

Fig. 5 Mapping IT role at XYZ

B. Gap Analysis and Change

A gap analysis was carried out by comparing the target's current conditions to a strategic role using the Applegate, Austin, and Soule framework [4]. The gaps and all recommendations for the change plan are described in TABLE II.

TABLE II
GAP AND CHANGE PLAN

Aspect	Gap	Change Plan
Operation and Infrastructure Services	Partially Centralized	Move all services to be full centralized
Project and Infrastructure Development	Partially Centralized	Change IT organization matrix for infrastructure projects and development.
Organizational and management approach, Leadership	Mixed	Clear segregation between functional and operation
	Mixed	Functional Division direct report to CIO. Operational Division as structural will report to subsidiaries management but still under CIO coordination.
Human Resources	Spread/different cost center	Divided into two structures, organizations are lean and agile. The lean structure will be at the holding company, and the Agile structure will be at subsidiaries.

C. Change in IT organization

Future changes in IT organizational structure will be divided into three groups, consist of (a) project and development, (b) operations, and (c) supply chain management. The CIO's role is (a) to coordinate all IT needs and synergize with other C-Levels in all subsidiaries and (b) to manage and control all specific resources at respective subsidiaries [9]. The subsidiaries' IT function will be

centralized into one committee to ensure coordination and tasks can equally distribute and complement each other.

The project and development section will be responsible for managing the project and developing the subsidiary's IT infrastructure. All project management will be controlled by the PMO (Project Management Office) and managed according to the project management framework. Each project must be based on an agile paradigm, which can take one of the agile development frameworks, for example, Scrum [10], [11], XP [12], or TDD [13], [14].

The operational section has the responsibility to keep daily services stable and reliable. This section divides into two subsections (a) an application sub-section was responsible for ensuring that the application services run stable and reliable, and (b) an infrastructure sub-section has responsibility for all IT infrastructure operations and daily support services. The supply management section has responsibility for managing procurement and administration at all subsidiaries. This section aims to get visibility of all IT needs to maximize and avoid overlapping at similar services. This section also focuses on maintaining and managing the level of service from third parties.

The entire IT organization is designed to become bimodal IT [8], [15], an organization that applied a lean functional paradigm at the holding while agile matrix paradigm at subsidiaries. The concept of integration between project development and operation section is carried out with a DevOps mindset [16]. This mindset is selected because it can synchronize all sections in good communication and coordination. Kim *et al.* [17] argue that organizations that run agile and lean systems can apply the DevOps mindset. Fig. 6 shows the new organizational structure.

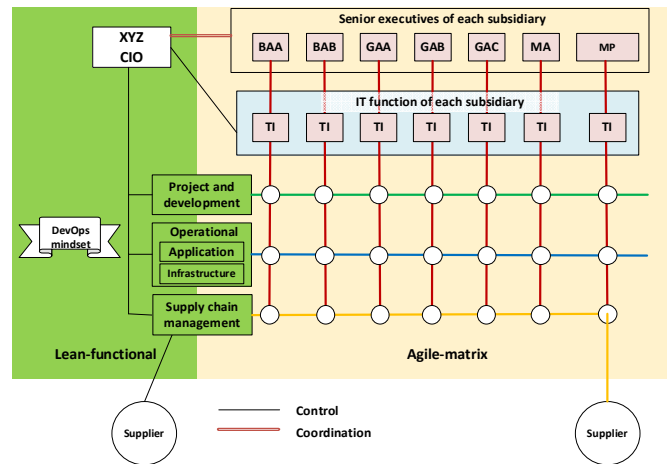


Fig. 6 New IT organization structure in XYZ.

The suitable IT governance for XYZ is the federal model [18], it's a hybrid governance concept between a centralized and distributed model. The federal model allows the corporate strategy to work parallel with specific components at the subsidiary. However, the federal model has a disadvantage, such as powerful subsidiaries will get more attention and influence than smaller subsidiaries [19]. This weakness can be mitigated by implementing a joint committee consisting of the CIO, Subsidiary C-Level, and IT representatives to set up the priorities to be financed and implemented.

A functional organization is an organization type designated based on its function [20]. This organization makes similar procedural and hierarchical functions into a single section [20]. This type can increase flexibility and knowledge and reduce duplication [21]. However, this type of organization will be less agile when facing rapid changes [21]. The matrix organization is designed for agility[22]. This type can make it easier for the organization to deal with rapid change. This organization type is also created for an organization to have fast coordination between divisions when problems occur, and when sources of information are not close to decision-makers [21]. However, this type of organization also has a high possibility of conflict and low response time [21]. In this case, the recommendation is to use the bimodal TI as an organization model for IT at XYZ with a combination model between Function-Lean and Matrix-Agile. The Functional-Lean model provides organizations as a function to keep lean but can deliver high standard services and keep it stable. The Matrix-Agile model can provide agility for the organization to develop new and run projects.

IV. CONCLUSION

Changes in the organizational model due to IT's changes and the external factors of the business environment require strong IT leadership. There are three organizational clusters obtained from the assessment using the Applegate, Austin, and Soule framework[4]. There are gaps between the clusters that need to be resolve from an organizational perspective. This study suggests that the organizational structure should change to the Bimodal IT Model with a combination model between Function-Lean and Matrix-Agile. The limitation of the study is conducted within a certain period. The research results are only on the organizational structure model changes. Future research can examine the effects of changes in this organization model over time through a longitudinal study. Further research can also investigate the IT business transformation model to support the company strategy.

ACKNOWLEDGMENT

We are grateful to all XYZ management for their support in this case study.

REFERENCES

[1] World Economic Group, "Digital Transformation Initiative Mining and Metals Industry In collaboration with Accenture-transformation 3 Digital Transformation Initiative: Mining and Metals," no. January, p. 36, 2017.

[2] Pradip, B. P. Gautham, S. Reddy, and V. Runkana, "Future of Mining, Mineral Processing and Metal Extraction Industry," *Trans. Indian Inst. Met.*, vol. 72, no. 8, pp. 2159–2177, 2019, doi: 10.1007/s12666-019-01790-1.

[3] A. Young and P. Rogers, "A Review of Digital Transformation in Mining," *Mining, Metall. Explor.*, vol. 36, no. 4, pp. 683–699, 2019, doi: 10.1007/s42461-019-00103-w.

[4] L. M. Applegate, R. D. Austin, and D. L. Soule, *Corporate Information Strategy and Management 8th Edition*. 2008.

[5] D. Chaffey, *Digital Business and E-commerce Management: Strategy, Implementation and Practice*. 2015.

[6] S. Narayan, *Agile IT organization design: for digital transformation and continuous delivery*. Crowdfordsville, Indiana: Addison-Wesley Professional, 2015.

[7] N. Loader, *The lean IT expert: leading the transformation to high performance IT*. New York, NY: Routledge, 2019.

[8] I. Haffke, B. Kalgovas, and A. Benlian, "The Transformative Role of Bimodal IT in an Era of Digital Business," 2017, doi: 10.24251/hicss.2017.660.

[9] H. Waheed, H. Hussin, and M. J. Mohamed Razi, "The influence of IT leaders' leadership behaviour on IT governance performance in higher Education: A literature Review," in *Proceedings - International Conference on Information and Communication Technology for the Muslim World 2018, ICT4M 2018*, Dec. 2018, pp. 254–259, doi: 10.1109/ICT4M.2018.00054.

[10] V. T. Faniran, A. Badru, and N. Ajayi, "Adopting Scrum as an Agile approach in distributed software development: A review of literature," in *2017 1st International Conference on Next Generation Computing Applications, NextComp 2017*, Aug. 2017, pp. 36–40, doi: 10.1109/NEXTCOMP.2017.8016173.

[11] K. S. Rubin, *Essential Scrum: A Practical Guide to the Most Popular Agile Process*. Upper Sadle River, NJ: Addison-Wesley, 2013.

[12] C. Beck, Kent; Andres, *Extreme Programming Explained: Embrace Change*. Boston, MA: Addison-Wesley, 2004.

[13] A. Nanthaamornphong and J. C. Carver, "Test-driven development in hpc science: A case study," *Comput. Sci. Eng.*, vol. 20, no. 5, pp. 98–113, Sep. 2018, doi: 10.1109/MCSE.2018.05329819.

[14] K. Beck, *Test Driven Development: By Example*. Boston, MA: Addison-Wesley Professional, 2002.

[15] B. Horlach, P. Drews, I. Schirmer, and T. Boehmann, "Increasing the Agility of IT Delivery: Five Types of Bimodal IT Organization," 2017, doi: 10.24251/hicss.2017.656.

[16] P. Drews, I. Schirmer, B. Horlach, and C. Tekaar, "Bimodal enterprise architecture management: The emergence of a New EAM function for a BizDevOps-based fast IT," in *Proceedings - IEEE International Enterprise Distributed Object Computing Workshop, EDOCW*, Oct. 2017, vol. 2017-October, pp. 57–64, doi: 10.1109/EDOCW.2017.18.

[17] J. Kim, Gene; Humble, Jez; Debois, Patrick; Willis, *The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations*. Portland, OR: IT Revolution Press, 2016.

[18] J. Peppard, Joe; Ward, *The Strategic Management of Information Systems: Building a Digital Strategy*. Hoboken, NJ: Wiley, 2016.

[19] J. Weill, Peter; Ross, *IT Governance: How Top Performers Manage IT Decision Rights for Superior Results*. Boston, MA: Harvard Business School Press, 2004.

[20] N. Kishore, J. H. C. Pretorius, and G. Chattopadhyay, "The Roles of Functional Managers and Project Managers in a Matrix Organization," in *IEEE International Conference on Industrial Engineering and Engineering Management*, Dec. 2019, pp. 784–788, doi: 10.1109/IEEM44572.2019.8978830.

[21] J. T. Marchewka, *Information Technology Project Management*. Hoboken, NJ: Wiley, 2015.

[22] R. M. Burton, B. Obel, and D. D. Håkonsson, "How to get the Matrix Organization to Work," *J. Organ. Des.*, vol. 4, no. 3, p. 37, Dec. 2015, doi: 10.7146/jod.22549.