desired change as a future finding, as a functional model that collaborates on industries: "IoT based" and telecommunication company. This is a transformation analysis, marked with an asterisk * in the thematic analysis Table 3 and CATWOE Tables 4, 5, 6, 7, 8, 9 and 10. In parallel, an analysis of the use cases of smartSantander (smart city) was also carried out in the customer column analysis in the CATWOE Tables 4, 5, 6, 7, 8, 9 and 10. The concept of stakeholder analysis brought by CATWOE allows these business processes to be analyzed as a model of change that can be accepted by stakeholders both in telecommunications companies and companies from IoT-based industries (as a new customer).

4.6. Phase 4: design and build (Evolutionary development)

The strategic design of the EA model is based on the definition of the business process described in the project foundation section, which is modeled in the architecture layer, to overcome the existing company challenges and be implemented by the business units in the directorates involved. Modular design involves elements in the EA, including business elements (including elements of business activities and actors who execute these activities), application elements, and technology elements. The ArchiMate® model elements and connections have a standard notation, as shown in Figure 3 (business element in yellow, application element in blue, and technology in green).

The current (As-Is) business process of the TSP company and the transformation/collaboration (To-Be) with an IoT-based industry (customer-centric) facilitates early implementation by differentiating the color of each element as in Figures 10, 11, 12, 13, 14, 15, 16. The black letter represents the current (As-Is) business process, ax existing practice in the TSP company, based on confirmations from experts through the FGD. The red letter represents the gap in transformation/collaboration with respect to the IoT-based company as a target for which an action plan needs to be implemented in a TSP company.

The resulting prototype models are then used as a strategic reference (ready to be implemented) in the telecommunication companies considered in this study, as shown in the EA output in Figures 10, 11, 12, 13, 14, 15, 16.

In Stage 4, the "request to answer" business process conceptual model is built by implementing EKD as an approach to corporate modeling that supports creativity and quality in the EA and business development. EKD modeling involves semantically rich notation including all sub-elements (Table 11) and their respective attributes to be modeled according to the flow diagram (Figure 3) in the context of "request to answer" business process modeling of telecommunications operations. During generation of a model, apart from the overall attributes and context of the business process being obtained, higher levels of formality and/or stakeholders who have more experience with modeling are also required, especially for architects who have experience in practical telecommunications operations (see Tables 12, 13, 14, 15).

4.6.1. Request to answer (R2A)

The R2A business process, as shown in Figure 10, provides information to customers based on their requests. Regarding concrete products or contracts, this process is related to pre-sales, cross-selling, and up-selling opportunities that are always initiated by the customer (IoT-based industry or smart city). In addition, answers to general requests are also provided, such as those regarding opening hours or the location of telecommunication IoT outlets.

4.6.2. Order to payment (O2P)

The O2P business process, as shown in Figure 11, is a typical sales process. This process starts with the customer's (IoT-based industry or smart city) request, where there is a prior decision by the customer to purchase a product. The decision is made because of a process related to "request to answer" or the customer's domain. The "order to payment" process involves a commercial process of customer requests, product provisioning, and billing. Depending on the product, provisioning can sometimes include several technical tasks that will be directed to the technology domain.

This business process involves activating services to customers that have previously been activated (after the contract is approved at R2A). New customer activation is separately handled in the technology domain of the "Production Order to Acceptance" business process, not in the customer-centric process.

4.6.3. Usage to payment (U2P)

The U2P business processes, as shown in Figure 12, are self-acting processes in which customers use telecommunications products. This business process commences with the customer's decision to use a product that has a basis or is based on an existent/defined contract, whether its use requires usage-based payment (usually related to volume or time), or if it is a part of a flat-rate agreement. The combination of the two is also common—for example, fixed rates with volume restrictions.

The process of collecting records/data and rating (price assessment) of the services by customers is part of the technology domain. Transactions can be pre-paid or post-paid.

4.6.4. Request to change (R2C)

The R2C business process is shown in Figure 13, which commences with a specific change request submitted by the customer. These changes can be divided into changes to the customer's "master data" or to existing contracts. The method of responding to the change request depends on the type of change. Some technical tasks may be required, which will be directed to the technology domain. Changes can be related to the address of a product, such as an IoT device connection.

4.6.5. Termination to confirm (T2C)

The T2C business process shown in Figure 14 involves terminating existing products from a commercial perspective. This business process commences with a request for termination from the customer. Depending on the company's strategy, this process can include customer retention activities, which can result in the interruption of the termination request.

In most cases, this disconnection requires technical activities such as the elimination of access to certain telecommunication services or collection/return of equipment owned by the telecommunication operators. These technical activities are directed to the technology domain.

This business process ends with the confirmation and processing of the final/closing bill. Particularly in the termination process, CRN® can only process terminations during working hours (5–8 h) because it requires approval from certain parties.

4.6.6. Problem to solution (P2S)

The P2S business process shown in Figure 15, manages the technical problems reported by customers. This process commences with a problem report (for technical problems, different levels of support are differentiated). The customer-centric domain includes high-level support based on well-developed scripts or tools. More complex technical activities are transferred to the technology domain. Overall responsibility in the case of managing the TT remains with the "problem solution" process. In addition, billing activity may occur, which may include billing credit as payment for troubleshooting.

4.6.7. Complaint to solution (C2S)

The C2S business process is shown in Figure 16 and involves management of commercial complaints (non-technical). This process shares no interface with the technology domain. The complaint process relies on the type of complaint and the strategy of the company. Complaints can relate to overt legal liability (for example, incorrect invoicing) and customer disappointment (for example, staff behavior). Complaints may involve a billing activity that results in a credit note, either as part of a company's legal obligations or as compensation for an apology from a customer.

During complaint management, certain cases in high-importance categories, after undergoing verification by internal marketing and the IoT customer satisfaction teams, can involve a special notice report being sent to the CEO. A reprimand from the CEO can result in certain punishments or defaults regarding employee KPIs. The complaint notice that reaches the CEO will affect the salary/bonus/promotion of the related employee(s) and may even result in transfer or termination from the company.

4.7. Phase 5: implement (Deployment)

Deployment refers to execution of every activity by each PIC of the process within the time specified in the project timeline. The transformation project implementation is based on the foundation of the architecture design. At this stage, the project manager monitors the transition from the As-Is process to the To-Be process in close collaboration with the IT department, network department, and various related stakeholders. The changes begin with clear responsibilities made known in terms of strategic architecture ownership. The responsibility must be fulfilled by the owner, which certainly requires a budget to be determined. The results of responsibility fulfillment in the ownership architecture, including budget allocation to make changes in the business process, can be incorporated with the implementation design into applicable action processes.

Application of the process of action in this implementation phase requires several practical project tools in the form of iterative development, timeboxing, and MoSCoW prioritization. Prioritization involves observation of all elements and prioritization of the most appropriate budget over the entire project implementation time range. Here, it may be necessary to hold a discussion on modeling and facilitating workshops to converge at an accurate solution that meets the business need and is also built adequately based on the technical standpoint.

4.7.1. Assign clear responsibilities

The new EA, as a result of transformation/collaboration, is represented using red letters in the design. The red-lettered model is the focus of an architect when designing solutions; the model needs to be defined and analyzed in a modular form according to its elements such that a role can be obtained in the overall transformation strategy, including business elements, applications, technology, and connections.

4.7.1.1. Changes in the business element to support the transformation. Project implementation modeled in the EA business element, please refer to Table 12.

4.7.1.2. Changes in the application element to support the transformation. Project implementation modeled in the EA application element, please refer to Table 13.

4.7.1.3. Changes in the technology element to support the transformation. Project implementation modeled in the EA technology element, please refer to Table 14.

4.7.1.4. Changes in the connection element to support the transformation. Project implementation modeled in the EA connection element, please refer to Table 15

4.7.2. Budget of the change activity

Budget analysis is required through capital and operational expenditure. The budget is discussed at the beginning of the iterative project implementation. The data collection is performed according to each impact EA obtained from each architect's business, application, technology, and connection element. This study does not discuss budgets for change activities because that is highly dependent on the company's financial condition; however, this is a useful insight and is very important for the real implementation process.

4.7.3. Designing implementability into the process

The MoSCoW prioritization technique was used in this DSDM method. The DSDM manages project work, including scope management, timeboxes, and target outcomes within fixed deadlines, whereas the MoSCoW focus on the most important requirements. In designing implementability into a process, it is very important to perform individual training in terms of strategies for making decisions and implementing each architectural element (Ansoff et al., 2019). Here, the training covered a strategic architectural discussion on each architectural element produced by involving relevant managers in their work. The project manager in a TSP company must be able to control the complexity of the analysis performed to be compatible with DSDM principles (see Table 1) such that the prioritization of each process is performed, as shown in Table 16.

The processes that are prioritized are implemented in a project roadmap by assigning a team to implement the process and allocating other supporting resources. The project roadmap consists of project milestones in the form of processes that are mapped into activities limited by the work timeline. An illustration of the process until it becomes a project activity is presented in Figure 17.

4.7.4. Managing the ongoing process transition from As-Is to To-Be

The management of the ongoing transition process should be performed to ensure that planning and implementation can be executed in parallel. There is a need to control the planning process to ensure balanced progress in decision-making and acceptance of project stakeholders from the entire process. It is therefore recommended to launch the implementation project as early as possible (Ansoff et al., 2019).

4.7.5. Institutionalizing the new strategy

Creating a new strategy to integrate with corporate institutions involves using a strategy development master plan based on an EA to manage processes in each business process. After the strategy is implemented, it is necessary to continue with the development of a corporate climate to a new culture with non-human (IoT) customers, new organizational forms, and power structures that support running of the strategy naturally.

In addition to support provided by the power structure, there is another important aspect regarding maintaining the strategy that has

been implemented through the change management team. The internal new resources "change management team" should be created and equipped with exclusive authority to ensure the efficient and consistent implementation of the action plan.

It is also necessary to consider the continued development of a company's capabilities to ensure overall balance and the new IoT strategy being effectively supported. Ultimately, if these steps are followed, such a company will become an IoT provider company (capability).

5. Conclusion

This study provides original and unique insights into direct future strategic opportunities for the telecommunications industry to manage turbulence and potential bankruptcy through market/customer development strategies. In this case, an IoT-based industry with a smart city is used as an example.

In the implementation stage, this study proposes a transformation strategy that addresses company elements: 22 at business layer, 6 at application layer, 4 at technology layer, and 15 relationships. Recommendations are also provided for executing a transformation project via the proposed APM approach to carry out each proposed process.

This research unfolds opportunities for future research. The methods proposed (together with EA models) serve as pivotal points for future work to be applied and evaluated in real scenarios. Moreover, this study is only focused on business process development in the customer-centric domain. However, there are three other domains relevant to TSP companies that can be further investigated, such as technology, products, and business partners. In addition, this research is qualitative in nature. From the standpoint of technical details as a result of the emergence of new IoT (non-human) customers, further research can be conducted via quantitative methods, involving application of tariffs, KPIs, SLAs, etc. for the IoT-based industry.

That being said, there are also limitations and shortcomings to this research, including the post-project stage as an activity to ascertain whether the project meets the expectations of the business. This requires a deep understanding of the TSP company and is outside the scope of the study. Moreover, this study also does not discuss the technical and business calculations of project feasibility because it is highly dependent on the financial condition of the company, which is also beyond the scope of the study.

Declarations

Author contribution statement

L. Ranjaliba Saragih: Conceived and designed the experiments; Wrote the paper.

M. Dachyar: Performed the experiments; Analyzed and interpreted the data.

Teuku Yuri M. Zagloel: Contributed reagents, materials, analysis tools or data.

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Data will be made available on request.

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The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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