



CONCEPTUAL STUDY ON THE IMPROVISING COMPETENCIES WITH T- SHAPED HR TRAINING MODELS

*Prof Dr C.Karthikeyan, IQAC Director TJC/Principal TIMS, T.John College, Affiliated to Bangalore University, Karnataka

ddprofkarthik@gmail.com

timsprincipal@tiohngrup.com

Abstract: The age of specialisation requirements though not yet over, yet the demand for HR discipline with the skill set that can collaborate cross-disciplinary with multiple business requirements and the ability to work on multiple projects are the need of the hour. This meta-analytic literature review could highlight the following skill sets that are either present in another form that requires to be revamped or upskilling on the areas specified directly or indirectly through the demands of the business.

Key Words: T-Shaped, Millennial, Upended, VUCA, Agility, Competencies, HR Professional

I. Introduction

Every company in the VUCA environment subdued by the Pandemic Impacts for the past couple of years are finding new normal challenges in the Talent Shortage, Talent Upgradation, Restructuring, Employee Engagement and the Millennial workforce that is dictating terms on the psychological issues of work. The recently upended economy is creating intensified pressures to change the gears of the organisation if the trajectory of growth needs to go positive and vibrant. The ample opportunities created for certain industries and wilting down the prosperity for some of the industries have finally come on the similar lines that they required T-Shaped HR professionals, rather than a functional HR with traditional skills to handle the organisational pressure. Changing demands on the HR professional: The modern VUCA environments demand the HR competencies to be more multi-disciplinary, the ability to handle complex issues of the organisations, create holistic systems and recognise the value of collaborating with the integrated approach to extend innovative work practices.

Conceptualising the T-Shaped HR professional:



Fig 1: Depicting T-Shaped Horizontal Bar for Multidisciplinary Areas of work and the Vertical Part of T-depicting the Depth in the HR competencies that the HR professional needs to have: **Ref: courtesy AIHR.** Recommended for academic purposes only.

T-Shaped HR professionals are conceptualised as HR professionals who can offer their best skill sets in the newer and demanding areas apart from their domain HR skills are;

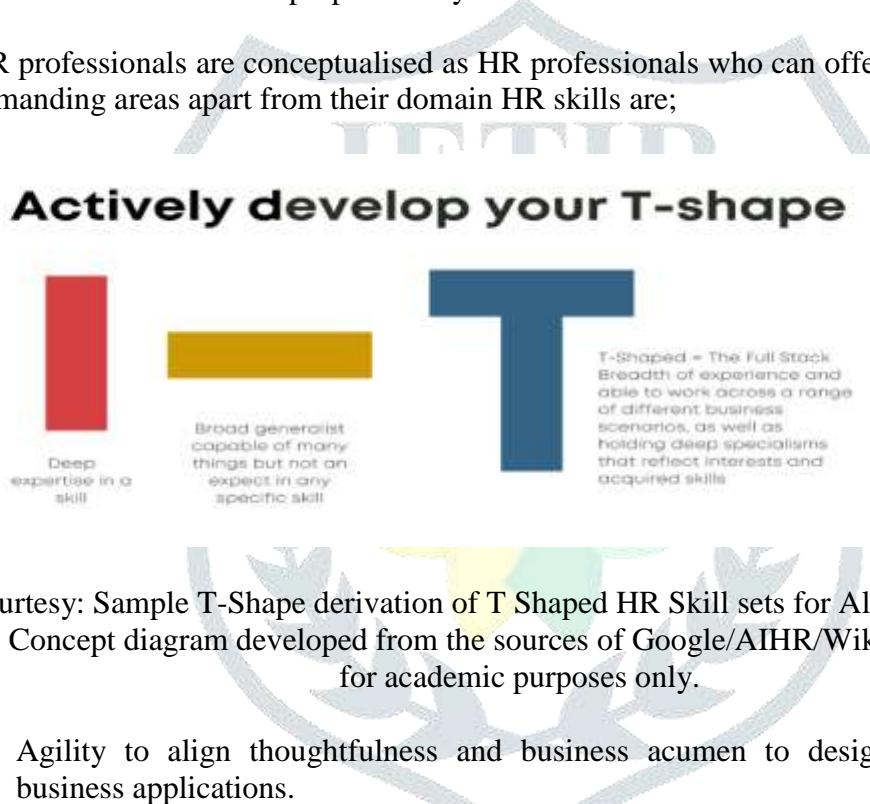


Fig 2: Courtesy: Sample T-Shape derivation of T Shaped HR Skill sets for Alignment. For Discussion Purpose only. Concept diagram developed from the sources of Google/AIHR/Wikipedia.org. Recommended for academic purposes only.

- Agility to align thoughtfulness and business acumen to design financial strategies for business applications.
- Ability to handle data to track how the business is done and where it moves.
- Ability to identify weak links of business and avert struggles for the organisation.
- Setting up KPIs (Key Performance Indicators) that adds value to the organisation.
- Ability to solicit accurate and correct data to improvise business strategies.
- Solve business problems with acumen including the issues of HR-related problems.

Problems of the HR professionals from the recent research reports from the McKinsey and other research organisations are:

- (i) They concentrate only on the specialised centres of expertise and they rarely even meet internal clients or develop too many isolated solutions.
- (ii) Competencies to reinvent the wheel are required for the clients and not doing the routine administrative functions.
- (iii) They are mostly remote and systematised rather than connecting to the human element in the organisations.
- (iv) Inability to create integrated HR practices and solutions that offers true value.
- (v) Lack of financial acumen or budgeting skills.
- (vi) Never create or develop your strategy and evolve as a copycat of other cultures.
- (vii) Never impact on the organisation's bottom line, or can't claim to have contributed to the same.

Evolution of T-SHAPED HR professionals as and when external skill set demands variable skill components within stable skill components simultaneously

Owing to changing demands on the skills, knowledge to use correct tools to operationalise the regular affairs, the evolution of T-Shaped HR professionals is the need of the hour, where the HR professionals need to have expertise in their respective HR domains and simultaneously work on the cross-disciplinary demands of the organisation to manage a wide variety of the tasks or challenges imposed on them like;

T-Shaped HR professionals are conceptualised as HR professionals who can offer their best skill sets in the newer and demanding areas apart from their domain HR skills are;

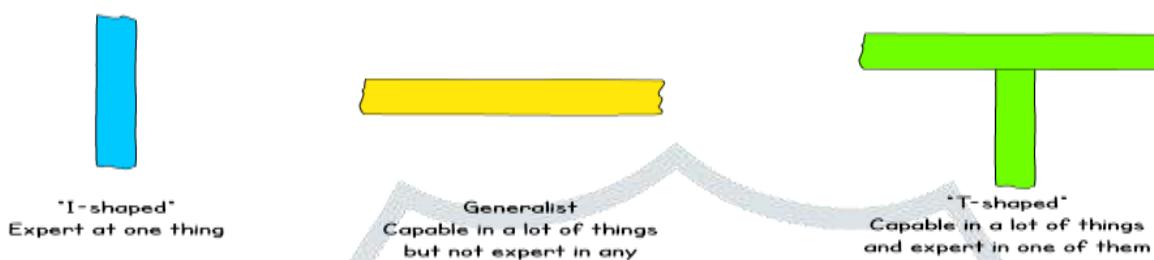


Fig: 3: Evolutionary process of T-Shaped skill development exercises conceptualised for VUCA environment that is ever dynamic. Source: Developed from the concept conceived from figures of google infographics. Source: www.infographics.com. Recommended for academic purposes only.

- (a) Operating agile way and collaborating to share knowledge.
- (b) Helping to integrate HR activities to create impact economically and culturally.
- (c) Ability to communicate using data for decision-making.
- (d) Leveraging the technology as well as updating the workplace work style to improvise productivity.
- (e) Ability to align business stakeholders.
- (f) Generous and positive attitude towards betterment of services to the customers.
- (g) Keen to upgrade better practices to the best practices.

Methodology

Literature review from the available secondary data sources and infographic representations from professional organisations training in T-Shaped HR training and its related literature.

Problem Statement

The HR professional needs to get inclined to the business results and the dying skill sets of the HR Functional areas are to be revamped to the present-day business requirements, if not to the levels of digital age organisational needs taking cognizance on the outcome expectation from the stakeholders. The impact of HR on the bottom line is the pre-requisite professionalism expectation that is unsaid, yet demanded.

Conceptualising T-Shaped HR skill development initiatives from concepts from HR training and development sources across the world

The age of specialisation requirements though not yet over, yet the demand for HR discipline with the skill set that can collaborate cross-disciplinary with multiple business requirements and the ability to work on multiple projects are the need of the hour. This meta-analytic literature review could highlight the following skill sets that are either present in another form that requires to be revamped or upskilling on the areas specified directly or indirectly through the demands of the business.

Understanding the importance of cross-disciplinary areas

The HR needs to be a T-Shaped HR Team with T-Shaped HR professionals to derive the outcome in the VUCA era. Although the demand for HR Professionals are steadily increasing, nevertheless the expertise in cross-disciplinary areas with expert knowledge in their respective HR disciplines are sought after. For example, training a marketer in the T-shaped training shall have various components as per the descriptions given in the T-Bar shown below:



Fig: 5: Example of training a Marketer with T-Shaped HR training that brings in T-Shaped skill development exercises conceptualised for VUCA environment that is ever dynamic. Source: Developed from the concept conceived from figures of google infographics. Source: www.infographics.com. Recommended for academic purposes only.

T-Shaped HR professional is now looked at as a problem solver apart from carrying out the routine HR tasks:

Can the HR profession now break out of the traditional routine work style to improvise their contribution to the internal stakeholders, while always committing them to their specialist performance both horizontally as well as vertically? Recent research reports across the world and the Meta analytical study conducted during this research.

They are:

- Training agile HR can cut down the waste hrs on unproductive experiences the HR professionals face in the organisation some of the routine tasks that the employees can do themselves are to be solved by HR professionals. Instead, the HR departments shall make multi-disciplinary project teams.
- Clients for various business activities and other business partners shall become the focus area for the HR cross-functional teams to address business issues, that shall indirectly contribute to the growth of business alongside HR functions.
- Reducing the HR functional burden with the solutions that create value-adding to the data, as well as help in scalability which will again bring out clarity in the functional expertise to also learn the generalist mentality.
- Integration of HR practices will increase the value of a business like the HR professionals shall improvise the capabilities of the workforce to address real problems with regular upskilling of the workforce capabilities.

- HR specialists need to draw strategic integration plans and needs to encourage their fellow employees to think entrepreneurially. The indispensable HR skill is the ability to collaborate with a T-Shaped approach. The support required needs to be from the performance management, compensation and selection practices that can achieve the stated objectives.
- HR to be aware of the business models with an operating model needs to be structured. The above shall become the centre of expertise although it may come with isolated solutions.
- The companies can create the workflow management system as an Online App so the younger generations who are experts can complete the same.
- Increasing the situation like the HR cross-functional teams facing HR business partners that can be the catalyst to the day to day business practices.
- T-Shaped HR professionals could develop the required levels of business acumen including design thinking. Thinking about the employee will automatically go inside the mindset of the HR professionals before setting standards of performance expectations from their stakeholders.
- T-Shaped HR professionals have the potential to become customer-oriented professionals.
- Developing All-around professionals with T-Shaped HR training that can converge them to the hyper-specialised, and the on the job experiences shall deepen the vertical part of the T, thus making them T-Shaped professionals.

T-Shaped HR Professionals evolving as problem solvers and creating a positive working climate

Solving problems is the most innate and explicit skill that any professional needs to possess to have sustainable career growth, and HR professionals cannot be isolated on this front. HR staff into T-Shaped professionals shall be built into an effective HR team with all necessary skills and competence with the ability to handle multifaceted challenges. Enhancing the HR operating models to align to the business requirements shall be improved as internal alignment that helps collaboration among internal stakeholders.

• New age challenges of HR leaders to transform through T-Shaped Training

Generalists with a specialist outlook and internally can diversify from specialist to generalist is a new age T-Shaped HR professional which is viewed as an evolving HR professional. HR is now more a people leader rather than a functional specialist since the world of work transforms much faster than any calculated predictions of the management specialists. The T-Shaped HR professional if trained adequately needs to be successfully upskilled to make an impact from commercial awareness, influencing capabilities, skill sets of the data analytics as well as to become a specialist and generalist simultaneously. The above is possibly the biggest challenge for new-age HR professionals who need clarity from various angles like the following:

- Will the HR professionals if training in T-Shaped skill sets, will acquire the full stack of skills that are in demand in the new age organisation.
- Are the HR professionals capable of taking the full stack of the skills that are in demand at the new-age workplaces?
- The challenge to create HR careers among the T-Shaped.

Setting up new workplace paradigms that demand a new-age workplace skillset

The challenges in the new-age workplace or organisation are far from regular and are more than unexpected and very fragile. HR needs to help organisations to solve challenging problems with all possible skill sets they have. The focus of HR professionals from doing regular functions needs to be viewed very seriously and the need to explore in-depth human behaviour in the workplace and try solving the problems.

- The HR professionals are to help organisations respond to business challenges immediately.
- Focus on well-being and safety of people rather than on the performance management of the entire TIME on close observations and micromanaging.
- Ability to navigate the organisation well even at the crucial time of business.

- Ability to demonstrate empathy to co-workers even in extremely demanding circumstances.
- Exhibiting empathy at all times and emotionally connecting with the employees on their grievances and problems.
- Train their mindsets to get into the strategic mindset or mode.
- Developing the ability to understand business acumen.
- Designing ability for making HR professionals develop a diverse workforce including upskilling.
- Ability to empathise with organisational requirements.
- Ability to cater to personalising the employee experience to set workforce strategies.
- Ability to handle hybrid as well as digitally capability workforce.

Increasing demands of the business environment and the new age organisations

The VUCA environment across the world is now delivering exceeding demands as well as performance that is beyond the perceived expectations of the employer and employee. The market standings of the company products and services and stock markets are now determining the standings of the companies' operations depending on the waves of external influences that have a direct impact on the cost factors. HR is a very important recurring cost factor for companies, every company big or small always wants a multi-tasking as well as people who can survive and sustain themselves in the VUCA environment, rather than the traditional employees who need direction and time to adjust to the storms of VUCA.

- Unlearn the traditional HR approaches, upskill with new T-Shaped skill sets and collate the best practice solutions to solve problems.
- Never work as siloed teams.
- Improvise the speed from traditional HR mode and make the response equally important as business needs.
- Develop interest in running the business activities and place HR in tandem with the growth of business cycles.
- Ability to partner and collaborate with businesses in the newest possible ways.
- Designing the HR policies and process as per the business requirements rather than the creation of Isolated HR policies.
- Co-creating personalised solutions for the employees and improvising the design thinking, prototyping and experimentation areas in the HR utility areas.
- HR teams need to develop T-Shaped people with T-Shaped training and development plans.
- Creation of breadth of experience in the people with exposure provision to people in different business scenarios and projects.
- Developing the people skillsets to take in-depth training into a few of the topics that require specialist skills.

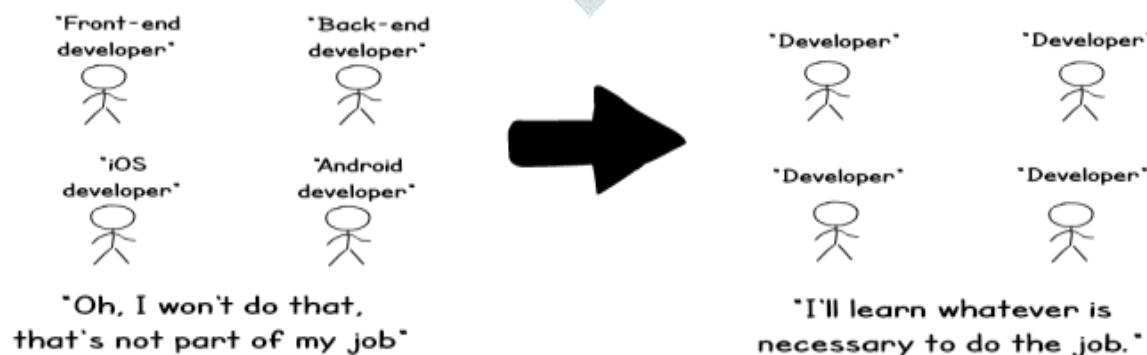


Fig: 6: Conceptual Diagram of Impactful Convergence level of T-Shaped HR Training Contribution:
Source: Concept diagram conceived from google www.inforgraphics.com. Recommended for academic purposes only.

The above are the strategic plans that need to be in the training plans for upgrading strategic HR career planning for the internal stakeholders apart from the HR professionals who handle the entire development process. The entire development process needs to be backed up with the mapping and proactively developing the T-Shape of each member. The activities to build on the skills shall start with the T-Shaped professionals in the team to exchange mutual communication and honestly appreciate each other's talents and encourage improvising the same. The motivations obtained from these interactions shall make the team members stretch the capabilities that are within the individual that could increase their potential for higher orders work challenges. This improvisation of capabilities needs to be identified by the HR professionals to nurture the capabilities to skill sets that can develop the employee as well as the organisation including the team members. They can deliver the end-to-end employee experience across the business.

Evolution of the T-Shaped HR Leader:

The T-Shaped HR profession usually is identified by the person who has numerous general skills that the horizontal upper part of the T-Bar represents, and few of the specialist in-depth areas in the vertical part of the T-Bar. The potential for evolution of T-Shaped HR leaders shall be identified by the following characteristics:

- A professional who can break out of the traditional HR silos
- A professional who can build a general business organisation.
- A professional who can explicitly work with the commercial capabilities.
- A professional whose scores remain supplemented with deep specialisms with specific people topics as their verticals is visible.
- T-Shaped HR professionals can reflect their preferences, interests and personal experiences, shall be intrinsically be possessing the skills to face modern workplace demands.
- They can remain customer-centric despite difficulties.
- They are capable of working with cross specialization and can network with multi-skilled teams.

T-Shaped HR leaders and their contributions to the organisation shall be:



Fig: 6: Conceptualising the T-Shaped Skills Sets that evolves in a leader: Source: AIHR.com/www.google.com and Wikipedia. Used for understanding purposes only. Recommended for academic purposes only.

- They can be specialists as well as a generalist.
- Increased capability and ability to move to different roles, teams and business scenarios.
- Ability to be agile and collaborative in their mindsets.
- The capability to solve complex business issues and related complexities in the problems.
- Can create end-to-end employee experiences.
- Agile to create as well as integrate HR best practices to the advantage of both the people and the organisation.
- Deliver evidence-based services and influence with data-based or fact-based decision making.
- Ability to leverage technology and digitalise the solutions.

- Understanding the complex requirements of the business and meticulous assumptions and presumptions to evolve strategies to tackle problems.
- Ability to empathise with the customers.
- The capability of adding value to the business and the know-how to measure the impact.

Modus Operandi for the HR leaders to design and prototype the T-Shaped Skill Sets in an Individual shall be as per the diagram given below;

They can develop a skeletal outline of the T-Shaped bars to accommodate the desired skills that they want to integrate and train their team and on attaining the desired skillsets shall fill on the T-Shaped horizontal and vertical bars.

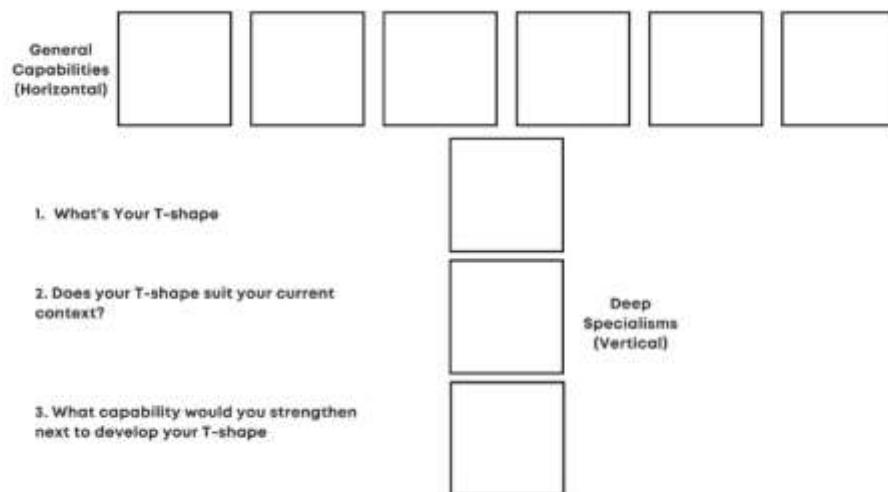


Fig: 7: Proposed Skeletal T-Shaped Vertical and Horizontal Bars for Setting Training Levels: Source: Developed by Author; Prof Dr C.Karthikeyan. Recommended for academic purposes only.

HR leader's developmental strategies for developing T-Shaped Employees: Iterations that can be carried out to build the skills sought after in T-Shaped employees like:

- Agile Mindset
- Employee experiences end to end journey mapping
- Human-Centric Product and Service Design
- Collaboration & working in multi-skilled teams
- Evidence-based and data-driven
- Emotional intelligence
- Know your customer
- Digital Savvy
- ESG-Environment/social & corporate governance
- Trust and Psychological Safety
- Nimble and Innovative
- Growth Mindset
- People Strategy and HR functional expertise
- Agile Organisational design
- Agile ways of working



Fig: 7: Expected Multifaceted skill components that shall be amalgamated for T-Shaped Vertical and Horizontal Bars for Setting Training Levels: Source: Developed by Author; Prof Dr C.Karthikeyan.
Recommended for academic purposes only.

The crucial skillsets to develop the T-Shaped HR professional or employees usually undergo the following stages:

Stages: Inviting and accepting the idea that the skills can be built by working on the iterations of life projects and it can be done exclusively to the career ladder. Various cycles of moving up, down, sideways and being in the best position to grasp opportunities as they arise is a very important consideration to be had.

1st stage: Mapping the current T-Shape. Making common general capabilities like change management, evolving as digital savvy, as well as understanding the customer using the data. Listing the specialisations with deeper expertise, training people, studies and preferences, developing the skill set of recruitment of talent management experts and facilitating the coaching people.

2nd Stage: Feedback provision on the status-quo among the peers, mentors, coaches, managers and family members. The assessment of the skills mapped in the T-Shape and exploring development areas as well as blind spots.

3rd Stage: Check on the needs of the business environment and set optimal operational standards for example creating the digital environment for business operations as well as systems. The rest of the general capabilities that these types of business environment demands are mapped to the innovation and redesigning of the existing process and systems, apart from the general capabilities that these types of business environments demand that shall be reflected in the T-Shaped HR skills set.

4th Stage: Evolving a skeletal CDB (Career Development Backlog). A backlog shall be created to support the career development training schedules and that is the best dynamic way for steering a career that helps the development plans with smaller increments that are easier to commit and implement as well. It shall be helpful to the HR leadership roles in the following ways like the following:



Fig: 7: Sample Multifaceted functional abilities that elicit outcome-based skillsets with-T-Shaped Training Levels: Source: Edison bond graphics. Recommended for academic purposes only.

The functional abilities of a salesman or marketing professional so far had been very core towards selling or marketing, but the sample training mapping with a T-Shaped model can deliver inputs that could elicit the best available skill components that are directly or indirectly related to or surrounding the single in-depth skill of marketing, wherein the employee can contribute more than one mode when hired for, which the modern-day organisations prefer. The above-suggested mode shall be initiated with the following steps to get optimal results, and they can be done by:

- a. Re-Prioritise the goals
- b. The critical areas of the focus time
- c. The utilisation of the Kanban or Scrum to manage backlogs
- d. Visualise and strategise the T-Shaping goals for every employee.
- e. To help improvise the T-Shape to an effective one.
- f. Creation of write up learning and development actions.
- g. Tasks to be completed on platforms like LinkedIn Learning.
- h. Setting up goals that specific skills or experiences during the time-based learning and development period.
- i. To analyse the completion stages.

Making T-Shape Operational

T-Shaped HR professionals can be an asset to organisations and they can articulate the new team or project that describes the areas to navigate as well as help solve complex problems. Steps to accelerate the T-Shape Developments are: Strategies to be implemented with bold leadership, to accelerate the T-Shape. Bold leadership qualities are to be expressive as part of the T-Shape developments.

Strategising with Bold Leadership mode

The leader when operating at the high uncertainty levels must be in a position to operate on the following agenda to keep the expectations of T-Shaped HR leaders high.

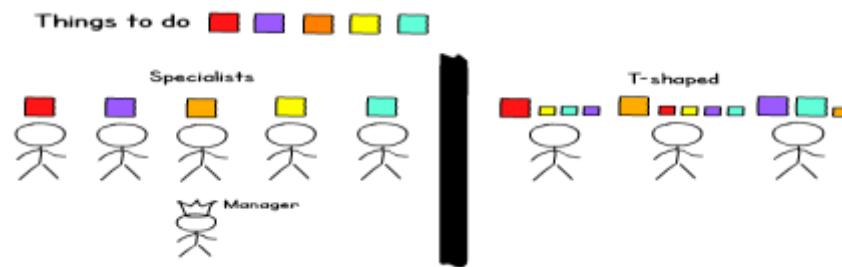


Fig: 8: Multifaceted functional abilities that elicit outcome-based skillsets with-Shaped Training Levels: Source: Developed by Author; Prof Dr C.Karthikeyan. Recommended for academic purposes only.

- Leaders need to strengthen their operational capabilities to handle uncertainty.
- Must concentrate on the context, since context is the key.
- Must strengthen the context setting.
- Capability to ensure talent creation.
- The Context needs to be taken care of then keeping control
- The creation of Autonomy needs to be concentrated than creating or existing over rules.
- Speaking regularly than keeping within self or being silent for long.
- Being simple than creating complexity
- Learning to stay ahead in the profession than going beyond or backward.

The other critical areas that the T-Shaped HR leaders shall take up is

- a. The leaders shall concentrate on the culture drift.
- b. They can choose the path of continuous learning.
- c. Putting a purpose to work and experimenting with continuous learning
- d. Inviting the iterative growth mindset
- e. Removing the bureaucratic-fixed mindset.
- f. Taking bold actions in the face of adversity and scale challenges and cultures.
- g. Leaders need to carry about the return on intelligence than a return on investment
- h. Leaders shall be redesigning workflows that are growth-led.
- i. Matching talents to the value additions.

All the above are possible when the HR leader as to how they interact and the levels of curiosity to learn. They are:

- **The curiosity to learn:** evolving as the world evolves.
- **The courage to unlearn:** the word ‘unworldly’ or ‘rewording’ means letting go of all the outdated ways of thinking and being open to new possibilities.
- **The clarity to focus:** building cultures where talent is empowered to solve the biggest problems.
- **The conviction to decide:** deciding future trends and their implications on strategy.
- **The compassion to care and co-create:** it is possible to win with empathy.

Agility, risk-taking, and reimagination occur in strategic, operational, information, and human capability choices. Satisficing, or making good enough choices, requires doing, learning, failing forward, and adapting quickly. Business and HR leaders who move quickly, even without perfect answers, can adjust and adapt to unknown and changing market conditions. Leadership questions include: What can we do now? Where do we start? How do we quickly learn from what works and what does not work?

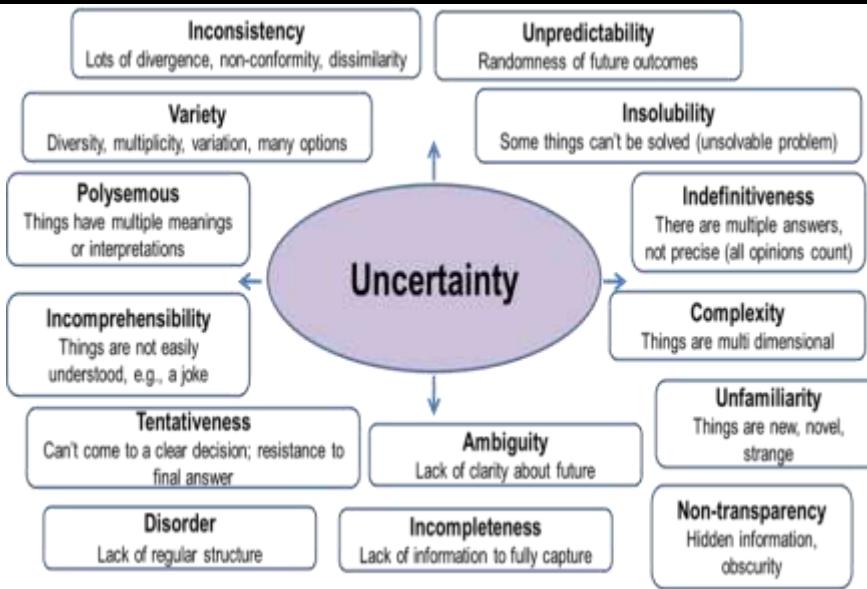


Fig: 9: Imaginary Diagram of Direction to move and method of envisioning for further actions. Source: www.infographics.com. Recommended for academic purposes only.

Conclusion:

This research study from the available literature reviews, research reports and other information received from schools are trying to resort to the following methods to improvise T-shaped HR leadership training. They are;

- Focusing more on the purpose of business meticulously rather than on profits alone, nevertheless, the outcome or bottom line is very important.
- Questioning the leadership as to how will the work help others to find meaning and purpose? How will the personal values be reflected in the organisation's purpose?
- Creating or envisioning a direction where the leaders shall establish a vision, mission or aspiration that creates meaning with an emotional bond for all the people affiliated with the organisation.
- Making a purpose prescribed as a step-by-step process that shall be accomplished by moving towards the desired direction for adapting as well as adjusting.
- Starting with smaller steps and adapting to the situations quickly, by asking what are the first steps that shall be taken to get started and who can adopt the idea early.
- Taking care of the organisation's purpose.
- Strategies to take care of the self:
 - Changing attitudes to positivity at all costs.
 - Taking care of health and psychological health.
 - Physically caring for self.

Some of the other actions could be:

- Pre-plan for the skill gaps to equip the organisation with requisite workforce skills.
- Planning on the areas of who, what and why of the reskilling programs.
- The reskilling programmes are to be greater or equal to the investments allocated for the training and development that also should bring in the contribution to the organisations.
- Conducting regular re-skilling programmes.



Fig: 10: Suggestive mode of Cross-Disciplinary Competence Development for deep discipline expertise.

Source: www.infographics.com. Recommended for academic purposes only.

- e. Ensuring strong skill-management practices.
- f. Looking ahead for the organisation in terms of growth and development.
- g. Redesigning of the jobs to encompass the different activities that can help employees develop new capabilities.
- h. Understanding the skill requirements and also conducting an assessment on the skill that is needed.
- i. Gaining the right skills that deliver results for the workforce.
- j. A building or reorienting of the partnerships that are required for building training capabilities.
- k. Employees in the company shall be trained to build training capabilities and partnerships.
- l. Structuring the learning journey to help employees retain new skills to apply where they want to improvise.
- m. Encouraging the employees to get training in a cohort of employees with similar experiences who are involved with the projects that shall be allowed to practice skills.
- n. Training employees on the combination of people skills/ soft skills / Social Skills as well as communication skills.
 - a. Leadership skills
 - b. Teamwork
 - c. Communication Skills
 - d. Problem-solving skills
 - e. Work Ethic
 - f. Flexibility/Adaptability
 - g. Interpersonal skills

Suggestions

The HR professionals are to understand the basics that shall build the unique qualities through T-Shaped HR training at the initial stages of education itself. The basic pillars for developing further from here needs to be laid as a foundation. Priority areas shall be on the communication areas, wherein the human resources are to be trained from the initial stages of education wherein they are to be trained to be a good communicator, and also to be psychologically trained to be ethical as well as improvise their abilities to improve their leadership qualities that can bring in the conflict management skills to solve problems. The other key competencies that can be assisting are effective communication; consultation; ethical practice; critical evaluation; business acumen; leadership and navigation; technical expertise; cross-cultural awareness, and relationship management. The ICT environment brought in by VUCA has improvised the mode of business operations in general and concerning HR training, the T-Shaped HR training modalities have occupied a special place in the training arena.

References

1. Johnston, D. L. (1978). Scientists Become Managers-The "T"-Shaped Man. *IEEE Engineering Management Review*, 6(3), 67–68. doi:10.1109/emr.1978.4306682
2. Fiore, Brittany. "Community-level data science and its spheres of influence: beyond novelty squared". eScience Institute. Retrieved 31 December 2018.
3. Schmidt, Sophie C.; Marwick, Ben (28 January 2020). "Tool-Driven Revolutions in Archaeological Science". *Journal of Computer Applications in Archaeology*. 3 (1): 18–32. doi:10.5334/jcaa.29.
4. Michels, David. "Going Pi-Shaped: How To Prepare For The Work Of The Future". Forbes.
5. Marco Iansiti (1993), "Real-world R&D: Jumping the product generation gap", *Harvard Business Review*, May-June, pp. 138–147.
6. IfM and IBM 2008, IfM and IBM. (2008). *Succeeding through Service Innovation: A Service Perspective for Education, Research, Business and Government*. Cambridge, United Kingdom: University of Cambridge Institute for Manufacturing, available at <http://www.ifm.eng.cam.ac.uk/ssme/>
7. Dorothy Leonard-Barton (1995), *Wellsprings of Knowledge: Building and Sustaining the Sources of Innovation*, Harvard Business School Press.
8. Colin Palmer (1990), "'Hybrids' — a critical force in the application of information technology in the nineties", *Journal of Information Technology*, volume 5, (1990) pp. 232-235
9. Alderman, Harold; Chiappori, Pierre Andre; Haddad, Lawrence; Hoddinott, John (1995). "Unitary Versus Collective Models of the Household: Time to Shift the Burden of Proof?". *World Bank Research Observer*. 10 (1): 1–19. doi:10.1093/bro/10.1.1.
10. Augsburg, Tanya (2005). *Becoming Interdisciplinary: An Introduction to Interdisciplinary Studies*. Kendall/Hunt.
11. Bagchi, Amiya Kumar (1982). *The Political Economy of Underdevelopment*. New York: Cambridge University Press.
12. Bernstein, Henry (1973). "Introduction: Development and The Social Sciences". In Henry Bernstein (ed.). *Underdevelopment and Development: The Third World Today*. Harmondsworth: Penguin. pp. 13–30.
13. Chambers, Robert (2001), "Qualitative approaches: self-criticism and what can be gained from quantitative approaches", in Kanbur, Ravi (ed.), *Qual-quant: qualitative and quantitative poverty appraisal - complementaries, tensions, and the way forward* (PDF), Ithaca, New York: Cornell University, pp. 22–25.
14. Chubin, D. E. (1976). "The conceptualization of scientific specialities". *The Sociological Quarterly*. 17 (4): 448–476. doi:10.1111/j.1533-8525.1976.tb01715.x.
15. Callard, Felicity; Fitzgerald, Des (2015). *Rethinking Interdisciplinarity across the Social Sciences and Neurosciences*. Basingstoke: Palgrave Macmillan.
16. Davies, M.; Devlin, M. (2007). "Interdisciplinary Higher Education: Implications for Teaching and Learning" (PDF). Centre for the Study of Higher Education, The University of Melbourne. Archived from the original (PDF) on 2 December 2007. Retrieved 7 November 2007.
17. Frank, Roberta: "Interdisciplinarity": The First Half-Century", *Issues in Integrative Studies* 6 (1988): 139-151, PDF
18. Frodeman, R.; Mitcham, C. (Fall 2007). "New Directions in Interdisciplinarity: Broad, Deep, and Critical". *Bulletin of Science, Technology & Society*. 27 (6): 506–514. doi:10.1177/0270467607308284. S2CID 145008466.
19. Franks, D.; Dale, P.; Hindmarsh, R.; Fellows, C.; Buckridge, M.; Cybinski, P. (2007). "Interdisciplinary foundations: reflecting on interdisciplinarity and three decades of teaching and research at Griffith University, Australia". *Studies in Higher Education*. 32 (2): 167–185. doi:10.1080/03075070701267228. S2CID 144173921.
20. Frodeman, R., Klein, J.T., and Mitcham, C. *Oxford Handbook of Interdisciplinarity*. Oxford University Press, 2010.
21. Granovetter, Mark (1985). "Economic Action and Social Structure: The Problem of Embeddedness" (PDF). *The American Journal of Sociology*. 91 (3): 481–510. doi:10.1086/228311. S2CID 17242802. Archived from the original (PDF) on 2 August 2014. Retrieved 25 October 2017.
22. Harriss, John (2002). "The Case for Cross-Disciplinary Approaches in International Development". *World Development*. 30 (3): 487–496. doi:10.1016/s0305-750x(01)00115-2.
23. Henry, Stuart (2005). "Disciplinary hegemony meets interdisciplinary ascendancy: Can interdisciplinary/integrative studies survive, and if so how?" (PDF). *Issues in Integrative Studies*. 23: 1–37.
24. Indiresan, P.V. (1990) *Managing Development: Decentralisation, Geographical Socialism And Urban Replication*. India: Sage
25. Jackson, Cecile (2002). "Disciplining Gender?". *World Development*. 30 (3): 497–509. doi:10.1016/s0305-750x(01)00113-9.
26. Jacobs, J.A.; Frickel, S. (2009). "Interdisciplinarity: A Critical Assessment" (PDF). *Annual Review of Sociology*. 35: 43–65. doi:10.1146/annual-soc-070308-115954.
27. Johnston, R (2003). "Integrating methodologists into teams of substantive experts" (PDF). *Studies in Intelligence*. 47 (1). Archived from the original (PDF) on 10 August 2006. Retrieved 8 August 2006.
28. Kanbur, Ravi (March 2002). "Economics, social science and development" (PDF). *World Development*. 30 (3): 477–486. doi:10.1016/S0305-750X(01)00117-6. hdl:1813/57796.
29. Kanbur, Ravi (2003), "Q-squared?: a commentary on qualitative and quantitative poverty appraisal", in Kanbur, Ravi (ed.), *Q-squared, combining qualitative and quantitative methods in poverty appraisal*, Delhi Bangalore: Permanent Black Distributed by Orient Longman, pp. 2–27, ISBN 9788178240534.
30. Kaplan Andreas (2021). Emerald (ed.). *Higher Education at the Crossroads of Disruption: the University of the 21st Century*.
31. Klein, Julie Thompson (1996) *Crossing Boundaries: Knowledge, Disciplinaries, and Interdisciplinaries* (University Press of Virginia)
32. Klein, Julie Thompson (2006) "Resources for interdisciplinary studies." *Change*, (Mark/April). 52–58

33. Kleinberg, Ethan (2008). "Interdisciplinary studies at the crossroads". *Liberal Education*. **94** (1): 6–11.
34. Kockelmans, Joseph J. editor (1979) *Interdisciplinarity and Higher Education*, The Pennsylvania State University Press ISBN 9780271038261.
35. Lipton, Michael (1970). "Interdisciplinary Studies in Less Developed Countries". *Journal of Development Studies*. **7** (1): 5–18. doi:10.1080/00220387008421343.
36. Yifang Ma, Roberta Sinatra, Michael Szell, Interdisciplinarity: A Nobel Opportunity, November 2018
37. Gerhard Medicus Interdisciplinarity in Human Sciences (Documents No. 6, 7 and 8 in English)
38. Ravallion, Martin (2003), "Can qualitative methods help quantitative poverty", in Kanbur, Ravi (ed.), Q-squared, combining qualitative and quantitative methods in poverty appraisal, Delhi Bangalore: Permanent Black Distributed by Orient Longman, pp. 58–67, ISBN 9788178240534
39. Rhoden, D. (2003). A multi-method analysis of the social and technical conditions for interdisciplinary collaboration.
40. Schuurman, F.J. (2000). "Paradigms Lost, paradigms regained? Development studies in the twenty-first century". *Third World Quarterly*. **21** (1): 7–20. doi:10.1080/01436590013198. S2CID 145181997.
41. Sen, Amartya (1999). *Development as freedom*. New York: Oxford University Press. ISBN 9780198297581.
42. Siskin, L.S. & Little, J.W. (1995). *The Subjects in Question*. Teachers College Press. about the departmental organization of high schools and efforts to change that.
43. Stiglitz, Joseph (2002) *Globalisation and its Discontents*, United States of America, W.W. Norton and Company
44. Sumner, A and M. Tribe (2008) *International Development Studies: Theories and Methods in Research and Practice*, London: Sage
45. Thorbecke, Eric. (2006) "The Evolution of the Development Doctrine, 1950–2005". UNU-WIDER Research Paper No. 2006/155. United Nations University, World Institute for Development Economics Research
46. Waldman, Amy (2003). "Distrust Opens the Door for Polio in India". *The New York Times*. Retrieved 4 November 2008.
47. Peter Weingart and Nico Stehr, eds. 2000. *Practising Interdisciplinarity* (University of Toronto Press)
48. Peter Weingart; Britta Padberg (30 April 2014). *University Experiments in Interdisciplinarity: Obstacles and Opportunities*. transcript Verlag. ISBN 978-3-8394-2616-6.
49. White, Howard (2002). "Combining Quantitative and Qualitative Approaches in Poverty Analysis". *World Development*. **30** (3): 511–522. doi:10.1016/s0305-750x(01)00114-0.
50. U.S. Army Heritage and Education Center (February 16, 2018). "Who first originated the term VUCA (Volatility, Uncertainty, Complexity and Ambiguity)?". USAHEC Ask Us a Question. The United States Army War College. Retrieved July 10, 2018.
51. Bennis, Warren; Nanus, Burt (1985). *Leaders: Strategies for Taking Charge*.
52. Stiehm, Judith Hicks; Nicholas W. Townsend (2002). *The U.S. Army War College: Military Education in a Democracy*. Temple University Press. p. 6. ISBN 978-1-56639-960-9.
53. Wolf, Daniel (2007). *Prepared and Resolved: The Strategic Agenda for Growth, Performance and Change*. dsb Publishing. p. 115. ISBN 978-0-9791300-0-7.
54. Rouvrais, Siegfried; Gaultier Le Bris, Sophie; Stewart, Matthew (July 2018). "Engineering Students Ready for a VUCA World? A Design-based Research on Decisiveness". *Proceedings of the 14th International CDIO Conference*, KIT, Kanazawa, Japan: 872–881. Archived from the original on 2018-08-28. Retrieved 2019-04-25. Alt URL

