

## Agenda

1. Understanding Knowledge Management
2. Importance of Knowledge Management
3. Knowledge and Change Management
4. Knowledge Management and Learning Organisation
5. Case Study of NASA
6. Knowledge-Based View



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## Understanding Knowledge Management

Knowledge management (KM) is a systematic approach to capturing, developing, sharing, and effectively using organisational knowledge.

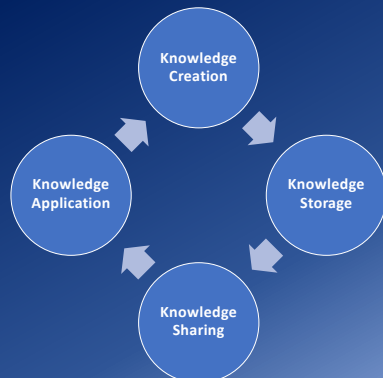
It encompasses a range of strategies and practices used in an organization to identify, create, represent, distribute, and enable the adoption of insights and experiences.

These insights and experiences can be embodied in individuals, embedded in processes or practices, and encapsulated in documents or repositories.



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## Understanding Knowledge Management



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## Importance of Knowledge Management in Organizations



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## Importance of Knowledge Management in Organizations

### 1. Enhancing Decision-Making Capabilities:

- a) **Rapid Access to Information:** KM systems allow quick retrieval of necessary information and expertise, enabling faster decision-making and response to critical situations.
- b) **Informed Decisions:** By having comprehensive knowledge resources, decision-makers can avoid repeating past mistakes and leverage existing knowledge to make informed, effective choices.



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## Importance of Knowledge Management in Organizations

### 2. Increased Efficiency and Productivity:

- a) **Streamlined Processes:** By organising knowledge and making it accessible, employees spend less time searching for information and more time using that information to execute tasks and solve problems.
- b) **Reduced Redundancy:** Avoid duplicating work by having a clear understanding of existing knowledge and ongoing efforts within the organisation.



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## Importance of Knowledge Management in Organizations

### 3. Innovation and Growth:

- a) **Fostering Innovation:** KM encourages the sharing of ideas and can lead to new thinking and innovative approaches to both routine and complex problems.
- b) **Sustained Competitive Advantage:** Effective knowledge management can help an organisation hold and build on its competitive edge through continuous learning and adaptation.



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## Importance of Knowledge Management in Organizations

### 4. Preserving Intellectual Capital:

- a) **Retaining Knowledge:** Organizations risk losing intellectual assets when employees leave or retire. KM helps capture tacit knowledge (personal know-how that resides in employees' minds) and makes it explicit for others to use.
- b) **Building a Learning Organization:** KM supports the development of a learning culture where knowledge enhancement and sharing are encouraged, helping to retain critical knowledge within the company.



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## Importance of Knowledge Management in Organizations

### 5. Enhancing Employee Training and Development:

- a) **Easier Onboarding:** New employees can access historical and procedural knowledge stored in KM systems, reducing the learning curve and time to productivity.
- b) **Continuous Learning:** Employees have opportunities for continual learning and skill improvement, as knowledge resources are readily available and up-to-date.



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## Importance of Knowledge Management in Organizations

### 6. Improving Customer Service and Satisfaction:

- a) **Consistency in Service:** KM ensures that all customer-facing agents have the same accurate and comprehensive information, leading to consistent service experiences.
- b) **Rapid Response:** Quick access to knowledge allows faster resolutions to customer inquiries and problems, enhancing overall customer satisfaction.



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## Importance of Knowledge Management in Organizations

### 7. Risk Management and Compliance:

- a) **Managing Risks:** With a sound KM system, organisations can better manage risks by ensuring that important information is readily available and lessons learned are applied.
- b) **Regulatory Compliance:** KM helps maintain detailed archives of decision-making processes and actions taken, which are crucial for meeting compliance and regulatory requirements.



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## Knowledge and Change Management



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## The Role of Knowledge in Change Management

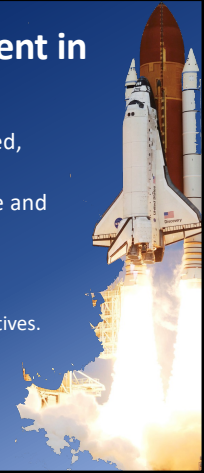
- **Integration:** Knowledge supports decision-making in change management.
- **Anticipation and Risk Management:** Knowledge is used to foresee potential challenges and plan solutions.
- **Stakeholder Engagement:** Informing and involving relevant stakeholders through effective knowledge dissemination.



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## Strategies for Knowledge Management in Change Processes

- **Knowledge Audits:** Identifying what knowledge is needed, available, and missing.
- **Communities of Practice:** Encouraging groups that share and develop knowledge around change management.
- **Learning Before, During, and After:**
  - Conducting lessons learned and after-action reviews.
  - Using past change management projects to inform new initiatives.
- **Technology Tools:**
  - Knowledge databases.
  - Collaboration tools like Intranets or specialized software.



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## Knowledge Management and Learning Organisation

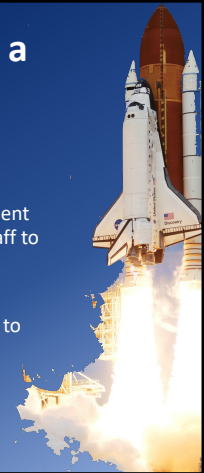


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## Knowledge Management can create a Learning Organization

### 1. Cultivating a Culture of Continuous Learning and Improvement

- Encouraging Learning at All Levels:** KM fosters an environment where learning is embedded in daily tasks. It encourages staff to share knowledge, learn from each other's experiences, and continuously seek improvement.
- Rewarding Knowledge Sharing:** By rewarding contributions to knowledge systems and participation in learning activities, organizations incentivize their employees to engage in continuous learning and knowledge sharing.



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## Knowledge Management can create a Learning Organization

### 2. Facilitating Information Sharing Across the Organization

- a) **Breaking Down Silos:** KM systems help break down departmental silos by enabling the flow of information across the organization. This cross-functional sharing fosters interdisciplinary learning and a broader understanding of the organization.
- b) **Creating Knowledge Repositories:** Centralized databases and document management systems ensure that valuable organizational knowledge is stored and accessible to all employees, facilitating learning and preventing knowledge loss.



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## Knowledge Management can create a Learning Organization

### 3. Supporting the Creation of New Knowledge

- a) **Communities of Practice:** KM encourages the formation of communities of practice (CoPs), which are groups of people who share a concern or a passion for something they do and learn how to do it better through regular interaction.
- b) **Idea Management Systems:** Platforms that capture innovative ideas contribute to creating new knowledge by leveraging the collective intelligence of the organization.



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## Knowledge Management can create a Learning Organization

### 4. Implementing Learning Before, During, and After Activities

- a) **Learning Before Doing:** KM practices involve reviewing existing knowledge before starting new projects or initiatives, ensuring that lessons from past experiences are learned and mistakes are not repeated.
- b) **Learning While Doing:** Real-time knowledge sharing and collaboration during project execution help adapt and make informed decisions as challenges arise.
- c) **Learning After Doing:** Conducting post-mortem reviews or after-action reviews to capture lessons learned ensures that knowledge gained from each project is documented and made available for future efforts.



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## Knowledge Management can create a Learning Organization

### 5. Enabling Faster Decision Making and Problem Solving

- a) **Quick Access to Expertise:** Advanced KM systems, including expert directories and decision support tools, enable employees to access needed expertise and make informed decisions quickly, enhancing their ability to respond to changing conditions and solve problems efficiently.



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## Knowledge Management can create a Learning Organization

### 6. Leveraging Technology for Enhanced Learning

- a) **Digital Learning Platforms:** E-learning systems and online training modules facilitated by KM technologies help in standardizing training and development efforts across the organization.
- b) **Analytics and Artificial Intelligence:** KM systems integrated with AI can analyze data patterns to provide insights, suggest learning content, and identify gaps in knowledge, thus supporting personalized learning paths.



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## Knowledge Management can create a Learning Organization

### 7. Developing Leadership and Mentoring

- a) **Mentorship Programs:** KM supports the implementation of mentorship where experienced employees impart their knowledge to newer or less experienced staff, thus fostering a culture of developmental relationships.
- b) **Leadership Development:** KM ensures that leadership knowledge and experiences are captured and shared, thus preparing the next generation of leaders by providing access to decades of accumulated wisdom.



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## Case Study - NASA



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## Context

- Downsizing through attrition and buyouts had resulted in an imbalance in NASA skill sets
- In 2002, 40% of the workforce eligible for retirement
- Budgets were reduced, but mission parameters increased
  - Workforce stretched to meet targets
  - Multiple mission failures
- **In 2000, US Congress recommends KM to reduce risk of failure**



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## The Dilemma

- Legacy KM tools were IT-based systems
  - Internet-based databases and portals easy to pitch & obtain funds (\$200k to \$500k)
  - No avenue for mentorship or training/sharing of tacit knowledge
- Continue with IT-based systems?
  - Senior managers comfortable
  - Systems in place
- Change the knowledge-sharing culture at NASA?
  - Higher budget requirement (\$2Mn to \$5Mn) with no guarantee on ROI
  - NASA was \$4Bn overbudget on International Space Station



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## Lessons from the Past

- Apollo Missions
  1. Performance
  2. Schedule
  3. Cost
- Shuttle Program
  - Cost control
  - Resisted technology advancement
  - Commercial business practices
  - Private contractor oversight



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## Lessons from the Past

- Shuttle flight was declared operational under duress
  - Annual launch schedule of 24 flights by 1990
- Jan 1986, Shuttle Challenger exploded.
  - All seven crew members died.
  - Failure of O-Ring
- Hubble launched with defects in 1990.
  - Could have been prevented



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## Faster, Better, Cheaper

- Goldin era – 1992 to
  - Reduced workforce by 28%
  - Outsourced operations with a freeze on hiring
  - Moved towards smaller and less expensive projects
    - Reduce the risk of failure
    - Increase creativity and diversity
    - More successful projects to regain confidence and public support
- **Faster:** Mars projects every 26 months
- **Better:** Open to interpretation
- **Cheaper:** Projects scrapped if off-budget by 15%



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## Faster, Better, Cheaper

- 1997 - \$260 Mn Mars Pathfinder – success
  - Overconfidence in team
  - Managed by JPL



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## Result of Success

- From 1992 to 2000, out of 16 FBC missions, six failed
  - Due to FBC, projects at JPL jumped 10x
  - Forced to onboard junior, inexperienced staff in senior positions
  - 80 to 90 workweeks became the norm
  - “Dot-gone syndrome”
  - Lack of oversight by Senior Experienced members
- Shortchanging the Future
- Using (Ignoring) the Past



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## KM Initiative

- 40-member team led by Holm setup in Jan 2000
  - Strategic plan & implementation
- Cultural change required
  - The NASA centres competed for resources – privatized knowledge
  - Transfer knowledge across missions & generations - missions last for over 50 years
  - Transfer knowledge across national boundaries – political ramifications
  - Curate knowledge on the web – develop next gen engineers



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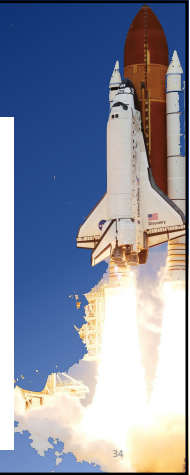
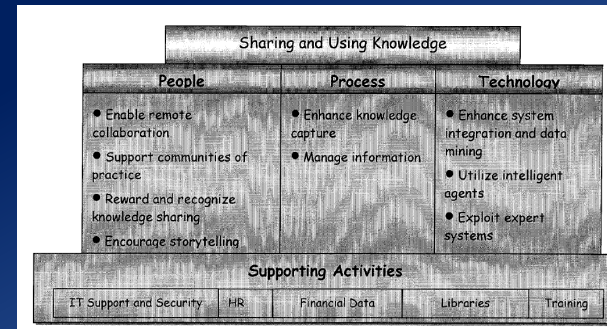
## KM Cornerstones

- “Knowledge Management is getting the right information to the right people at the right time, and helping people create knowledge and share and act upon information in ways that will measurably improve the performance of NASA and its partners”
- Major stakeholders
  - Congress – Controls budget
  - Taxpayers – Failures and technical tragedies affect PR & Congress
- The knowledge architecture addresses:
  - Services
  - Processes
  - Systems



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## KM Cornerstones



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## KM Cornerstones

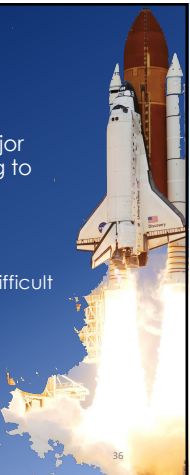
- Process of making relevant information available quickly and easily for people to use productively
  - Helping people *capture* key knowledge for reuse (creating a knowledge-sharing culture)
  - Helping people work together to *develop* knowledge (individual & group support)
  - Helping people *organize* and catalogue knowledge
  - Helping people *distribute* and find knowledge
  - Infrastructure to make this work



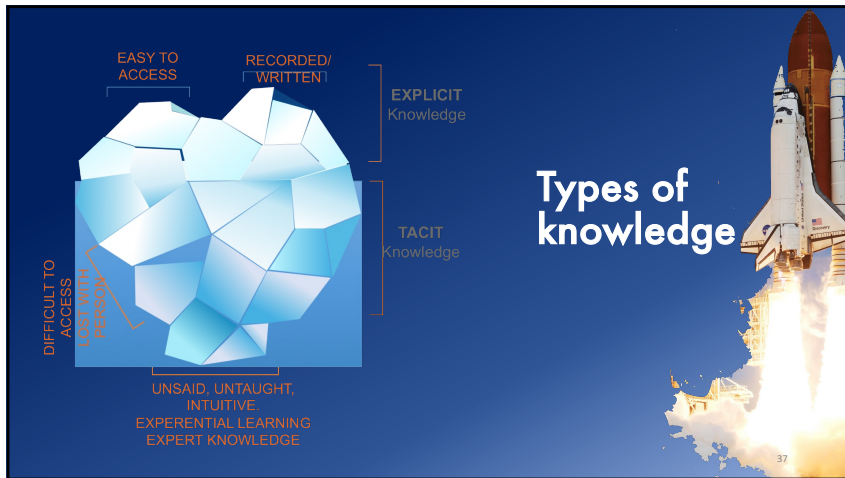
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## Types of knowledge

- Explicit knowledge and tacit knowledge are the two major types of knowledge that firms can observe when seeking to achieve competitive advantage
  - An individual develops tacit knowledge by action and experience
  - Tacit knowledge is implicit in nature and operates on a subconscious level within each individual, making it very difficult to articulate and disseminate across the organization
  - Explicit knowledge represents information that can be articulated, documented, formalized, and therefore systematically shared



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## Types of knowledge

- Because all organizational knowledge originates as tacit knowledge at some point and because tacit knowledge is most inimitable and immobile, KBV recognizes tacit knowledge as the primary strategic resource of the firm.

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## KM Initiative

- The Lessons Learned Information Systems (LLIS)
  - Encourage storytelling and recognize people for sharing knowledge; sharing of success and failures
  - Irrelevant entries; fear of acknowledging failure
- Web-based portal
  - Providing access to experts through integrated directories
- Academy of Program and Project Leadership (APPL)
  - Training & mentorship – classes, team-targeted training, just-in-time online learning, community of practice

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# Capturing Knowledge

- Standards** (<http://step.jpl.nasa.gov>)
  - Advocates and adopts standards for core metadata, name spaces, and engineering models (STEP)
- Documentation and Data Management**
  - Goal is to support the entire lifecycle of project information
  - Currently provides Project Libraries (Xerox's Docushare software) to 6500 users and 75 organisations
  - Moving to an electronic archive and integrated authoring environment
- Knowledge Navigation**
  - Using portals, taxonomies, and enhanced searching to help gather information for individuals and communities
- Knowledge Capture Studies**
  - Investigating how teams create, capture, and share knowledge
- Expert Connections**
  - Helps to find people with the answers, includes profiles of ~1100 technical experts

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# IS Architecture

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# Knowledge Navigation

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# Expert Connection

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# Capturing Knowledge

**Knowledge Management Roadmap**

**Sharing Knowledge**

- Adaptive knowledge infrastructure is in place
- Knowledge resources identified and shared appropriately
- Timely knowledge gets to the right person to make decisions through archiving
- Intelligent tools for authoring
- Collective knowledge development between NASA, its partners, and customers

**Enables sharing of essential knowledge to complete Agency tasks**

- International Space Station
- MarsNet
- Mars Exploration Rovers
- Space Interferometry Mission

**Integrating Distributed Knowledge**

- Instrument design is semi-automatic based on knowledge repositories
- Mission software auto-installs based on unique mission parameters
- PM principals are part of NASA culture and supported by layered COTS products
- Remote data management allows spacecraft to self-command

**Enables seamless integration of systems throughout the world and with robotic spacecraft**

- Kepler (galactic survey)
- JAXA/CX (spacecrafting)
- Phoenix to Mars
- Constellation Program

**Capturing Knowledge**

- Knowledge gathered anywhere from hand-held devices, using standard formats on interplanetary Internet
- Expert systems on spacecraft analyze and upload data
- Autonomous agents generate services creating advice and telemetry products
- Industry and academia supply spacecraft parts based on collaborative designs derived from NASA's knowledge system

**Enables capture of knowledge at the point of origin, human or robotic, without invasive technology**

- Mars robotic outposts
- Constellation Program
- Terrestrial Planet Finder

**Modeling Expert Knowledge**

- Systems model experts' patterns and behaviors to gather knowledge implicitly
- Semantic knowledge exchange with robotic explorers
- Planetary explorers contribute to their successor's design from experience and profiles
- Knowledge systems collaborate with experts for new research

**Enables real-time capture of tacit knowledge from experts on Earth and in permanent outposts**

- Interstellar missions
- Permanent lunar and Martian colonies

Timeline: 2003, 2007, 2010, 2025

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# Lessons Learned

- Enlist, encourage, empower (baptize the evangelists)
- Develop solutions, services, and rewards
  - Deliver specific solutions to specific customers
  - Build KM into the way people already do their jobs
  - Understand that cultural acceptance is key
  - Make services operational (including funding and metrics)
  - Reward knowledge sharers through promotions, recognition, and time to learn and share
  - Recognize and celebrate contributions of the KM team and others
- Keep the alliances strong
- Balance long-term desires (capturing knowledge) with local requirements (specific solutions to a problem)
- Don't try to solve the whole problem-just start somewhere and solve part of the problem

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# Lessons Learned

- KM and Business Drivers**
  - When selecting a KM solution to implement, it needs to be tied to the core issues and business drivers for that firm
  - KM solutions are not "one-size-fits-all" and need to be tailored for each organization
- Stock and Flow**
  - Knowledge is sticky...
  - Without processes (and a system) it won't flow
  - Knowledge depreciates with time

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# Lessons Learned

- The need to manage knowledge**
- Because we have to:
  - Cost savings and growth to deal with competition
  - Create differentiation based on knowledge
  - Work faster and agile to keep up with change
- Because we can:
  - Rise of IT/communication technology
  - Mature, proven strategies to motivate behaviour change
  - Better understanding of how to make knowledge flow

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## Lessons Learned

### • Objectives of Knowledge Management

- Mitigate enterprise risk by protecting critical knowledge
- Increasing operational efficiencies by making knowledge accessible and encouraging its reuse
- Support employee learning and development
- Use product, process, customer or market information to improve offerings and better serve customers.



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## Lessons Learned

### • Knowledge Management Approaches

- **Process approach:** attempts to organize knowledge (explicit) through formalized controls, processes and technologies
  - Content management for text/video
  - After action review or lessons learned processes
  - Transfer of best practices
- **Practice approach:** focuses on building the social environment necessary to facilitate the sharing of knowledge (tacit)
  - Communities of practice
  - Enterprise social networking
  - Knowledge retention and transfer
  - Virtual collaboration



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## Lessons Learned

### • Knowledge Management Enablers

- Knowledge is embedded and carried through multiple entities including
  - Organizational culture and identity
  - Policies
  - Routines
  - Documents & systems
  - Employees



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## Knowledge Based View



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## Building on RBV

- Building upon RBV, the knowledge-based view of the firm highlights the strategic importance of a specific type of resource, knowledge
- Whereas RBV treats a wide variety of resource types in a generic fashion, KBV recognises that knowledge is maintained by individuals, not by organizations, and can take the form of either tacit or explicit knowledge



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## Assumptions of KBV

- Knowledge-based resources hold the most strategic significance in firms.
- Production activities and processes in firms involve knowledge application.
- Individuals rather than organizations are responsible for creating, holding, and sharing knowledge.



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## Assumptions of KBV

- The incapability of markets to coordinate specialized knowledge necessitated the existence of firms, with management playing the coordination roles within the firms.
- Knowledge-based resources are characterized by difficulty of imitation and social complexities.
- Knowledge draws strategic significance from its appreciative value as opposed to other traditional factors of production, which depreciate.



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