सत्यमेव जयते
Ministry of AYUSH

AYUSH INNOVATION READINESS FRAMEWORK

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About the AIR Framework

- Innovators and startups utilize this framework for self-assessment, development planning, milestone establishment and investment readiness demonstration.
- Research institutions apply it for program positioning, collaboration identification, capability development and impact measurement.
- Funding bodies and investors employ it for objective evaluation, risk assessment, portfolio management and milestone-based funding structures.
- Regulatory agencies use it for pathway determination, oversight planning, approval sequencing and compliance validation.
- Healthcare systems apply it for technology adoption decisions, integration planning, quality assurance and outcome optimization.
- Manufacturing organizations utilize the framework for capability assessment, production planning, quality system development and supply chain optimization.
- Service providers employ it for delivery system design, quality assurance, scalability planning and continuous improvement.
- Educational institutions apply it for curriculum development, training program design, competency assessment and institutional capability building.

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FOREWORD

It is with great pride that we present the **AYUSH Innovation Readiness Framework (AIR Framework)**—a comprehensive and unified methodology for assessing innovation maturity across Ayurveda, Yoga, Unani, Siddha, and Homeopathy (AYUSH) systems. This pioneering framework marks a significant step in aligning traditional knowledge systems with contemporary innovation and commercialization standards.

In an era where healthcare challenges are increasingly complex, the AIR Framework provides a robust structure for innovators, researchers, and entrepreneurs to evaluate technology development, manufacturing readiness, and service delivery capability. Its integrated approach—spanning Technology Readiness Levels (TRL), Manufacturing Readiness Levels (MRL), and Service Readiness Levels (SRL)—enables stakeholders to navigate the path from concept to commercialization with clarity and confidence.

This document aims to support **startups, research institutions, regulatory bodies, funding agencies, healthcare providers, and educational institutions** in making evidence-based decisions, fostering collaboration, and ensuring that AYUSH innovations achieve scalable impact while upholding quality, safety, and authenticity.

At the **All India Institute of Ayurveda**, we remain committed to driving excellence in research, innovation, and education. We believe this framework will serve as a cornerstone for creating globally competitive AYUSH solutions that contribute to health, wellness, and economic growth.

I extend my appreciation to the core committee members, partner institutions, and domain experts who contributed to the creation of this standard. Their collective vision and expertise have made it possible to deliver a framework that is practical, globally relevant, and deeply rooted in the principles of traditional medicine.

We hope that this document will inspire innovators, guide policymakers, and empower the entire AYUSH ecosystem to work towards **a future where evidence-based traditional medicine thrives on the global stage.**

18/9/25

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1. PURPOSE, SCOPE AND APPLICATION

1.1 Framework Objective

This framework establishes a unified assessment methodology for evaluating innovation maturity across traditional medicine commercialization through three integrated readiness dimensions. The Technology Readiness Level measures product and technology development from concept through market deployment. The Manufacturing Readiness Level evaluates industrial capability and production scalability for commercial success. The Service Readiness Level assesses service delivery capability and market readiness. Together, these three scales provide comprehensive maturity assessment for any innovation within the AYUSH domain, enabling objective evaluation, strategic planning and informed investment decisions.

The framework serves as the authoritative reference for innovation assessment, funding allocation, regulatory pathway determination and commercialization planning within the traditional medicine sector. It addresses the unique characteristics of AYUSH commercialization while maintaining alignment with international readiness assessment standards used across innovation sectors globally.

1.2 Innovation Focus and Commercial Applicability

This standard applies to all innovations, products, services, systems and market solutions developed for commercialization within or derived from traditional medicine systems. The framework specifically addresses market-oriented innovations including commercial pharmaceutical and therapeutic products, consumer health and wellness solutions, professional services and knowledge delivery, agricultural and environmental applications, manufacturing and production services, and digital technology, platform solutions and biotech convergence.

The framework accommodates innovations at any stage of commercialization, from early concept development through market launch and scaling. It recognizes that traditional medicine innovations often integrate multiple market segments and business models, requiring flexible assessment methodologies that capture commercial complexity while maintaining evaluation precision for investor and stakeholder decision-making.

To eliminate classification ambiguity, each innovation is categorized based on its primary business model and revenue source. When innovations have multiple applications, classification follows a clear hierarchy based on primary market served, primary value proposition delivered and primary revenue model employed. This approach ensures mutually exclusive categories while maintaining comprehensive coverage of the Ayush innovation landscape.

1.3 Stakeholder Application

Innovators and startups utilize the framework for self-assessment, development planning, milestone establishment and investment readiness demonstration. Research institutions apply it for program positioning, collaboration identification, capability development and impact measurement. Funding bodies and investors employ it for objective evaluation, risk assessment, portfolio management and milestone-based funding structures. Regulatory agencies use it for pathway determination, oversight planning, approval sequencing and compliance validation. Healthcare systems apply it for technology adoption decisions, integration planning, quality assurance and outcome optimization.

Manufacturing organizations utilize the framework for capability assessment, production planning, quality system development and supply chain optimization. Service providers employ it for delivery system design, quality assurance, scalability planning and continuous improvement. Educational institutions apply it for curriculum development, training program design, competency assessment and institutional capability building.

2. INNOVATION THEMATIC CATEGORIES

INNOVATION THEMATIC CATEGORIES are distinct, mutually exclusive commercial classification domains that systematically organize AYUSH innovations based on their primary business model, revenue generation mechanism and target market focus. These categories serve as the foundational organizational structure for applying the integrated TRL-MRL-SRL assessment framework to traditional medicine commercialization.

Innovation Thematic Categories represent a comprehensive taxonomic system that:

- Classifies all Ayush innovations into six distinct domains based on primary business characteristics
- Eliminates assessment ambiguity through mutually exclusive category boundaries
- Enables appropriate application of Technology, Manufacturing and Service Readiness Level scales
- Facilitates consistent evaluation criteria application across different innovation types
- Supports strategic planning and resource allocation decisions for commercialization

Functional Purpose

The Innovation Thematic Categories serve as:

- 1. Assessment Gateway - Determines which readiness scales (TRL, MRL, SRL) apply and at what intensity
- 2. Classification System - Provides unambiguous categorization for consistent framework application
- 3. Strategic Planning Tool - Guides development pathway selection and milestone establishment
- 4. Communication Standard - Creates common language for stakeholders across and beyond the AYUSH innovation ecosystem
- 5. Evaluation Framework - Ensures appropriate assessment criteria and evidence requirements application
- 6. Software platforms, digital technology solutions and biotech convergence applications serving AYUSH stakeholders

The AYUSH Innovation Readiness Framework organizes all AYUSH innovations into six mutually exclusive Innovation Thematic Categories:

Category 1: Clinical Therapeutics and Medical Solutions- Healthcare provider-focused innovations requiring clinical expertise

Category 2: Consumer Health and Wellness Products - Direct-to- consumer products for personal health and wellness use

Category 3: Professional Services and Knowledge - Solutions Expertise delivery and knowledge transfer services to Ayush professionals

Category 4: Agricultural and Environmental Applications Farming, food processing, and agricultural input innovations

Category 5: Manufacturing and Production Services - B2B manufacturing and production services for AYUSH companies

Category 6: Digital Technology, Platform Solutions and Biotech Convergence for AYUSH Sector

2.1 Clinical Therapeutics and Medical Solutions

This category encompasses all commercial product and service innovations where the primary business model involves developing offerings for direct patient treatment, diagnosis, or clinical care delivered through healthcare providers. The defining characteristic is that healthcare professionals serve as the primary customers and decision-makers, with revenue generated through professional healthcare channels rather than direct consumer sales.

Innovation scope within this category includes prescription pharmaceuticals and medicines requiring practitioner supervision, medical devices requiring clinical expertise for operation, diagnostic tools used by healthcare professionals, clinical treatment protocols and therapeutic services, surgical instruments and procedures based on traditional approaches and clinical-grade therapeutic equipment designed for professional use. These innovations typically require regulatory approval through pharmaceutical or medical device pathways and involve clinical validation studies demonstrating safety and efficacy.

Product development priorities focus on clinical effectiveness and safety validation, regulatory compliance and approval pathway navigation, integration with existing healthcare systems and workflows, practitioner adoption and training requirements and reimbursement and payment model development. The commercial pathway typically involves lengthy development timelines due to regulatory requirements, significant clinical validation investments and complex healthcare market dynamics.

Revenue models center on sales to healthcare providers, hospitals, clinics and healthcare systems, with potential for reimbursement through insurance or government healthcare programs. Professional service fees, licensing arrangements with healthcare institutions and outcome-based payment models represent additional revenue streams. Market access requires building relationships with key opinion leaders, healthcare administrators and regulatory bodies while demonstrating clinical value and economic benefits.

Assessment within this category emphasizes clinical innovation significance and therapeutic value, regulatory compliance and approval pathway clarity, clinical evidence quality and validation standards, healthcare provider acceptance and adoption potential, integration capability with existing healthcare infrastructure and commercial viability within healthcare payment systems. Evidence requirements include clinical efficacy and safety data, regulatory submission materials, healthcare provider validation studies, market research within healthcare segments and business model validation for healthcare markets

2.2 Consumer Health and Wellness Products

This category addresses commercial innovations where the primary business model involves developing and selling products directly to consumers for self-care, wellness, prevention, or lifestyle enhancement. The distinguishing factor is direct consumer purchase decision-making, with revenue generated through retail distribution, e-commerce platforms and direct-to-consumer channels rather than through healthcare professional intermediaries.

Innovation areas encompass over-the-counter health supplements and nutraceuticals, consumer wellness and beauty products incorporating traditional ingredients, home-use health and wellness devices designed for non-professional operation, fitness and yoga equipment and accessories, consumer food and beverage products with health benefits, and personal care and cosmetic products based on traditional formulations. These products typically require consumer product safety validation and may need dietary supplement (FSSAI) or cosmetic regulatory compliance rather than pharmaceutical approval.

Product development focuses on consumer appeal and market positioning, quality and safety standards appropriate for consumer markets, convenience and ease of use optimization, branding and marketing differentiation strategies and retail and e-commerce distribution channel development. The commercial pathway emphasizes consumer research, brand building, retail relationships and marketing communications rather than clinical validation and healthcare provider education.

Market segments include health-conscious consumers seeking natural alternatives, beauty and personal care markets emphasizing traditional and natural ingredients, fitness and wellness enthusiasts interested in traditional approaches, stress management and mental wellness markets, and luxury and premium wellness product segments. Distribution strategies encompass retail partnerships with health stores and pharmacies, e-commerce platforms and direct-to-consumer sales, subscription and auto-delivery models, influencer and social media marketing, and international market expansion with appropriate localization.

Assessment emphasizes consumer market appeal and purchase intent, product quality and safety standards for consumer use, brand strength and competitive positioning, distribution channel effectiveness and retail partnerships, regulatory compliance for consumer products, and financial performance potential including profitability and scalability. Evidence requirements include consumer market research and validation studies, product safety and quality documentation, brand recognition and consumer preference data, retail and distribution agreements, and financial projections based on consumer market dynamics.

2.3 Professional Services and Knowledge Solutions

This category encompasses innovations where the primary business model involves delivering knowledge, training, consultation, or professional services to practitioners, institutions, or organizations within the AYUSH ecosystem. Revenue generation centers on expertise delivery and knowledge transfer rather than physical product sales or digital platform operations.

Service innovation includes healthcare service delivery and clinical practice management, professional training and certification program development, consulting and advisory services for institutions and organizations, educational content and curriculum development for professional audiences, practice management and professional support services, and quality assurance and compliance services for AYUSH organizations. These services typically leverage deep traditional medicine expertise and focus on knowledge transfer, capability building and professional development.

Service delivery model development prioritizes client relationship management and professional credibility establishment, customization and personalization for diverse professional needs, quality assurance and outcome measurement for service effectiveness, scalability through systematized service delivery approaches, and continuous improvement based on client feedback and professional evolution. Success requires building reputation within professional communities, demonstrating measurable outcomes and value creation, and maintaining current expertise as traditional medicine practices evolve.

Revenue models include professional service fees charged hourly, daily, or per project, consultation charges for expert advice and guidance, training program fees for educational services, licensing fees for educational content and methodologies, subscription services for ongoing professional support, and outcome-based fees tied to measurable results and value creation.

Assessment focuses on service innovation significance and professional value creation, market demand and professional community acceptance, service quality and outcome measurement effectiveness, scalability potential and systematic delivery capability, professional credibility and expertise validation, and business model sustainability and growth potential. Evidence requirements include professional validation and testimonials, service outcome measurement and effectiveness data, professional community recognition and endorsements, business model validation and financial sustainability demonstration and competitive positioning within professional service markets.

2.4 Agricultural and Environmental Applications

This category addresses commercial innovations where the primary business model involves developing and selling products or services specifically for agricultural production, farming operations, environmental conservation, or food processing applications. The key distinguishing factor is that farmers, agricultural businesses and food processors serve as the primary customers, with products and services designed to improve agricultural outcomes rather than direct human health applications.

Innovation scope includes agricultural inputs such as bio-fertilizers, bio-pesticides and soil amendments based on traditional principles, farming equipment and agricultural technology incorporating traditional methods, crop protection and plant health products derived from traditional knowledge, agricultural extension and farming advisory services, food processing and preservation technologies using traditional approaches and environmental conservation and restoration products for agricultural applications.

Product development priorities encompass agricultural effectiveness and yield improvement validation, environmental sustainability and organic certification compliance, farmer adoption and ease of use considerations, cost-effectiveness and return on investment demonstration for agricultural customers, and supply chain development for consistent product availability. The commercial pathway typically involves agricultural trials, farmer validation studies, regulatory approval for agricultural inputs and building relationships with agricultural distribution channels.

Market opportunities encompass organic and sustainable agriculture sectors seeking natural input alternatives, precision agriculture markets interested in traditional method integration, specialty crop and premium agricultural product markets, export markets for traditional and organic products, and agritourism and farm-to-table market development. Success requires understanding agricultural market dynamics, seasonal demand patterns, and farmer decision-making processes.

Assessment emphasizes agricultural innovation effectiveness and sustainability impact, market demand within agricultural sectors and farmer adoption potential, environmental benefits and sustainability validation, competitive positioning within agricultural input markets, regulatory compliance and certification achievements, and commercial viability and scalability within agricultural markets. Evidence requirements include agricultural trial results and farmer validation studies, environmental impact assessments and sustainability metrics, market research within agricultural segments, regulatory compliance documentation, and financial projections based on agricultural market dynamics.

2.5 Manufacturing and Production Services

This category encompasses innovations where the primary business model involves providing manufacturing, production, quality control, or supply chain services to other businesses within the AYUSH sector. The distinguishing characteristic is that other AYUSH companies and organizations serve as customers, with revenue generated through business-to-business manufacturing and production services rather than end-product sales to consumers or healthcare providers.

Service scope includes contract manufacturing and production services for AYUSH pharmaceuticals and products, quality control and analytical testing services for traditional medicine companies, supply chain and logistics services specialized for AYUSH industry requirements, manufacturing equipment and technology development for traditional medicine production, process development and optimization services for scaling traditional preparation methods, and regulatory compliance and validation services for manufacturing operations.

Manufacturing technology development focuses on traditional preparation method modernization and scaling, green chemistry and sustainable manufacturing approaches adapted for traditional medicine production, automation and digitization of manufacturing processes while maintaining traditional method integrity, quality assurance and batch consistency optimization for traditional formulations, and regulatory compliance and good manufacturing practice implementation. These innovations bridge traditional preparation methods with modern manufacturing requirements and standards.

Revenue models center on manufacturing service fees based on production volume and complexity, testing and analytical charges for quality control services, equipment sales and technology licensing for manufacturing solutions, consulting fees for process development and optimization services and long-term partnership arrangements with AYUSH companies requiring ongoing manufacturing support.

Assessment focuses on manufacturing innovation significance and efficiency improvement potential, technology scalability and cost-effectiveness for AYUSH applications, quality system robustness and regulatory compliance capability, supply chain reliability and risk management effectiveness, competitive advantage and intellectual property protection, and commercial viability and market demand for specialized manufacturing services. Evidence requirements include manufacturing capability demonstrations and quality certifications, technology validation and efficiency improvement documentation, regulatory compliance records and certifications, client testimonials and service validation data, and financial performance and business sustainability metrics.

2.6 Digital Technology, Platform Solutions and Biotech Convergence

This category encompasses innovations where the primary business model involves developing and operating digital platforms, software applications, AIML, automation, biotech convergence applications or technology solutions that serve multiple stakeholders within the AYUSH ecosystem. The defining characteristic is that technology and digital platforms represent the core product offering, with revenue generated through software subscriptions, platform fees, and technology services rather than physical products or traditional services.

Platform innovation includes digital health platforms and mobile applications designed for AYUSH practice and patient care, practice management and healthcare information systems adapted for traditional medicine requirements, e-commerce and marketplace platforms connecting AYUSH stakeholders, telemedicine and remote consultation platforms specialised for traditional medicine delivery, educational technology and e-learning platforms for AYUSH education and training, data analytics and artificial intelligence solutions for traditional medicine applications, AI-driven drug discovery platforms for traditional medicine compounds,

precision herbal formulation systems using biotech optimisation, automated bioassay and compound screening systems for traditional ingredients, digital clinical trial platforms specialised for traditional medicine research, personalised AYUSH therapy recommendation systems based on biomarker analysis, biotech-enabled quality control and standardisation platforms, pharmacogenomics applications for traditional medicine personalisation and biomarker-based traditional medicine diagnostic platforms.

Technology development priorities encompass user experience design optimised for diverse AYUSH stakeholder needs, cultural sensitivity and traditional medicine authenticity preservation in digital formats, regulatory compliance for digital health applications and data privacy requirements, scalability and performance optimisation for growing user bases, integration capabilities with existing healthcare and business systems, biotech-digital convergence validation and regulatory compliance for combined applications, precision medicine platform development specialised for traditional medicine applications, interoperability standards for biotech-digital health ecosystems, AI-driven discovery outcome validation and therapeutic efficacy preservation, biotech convergence manufacturing integration with digital quality control systems, and traditional medicine authenticity maintenance in biotech convergence applications. Success requires balancing traditional medicine principles with modern digital technology capabilities.

Business model innovations encompass software-as-a-service subscription models for ongoing platform access, marketplace platform fees and transaction charges, digital therapeutics and intervention program subscriptions, data analytics and insights services for AYUSH organisations, integrated hardware-software solutions combining devices with digital platforms, precision medicine platform licensing for personalised traditional therapy development, AI-driven discovery services for pharmaceutical companies developing traditional medicine compounds, biotech-digital integration consulting for traditional medicine modernisation, personalised therapy development partnerships with healthcare providers, digital biomarker licensing and data services for traditional medicine applications, and automated research platform subscriptions for biotech convergence applications. Success requires understanding diverse stakeholder needs and creating network effects that benefit all platform participants.

Assessment emphasises technological innovation and user experience quality across both digital and biotech convergence applications, market demand and user adoption potential among diverse AYUSH stakeholder groups, platform scalability and performance capability including biotech convergence processing requirements, regulatory compliance and data security effectiveness for digital health and biotech applications, competitive positioning and differentiation within digital health and biotech convergence markets, business model sustainability and revenue growth potential across platform and biotech services,

biotech-digital integration validation demonstrating seamless functionality and therapeutic preservation, precision medicine platform performance metrics showing accuracy and clinical relevance, AI-driven discovery outcome validation with therapeutic efficacy confirmation, and traditional medicine authenticity preservation throughout biotech convergence applications. Evidence requirements include user experience testing and adoption metrics across digital and biotech convergence platforms, technology performance and scalability validation for integrated biotech-digital systems, regulatory compliance documentation and security certifications for health and biotech applications, market validation and competitive analysis covering both digital health and biotech convergence markets, financial projections demonstrating platform economics and biotech service growth potential, biotech-digital integration validation reports confirming functional effectiveness and therapeutic preservation, precision medicine platform performance data showing accuracy and clinical utility, AI-driven discovery validation results demonstrating therapeutic compound identification success, biotech convergence manufacturing compliance documentation for quality and safety standards, and traditional medicine authenticity preservation validation throughout biotech application development.

Table 1: Innovation Category Assessment Requirements Matrix

Innovation Category	Primary TRL Range	Corresponding MRL Range	Corresponding SRL Range	Assessment Priority
Clinical Therapeutics & Medical Solutions	1-9	3-10	4-8	TRL-MRL Primary, Moderate SRL
Consumer Health & Wellness Products	1-9	2-10	2-7	TRL-MRL Primary, Moderate SRL
Professional Services & Knowledge Solutions	3-8	1-4	1-9	SRL Primary, TRL Support, Limited MRL
Agricultural & Environmental Applications	1-9	2-10	3-8	Full Integration Required
Manufacturing & Production Services	4-9	1-10	3-8	MRL Primary, TRL-SRL Support
Digital Technology, Platform Solutions & Biotech Convergence	2-9	1-6	2-9	TRL-SRL Primary, MRL Support for Biotech Applications

Purpose: This table provides stakeholders with a comprehensive overview of assessment requirements across all innovation categories, showing the relationship between TRL progression and corresponding MRL and SRL requirements. Use this table to understand the scope and priority of assessment dimensions for your specific innovation category, enabling appropriate resource allocation and development planning.

3. TECHNOLOGY READINESS LEVEL ASSESSMENT

The Technology Readiness Level scale provides systematic evaluation of innovation and product development maturity from initial concept through market deployment and commercial success. Each level represents specific development milestones with defined entry criteria, assessment questions, evidence requirements, and exit criteria focused on commercial viability and market readiness.

Innovation development progresses through increasingly sophisticated validation stages, beginning with concept identification and market opportunity recognition, advancing through technical feasibility demonstration and prototype development, continuing through market validation and customer acceptance testing and culminating in commercial launch and sustained market success. Each advancement requires specific evidence of progress and capability, ensuring systematic development toward commercial viability.

3.1 TRL 1: Innovation Concept Identified and Market Opportunity Observed

At this foundational level, innovation development begins with the identification of a clear market opportunity based on traditional medicine principles or applications. Basic innovation concepts are formulated through analysis of market needs, traditional medicine knowledge and potential commercial applications. For AYUSH innovations, this includes identification of therapeutic opportunities in traditional systems, recognition of unmet market needs in healthcare or wellness sectors, preliminary assessment of commercial feasibility based on market research and initial hypothesis formulation for innovation development.

The evaluation process requires demonstration that a compelling market opportunity has been identified from credible market research, traditional medicine knowledge, or user needs assessment. The innovation concept must be clearly articulated with basic commercial rationale and market justification. Initial feasibility assessment should indicate commercial potential and development viability. Market opportunity analysis should demonstrate sufficient demand and competitive positioning potential.

Evidence requirements include comprehensive market opportunity analysis documenting unmet needs and commercial potential, innovation concept documentation with clear value proposition, preliminary feasibility assessment indicating development and commercial viability, initial market research supporting demand validation, and competitive analysis demonstrating differentiation potential. Documentation should establish solid market foundation, clear innovation vision, logical connection between traditional principles and market opportunity, and reasonable expectation of commercial success based on market evidence.

Assessment questions focus on whether clear market opportunity has been identified and validated through appropriate research, whether innovation concept addresses real market needs with compelling value proposition, whether traditional medicine principles provide meaningful differentiation and competitive advantage, and whether preliminary assessment suggests reasonable probability of commercial success. Successful completion requires establishment of validated market opportunity, clear articulation of innovation concept with commercial rationale, logical connection between traditional medicine principles and market application and documented market potential supporting further development investment.

3.2 TRL 2: Innovation Concept and Commercial Application Formulated

Building upon identified market opportunity, detailed innovation concepts are developed with specific commercial applications and comprehensive value propositions. The technology concept moves from general market opportunity to concrete innovation approaches and business models. For traditional medicine innovations, this involves translation of market opportunity into specific innovation concepts, identification of target customer segments and user needs, development of comprehensive value propositions and competitive positioning and conceptual business model formulation including revenue streams and market access strategies.

Innovation concept formulation requires clear definition of the proposed innovation and its intended commercial applications. Target customer segments should be identified and characterized with specific needs and purchasing behaviors. Value propositions must be compelling and differentiated relative to existing solutions. Conceptual business model should outline revenue generation, market access and growth strategies. Preliminary intellectual property analysis should identify protection opportunities and competitive positioning.

Evidence requirements include detailed innovation concept document describing commercial applications and value propositions, target customer identification and characterization with needs analysis, comprehensive competitive analysis and differentiation strategy, conceptual business model outlining revenue generation and market access, initial intellectual property landscape analysis and protection strategy, and risk assessment identifying potential challenges and mitigation approaches. Documentation should provide clear commercial vision with compelling value proposition, practical understanding of target customers and competitive dynamics, realistic business model and revenue projections and thoughtful approach to intellectual property protection and competitive positioning.

Assessment criteria examine whether comprehensive innovation concept has been formulated with clear commercial applications and compelling value propositions, whether target customers and market segments are well-defined with validated needs, whether competitive analysis demonstrates meaningful differentiation and sustainable competitive advantage, and whether conceptual business model appears viable and scalable. Success requires articulation of innovative commercial concept with differentiated value proposition, identification of viable customer segments with validated needs, realistic business model with clear revenue generation, and appropriate intellectual property and competitive strategy.

3.3 TRL 3: Innovation Proof of Concept Demonstrated

Active development initiates with experimental validation of key innovation assumptions and technical approaches. Laboratory studies, prototypes or pilot programs physically validate commercial concepts and demonstrate feasibility of core innovation elements. For traditional medicine innovations, this includes prototype development and initial testing of product concepts, experimental validation of traditional preparation methods or therapeutic approaches, proof-of-concept studies for technology solutions or service delivery models, and preliminary user testing and feedback collection.

Innovation proof of concept requires successful demonstration that key commercial and technical assumptions are valid and that the proposed approach can work under controlled conditions. Critical performance parameters must be identified and measured. Basic market acceptance should be tested with potential users. Reproducible development processes must be established. Initial performance data should confirm commercial feasibility and user acceptance.

Evidence includes experimental study reports or prototype demonstrations confirming innovation feasibility, measured performance data for critical parameters and user acceptance metrics, preliminary market testing results with potential customers, reproducible development processes and quality control methods appropriate for the development stage, user feedback analysis and iteration documentation, and analysis of results confirming commercial potential and technical feasibility. Documentation should provide convincing evidence that the innovation approach is viable, that critical performance parameters can be achieved, that initial market acceptance is positive and that development results can be reproduced consistently.

Assessment focuses on whether innovation proof of concept has been convincingly demonstrated under controlled conditions, whether critical performance parameters have been identified and achieved, whether initial market testing indicates positive user acceptance and commercial potential, and whether development processes are sufficiently robust and reproducible. Successful completion requires experimental validation of innovation feasibility, achievement of target performance parameters, demonstration of initial market acceptance, and establishment of reproducible development methods supporting further advancement.

3.4 TRL 4: Innovation Validated in Controlled Environment

Individual innovation components are integrated to demonstrate that they work together effectively in controlled settings. Integration testing occurs with controlled conditions that approximate real-world constraints while maintaining development environment control. For traditional medicine innovations, this includes integration of product components with demonstrated performance and quality, service delivery model validation with real users in controlled settings, technology platform integration with validated functionality and user experience and comprehensive performance assessment meeting commercial specifications.

Innovation validation requires successful integration of individual components into a functioning system, product, or service offering. Performance specifications must be defined and consistently achieved. Market acceptance should be validated with representative user groups. Quality control methods must be effective and reliable. Risk assessment should identify and mitigate potential commercial and technical issues.

Evidence encompasses integrated system performance data demonstrating successful component integration, achievement of defined performance specifications with consistent quality, market validation results with representative user groups showing acceptance and satisfaction, quality control validation demonstrating consistent results and reliable processes, risk assessment and mitigation strategy documentation addressing identified challenges, and scaling feasibility analysis indicating potential for advancement to relevant environment testing.

Documentation should confirm successful integration of innovation components, achievement of performance targets with consistent quality, positive market validation with target users, effective quality control and risk management and clear understanding of requirements for advancement to relevant environment validation.

Assessment examines whether innovation components have been successfully integrated with demonstrated performance meeting specifications, whether market validation indicates strong user acceptance and commercial potential, whether quality control methods are validated and effective for consistent results, and whether scaling challenges have been identified with appropriate mitigation strategies. Success requires integration of functional innovation system with consistent performance, validated market acceptance with target users, effective quality control methods and risk management, and clear understanding of scaling requirements for further development.

3.5 TRL 5: Innovation Demonstrated in Relevant Commercial Environment

Innovation is tested in an environment that closely approximates the intended commercial application environment. Performance validation occurs under realistic market conditions with actual or representative customers. For traditional medicine innovations, this includes market testing with real customers in realistic commercial settings, integration with existing systems and infrastructure relevant to target markets, validation under realistic operating conditions with supporting commercial infrastructure, and demonstration of commercial viability including cost structure and revenue generation.

Relevant environment validation requires demonstration of innovation performance under conditions that approximate real-world commercial application. Market factors and constraints must be addressed with realistic solutions. Supporting systems and infrastructure should be integrated and operational. Customer interaction and acceptance should be evaluated under realistic commercial conditions. Performance sustainability should be demonstrated over extended periods with realistic usage patterns.

Evidence includes relevant environment testing results demonstrating sustained performance under realistic commercial conditions, integration with supporting systems and commercial infrastructure, customer acceptance and satisfaction documentation from realistic market testing, commercial viability confirmation including cost structure and revenue validation, performance sustainability data over extended testing periods, and operational feasibility confirmation with realistic resource requirements. Documentation should prove innovation effectiveness under realistic commercial conditions, successful integration with necessary supporting elements, positive customer acceptance in realistic market settings, validated commercial viability with acceptable cost structure and sustainable performance characteristics supporting commercial deployment.

Assessment considers whether innovation has been successfully validated in relevant commercial environment with sustained performance, whether performance is maintained under realistic market conditions and constraints, whether integration with supporting systems is effective and reliable, and whether customer acceptance indicates viability for broader commercial deployment. Successful completion requires demonstration of innovation effectiveness in relevant commercial environment, sustained performance under realistic conditions with acceptable cost structure, successful integration with supporting commercial infrastructure and positive customer acceptance indicating strong market viability and commercial potential.

3.6 TRL 6: Innovation Prototype Demonstrated in Commercial Environment

Representative innovation system undergoes comprehensive testing in commercial environment that closely approximates the intended deployment setting. Commercial feasibility is fully demonstrated in actual market configuration with real customers and commercial constraints. For traditional medicine innovations, this includes full commercial prototype testing with paying customers in actual market settings, demonstration of complete business model and revenue generation, integration testing with existing commercial infrastructure and market channels, and comprehensive performance evaluation under full commercial operating conditions.

Innovation demonstration requires development and testing of representative system that accurately reflects the intended final commercial offering. All major technical and commercial issues should be resolved. System-level integration must be validated with commercial partners and channels. Performance should meet commercial requirements with acceptable cost structure. Regulatory and compliance considerations should be addressed with clear approval pathway.

Evidence encompasses commercial prototype system performance data demonstrating operational capability in actual market conditions, resolution of major technical and commercial challenges with validated solutions, achievement of commercial performance requirements with acceptable cost structure and revenue generation, regulatory compliance assessment and pathway progression with clear approval timeline, system-level validation confirming integrated functionality with commercial partners, and customer acceptance confirmation in actual commercial environment with paying customers. Documentation should establish prototype system readiness for commercial deployment, resolution of technical and commercial challenges, meeting of performance requirements with viable economics, regulatory compliance progress with clear pathway and strong customer acceptance in commercial environment.

Assessment evaluates whether representative prototype system has been successfully demonstrated in actual commercial environment, whether major technical and commercial challenges have been resolved with viable solutions, whether performance meets commercial requirements with acceptable cost structure and revenue potential, and whether regulatory pathway is clear and progressing appropriately toward market authorization. Success requires commercial demonstration of representative prototype system, resolution of major technical and commercial issues, achievement of performance requirements with viable commercial economics, and clear regulatory pathway toward full market authorization and commercial launch.

3.7 TRL 7: Innovation System Demonstrated in Operational Market Environment

Complete innovation system is tested and demonstrated in operational market environment that matches the intended deployment setting with full commercial infrastructure. Commercial feasibility is fully proven in actual system configuration with established market channels and customer relationships. For traditional medicine innovations, this includes full system demonstration in actual commercial market settings with established distribution and customer relationships, validation of complete commercial infrastructure including manufacturing and quality systems, integration with real-world market channels and commercial partnerships and operational performance confirmation over extended periods with sustained customer demand.

System demonstration requires comprehensive testing of complete innovation system in actual operational market environment. All system interfaces and market relationships must be validated and functioning effectively. Operational performance should consistently meet commercial requirements with sustained customer satisfaction. System reliability and maintainability should be demonstrated under actual commercial operating conditions. Readiness for full commercial deployment should be confirmed with market validation and customer acceptance.

Evidence includes comprehensive system demonstration results in operational market environment with sustained commercial performance, validation of all system interfaces and market relationships with confirmed functionality, sustained operational performance data meeting commercial requirements over extended periods, system reliability and maintainability confirmation under actual operating conditions, commercial deployment readiness assessment with market validation and customer acceptance, and stakeholder acceptance and satisfaction documentation from actual commercial operations. Documentation should prove system readiness for full commercial deployment, validated system functionality and market relationships, consistent performance meeting all commercial requirements, adequate reliability and maintainability under commercial conditions, and strong stakeholder acceptance across the commercial ecosystem.

Assessment focuses on whether complete innovation system has been successfully demonstrated in actual operational market environment with sustained commercial performance, whether all system interfaces and market relationships function correctly and reliably, whether operational performance consistently meets commercial requirements over extended periods, and whether the system is ready for full commercial deployment with confirmed market acceptance. Successful completion requires comprehensive system validation in operational market environment, proven system interfaces and market functionality, consistent performance meeting all commercial requirements with sustained customer satisfaction and demonstrated readiness for full commercial deployment and market expansion.

3.8 TRL 8: Innovation System Complete and Qualified for Commercial Launch

Innovation system is proven to work in its final form under expected commercial conditions. System qualification is complete and regulatory approvals are obtained or imminent with full commercial launch readiness. For traditional medicine innovations, this includes final system qualification with regulatory approval and market authorization, complete commercial infrastructure validation including manufacturing and distribution systems, full integration with commercial market channels and established partnerships, and commercial deployment readiness with confirmed customer demand and revenue projections.

System completion and qualification requires final innovation system configuration with all components optimized and validated for commercial operation. Regulatory approvals should be obtained or final approval imminent with confirmed timeline. Commercial systems must be fully operational and compliant with all requirements. Commercial production or service delivery capability should be established and validated. Market readiness should be confirmed through customer demand validation and revenue projection accuracy.

Evidence encompasses complete system qualification documentation including regulatory approvals and market authorization, validated commercial infrastructure including manufacturing and distribution systems operating at commercial scale, full system integration with commercial market channels and established partnerships, commercial deployment capability demonstration with confirmed customer demand, market readiness confirmation through customer validation and accurate revenue projections, and launch preparation completion including marketing and sales readiness. Documentation should confirm system qualification and regulatory approval for commercial operation, operational commercial infrastructure with validated capabilities, successful commercial integration with market channels and partnerships, established commercial deployment capacity and confirmed market readiness with validated customer demand and revenue potential.

Assessment examines whether innovation system is completely qualified with appropriate regulatory approvals for commercial launch, whether commercial infrastructure is fully operational and compliant with all requirements, whether commercial deployment capability is established and validated, and whether market readiness is confirmed with validated customer demand. Success requires complete system qualification with regulatory approval for commercial operation, operational commercial infrastructure with validated capabilities, established commercial deployment capacity meeting market demand and confirmed market readiness for successful commercial launch with validated revenue projections.

3.9 TRL 9: Innovation System Proven in Commercial Market Operation

Innovation system is operating successfully in its final form under actual commercial conditions with sustained market performance. Sustained operational and commercial performance demonstrates system maturity, market acceptance, and business model viability. For traditional medicine innovations, this includes sustained commercial operation with confirmed market success and revenue generation, continuous commercial infrastructure operation with maintained quality and cost performance, ongoing integration with commercial market ecosystem with strong partnerships, and proven long-term performance with continuous improvement and customer satisfaction.

Proven commercial performance requires sustained successful operation over extended periods under actual commercial conditions with confirmed profitability and market leadership. Performance metrics should consistently meet or exceed commercial requirements. Continuous improvement processes should be active and effective in maintaining competitive advantage. Customer satisfaction should be high and sustained with strong loyalty and retention. Market success should be demonstrated through adoption growth, market share gains and financial performance.

Evidence includes sustained commercial performance data over extended periods demonstrating profitability and market success, continuous achievement of performance metrics and commercial requirements with maintained quality and cost effectiveness, active continuous improvement processes with documented results and competitive advantage maintenance, high customer satisfaction and loyalty metrics with strong retention and advocacy, demonstrated market success through adoption growth and market share expansion and operational excellence confirmation through independent assessment and industry recognition. Documentation should prove sustained innovation system success in commercial operation, consistent achievement of performance targets with maintained competitiveness, effective continuous improvement maintaining market leadership, high customer satisfaction with strong loyalty, and demonstrated long-term commercial success with market expansion.

Assessment considers whether innovation system operates successfully in actual commercial environment over extended periods with sustained profitability and market leadership, whether performance consistently meets or exceeds commercial requirements with maintained cost effectiveness, whether continuous improvement processes are effective in maintaining competitive advantage and market position, and whether market success is sustained with demonstrated growth and expansion. Successful completion requires proven sustained commercial performance with confirmed profitability and market leadership, consistent achievement of performance requirements with maintained competitiveness, effective continuous improvement processes maintaining competitive advantage and demonstrated long-term market success and expansion with sustained customer satisfaction and business growth.

Table 2: Technology Readiness Level (TRL) Assessment Framework for Innovation

Purpose: This table serves as the primary reference for conducting TRL assessments across all innovation categories with focus on commercial development and market readiness. Use this table to systematically evaluate the current innovation maturity, identify required evidence for commercial advancement and plan progression toward market launch.

TRL	Definition	Key Assessment Questions	Required Evidence	Exit Criteria
1	Innovation concept identified and market opportunity observed	Has a clear innovation opportunity been identified with market potential?	Market opportunity analysis, innovation concept documentation, preliminary feasibility assessment	Validated innovation concept with market opportunity
2	Innovation concept and commercial application formulated	Has the innovation concept been developed with clear commercial applications and value proposition?	Innovation concept document, commercial application identification, value proposition development	Well-defined innovation with commercial applications
3	Innovation proof of concept demonstrated	Has innovation feasibility been demonstrated through prototype or pilot testing?	Proof of concept demonstration, prototype development, initial validation results	Validated innovation feasibility and commercial potential

TRL	Definition	Key Assessment Questions	Required Evidence	Exit Criteria
4	Innovation validated in controlled environment	Has the innovation been validated with performance meeting commercial specifications?	Controlled testing results, performance validation, quality standards achievement	Innovation performance validated for commercial development
5	Innovation demonstrated in relevant commercial environment	Has innovation performance been validated under realistic market conditions?	Market environment testing, user validation, commercial feasibility confirmation	Innovation validated under commercial conditions
6	Innovation prototype demonstrated in commercial environment	Has commercial-ready prototype been successfully demonstrated to target customers?	Commercial prototype demonstration, customer validation, market acceptance testing	Commercial prototype validated with customer acceptance
7	Innovation system demonstrated in operational market environment	Has complete innovation system been demonstrated with customers in market setting?	Market demonstration results, customer adoption evidence, operational performance validation	Innovation system proven in market environment
8	Innovation system complete and qualified for commercial launch	Is innovation system ready for commercial launch with all requirements met?	Commercial launch readiness, regulatory approvals, quality system validation	Innovation qualified for full commercial deployment
9	Innovation system proven in commercial market operation	Has innovation achieved sustained commercial success with proven market acceptance?	Commercial performance data, market success metrics, sustained customer adoption	Proven commercial success and market leadership

4. MANUFACTURING READINESS LEVEL ASSESSMENT

The Manufacturing Readiness Level scale evaluates industrial capability and production scalability from initial manufacturing implications through manufacturing excellence. Each level addresses specific production maturity milestones with defined assessment criteria and evidence requirements focused on commercial production capability and market supply requirements.

Manufacturing development progresses through systematic capability building stages, beginning with basic manufacturing requirement identification, advancing through process development and validation, continuing through pilot-scale demonstration and supply chain development, and culminating in commercial production excellence with continuous improvement culture. Each advancement requires specific evidence of manufacturing capability and production readiness.

4.1 MRL 1: Commercial Manufacturing Requirements Identified

Initial assessment of manufacturing requirements and constraints is conducted based on innovation characteristics and commercial production needs. Basic understanding of raw materials, unit operations, and manufacturing challenges is established with focus on commercial viability and market supply requirements. For traditional medicine innovations, this includes identification of traditional preparation methods and their commercial manufacturing implications, assessment of raw material availability and supply chain requirements for commercial production, understanding of traditional quality requirements and their translation to commercial manufacturing standards, and recognition of regulatory and compliance requirements for commercial traditional medicine manufacturing.

Manufacturing requirements identification requires systematic analysis of innovation characteristics and their commercial manufacturing impact. Raw material specifications and commercial sourcing requirements must be understood with seasonal availability considerations and quality variability typical of botanical materials.

Traditional preparation methods should be analysed for commercial manufacturing applicability and scalability while preserving therapeutic efficacy. Basic unit operations and process requirements should be identified with commercial production considerations including batch sizes, processing times and equipment needs.

Initial assessment of manufacturing challenges and constraints should be conducted with focus on commercial viability and competitive cost structure. Traditional medicine manufacturing faces unique challenges including raw material standardization, preservation of traditional preparation principles, seasonal supply variations, and regulatory compliance across multiple jurisdictions. Cost analysis must consider traditional ingredient premium pricing, specialized processing requirements and quality control complexities inherent in traditional formulations.

Evidence includes comprehensive manufacturing requirements assessment document identifying commercial production needs and specific challenges for traditional medicine manufacturing, detailed raw material analysis including specifications and commercial sourcing considerations with seasonal availability assessment, traditional preparation method analysis and commercial manufacturing translation while preserving therapeutic principles, basic unit operation identification and commercial scalability assessment with equipment and facility requirements, initial manufacturing challenge and constraint documentation with commercial impact analysis and competitive cost considerations, and preliminary cost and resource requirement estimates for commercial production with market pricing analysis. Documentation should demonstrate thorough understanding of commercial manufacturing requirements specific to traditional medicine, realistic assessment of challenges and constraints unique to AYUSH manufacturing and initial planning foundation for commercial manufacturing development with competitive positioning.

Assessment focuses on whether basic commercial manufacturing requirements have been comprehensively identified and documented with traditional medicine considerations, whether raw material requirements and commercial sourcing challenges are understood including seasonal variations and quality standardization, whether traditional preparation methods have been analysed for commercial manufacturing applicability while preserving therapeutic efficacy, and whether initial manufacturing challenges and constraints have been recognized with commercial impact assessment and competitive cost analysis. Success requires comprehensive identification of commercial manufacturing implications specific to traditional medicine, realistic understanding of requirements and challenges unique to AYUSH manufacturing, appropriate analysis of traditional methods for commercial scalability while preserving authenticity, and initial planning foundation for commercial manufacturing development with competitive cost considerations.

4.2 MRL 2: Manufacturing Approach and Process Concepts Developed

Manufacturing concepts and approaches are developed based on innovation requirements and commercial production objectives. Alternative manufacturing strategies are evaluated and preliminary commercial manufacturing approach is selected with focus on scalability, quality, and cost competitiveness. For traditional medicine innovations, this includes development of commercial manufacturing approaches for traditional preparations that preserve therapeutic efficacy while enabling commercial scalability, evaluation of alternative manufacturing technologies and processes for commercial production including modern adaptations of traditional methods, selection of appropriate manufacturing scale and capacity for market requirements with consideration of demand forecasting and seasonal variations, and preliminary commercial manufacturing cost and resource estimation with competitive benchmarking against existing traditional medicine products.

Manufacturing concept development requires comprehensive analysis of commercial manufacturing approaches addressing all innovation requirements while preserving traditional medicine authenticity. Alternative manufacturing strategies should be evaluated for commercial feasibility, cost competitiveness, and quality implications with particular attention to maintaining therapeutic efficacy during scaling. Manufacturing scale and capacity requirements should be determined based on market demand projections and seasonal demand patterns typical of traditional medicine products.

Preliminary commercial cost analysis should be conducted with competitive benchmarking against both traditional medicine products and conventional alternatives. Manufacturing risk assessment should identify potential challenges and mitigation approaches for commercial production including supply chain disruptions, quality variations, regulatory compliance across multiple markets and preservation of traditional preparation integrity during industrial scaling.

Traditional medicine manufacturing presents unique conceptual challenges including balancing efficiency with traditional methods, maintaining ingredient potency during processing, managing complex multi-ingredient formulations, and ensuring reproducible quality despite natural ingredient variations. Technology selection must consider traditional preparation principles, regulatory requirements for different markets, environmental impact of traditional ingredients and cultural acceptance of modernized traditional preparations.

Evidence encompasses comprehensive manufacturing concept document describing commercial approach and rationale with specific traditional medicine considerations, alternative strategy evaluation with commercial feasibility and cost analysis including preservation of therapeutic efficacy, manufacturing scale and capacity requirement determination based on market projections and seasonal demand patterns, preliminary commercial cost estimation and competitive benchmarking analysis against traditional medicine and conventional products, manufacturing risk assessment identifying commercial challenges and mitigation strategies specific to traditional medicine production, and manufacturing technology selection and justification with commercial production focus and traditional method preservation. Documentation should provide clear commercial manufacturing vision and approach appropriate for traditional medicine, thorough evaluation of alternatives with competitive analysis and therapeutic efficacy preservation, realistic scale and cost planning for market requirements with seasonal considerations, and appropriate risk assessment and mitigation planning for traditional medicine commercial production.

Assessment examines whether comprehensive commercial manufacturing concepts have been formulated addressing all innovation requirements while preserving traditional medicine authenticity, whether alternative strategies have been appropriately evaluated with commercial feasibility analysis and therapeutic efficacy considerations, whether manufacturing scale and capacity requirements are realistic for market demand including seasonal variations, and whether cost and risk considerations have been adequately addressed for commercial competitiveness in traditional medicine markets. Successful completion requires development of viable commercial manufacturing concepts appropriate for traditional medicine, appropriate evaluation of alternatives with competitive analysis and therapeutic preservation, realistic planning for commercial scale and cost structure with traditional medicine market considerations and thorough risk assessment and mitigation planning for traditional medicine commercial production success.

4.3 MRL 3: Manufacturing Process Proven at Laboratory/Pilot Scale

Manufacturing process is validated at small scale to demonstrate technical feasibility and product quality achievement under controlled conditions. Process parameters are optimized and documented with reproducible procedures for consistent quality production. For traditional medicine innovations, this includes laboratory-scale validation of traditional preparation methods adapted for commercial manufacturing while maintaining therapeutic efficacy, development of reproducible procedures for consistent quality production of traditional formulations with documented process parameters and quality control methods, validation of raw material processing and ingredient integration procedures ensuring therapeutic potency and stability and establishment of quality verification protocols appropriate for traditional medicine products with relevant analytical methods and specifications.

Laboratory-scale manufacturing validation requires demonstration that all key production steps can be executed reproducibly with consistent quality outcomes. Process parameters must be optimized for both efficiency and quality with particular attention to preserving traditional medicine therapeutic properties. Standard operating procedures must be developed and validated for all critical manufacturing steps with clear specifications and quality control checkpoints.

Raw material processing procedures must address the unique challenges of traditional ingredients including variability in potency, seasonal quality differences, appropriate extraction methods, and preservation of bioactive compounds. Quality verification protocols must be established using analytical methods appropriate for traditional medicine products including traditional assessment methods where applicable and modern analytical techniques for consistency and standardization.

Batch records must demonstrate reproducible manufacturing results with consistent quality achievement across multiple production runs. Process optimization should balance manufacturing efficiency with preservation of traditional preparation principles and therapeutic efficacy. Documentation must include detailed procedures, quality control data and analysis of process capability for commercial scaling.

Evidence includes laboratory-scale manufacturing validation documentation demonstrating reproducible procedures and consistent quality achievement for traditional medicine products, detailed standard operating procedures for all critical manufacturing steps with clear specifications and quality control protocols, raw material processing validation ensuring therapeutic potency preservation and appropriate handling of traditional ingredients, quality verification protocol establishment with analytical methods appropriate for traditional medicine products and documented specifications, batch record documentation showing consistent manufacturing results across multiple production runs with quality data analysis, and process optimization analysis balancing manufacturing efficiency with traditional preparation principles and therapeutic efficacy preservation. Documentation should demonstrate reliable laboratory-scale manufacturing capability with consistent quality for traditional medicine products, established procedures appropriate for traditional ingredients and methods and validated quality control ensuring therapeutic efficacy and product consistency.

Assessment considers whether laboratory-scale manufacturing process has been proven with reproducible procedures and consistent quality achievement for traditional medicine products, whether standard operating procedures are comprehensive and appropriate for traditional

ingredients and methods, whether raw material processing and quality verification protocols ensure therapeutic potency preservation and product consistency, and whether batch records demonstrate reliable manufacturing capability suitable for commercial scaling. Success requires proven laboratory-scale manufacturing with reproducible procedures and consistent quality appropriate for traditional medicine products, comprehensive standard operating procedures suitable for traditional ingredients and methods, validated quality control ensuring therapeutic efficacy preservation, and demonstrated manufacturing reliability suitable for commercial scaling with consistent batch quality.

4.4 MRL 4: Manufacturing Process Validated for Commercial Production

Manufacturing process is systematically validated with statistical process control and comprehensive quality assurance systems appropriate for commercial production. Process capability is demonstrated with consistent achievement of quality specifications and production targets. For traditional medicine innovations, this includes statistical validation of manufacturing process capability for traditional medicine products with demonstrated achievement of quality specifications and therapeutic efficacy targets, implementation of comprehensive quality assurance systems appropriate for traditional medicine manufacturing including both traditional assessment methods and modern analytical validation, validation of critical process parameters and control strategies ensuring consistent therapeutic potency and product quality across production batches, and establishment of manufacturing risk management and hazard analysis protocols specific to traditional medicine production challenges.

Manufacturing process validation requires comprehensive statistical analysis of process performance with capability studies demonstrating consistent achievement of quality targets. Quality assurance systems must be implemented with appropriate sampling plans, analytical methods, and release criteria specifically designed for traditional medicine products. Critical process parameters must be identified and controlled with validated limits ensuring therapeutic efficacy and product consistency.

Risk management protocols must address traditional medicine manufacturing risks including raw material quality variations, seasonal supply disruptions, cross-contamination between different formulations, environmental factors affecting ingredient stability, and regulatory compliance across multiple jurisdictions. Hazard analysis should identify potential failure modes and establish prevention and mitigation strategies appropriate for traditional medicine manufacturing.

Design of experiments should be conducted to optimize process parameters while maintaining therapeutic efficacy and traditional preparation authenticity. Process control strategies must balance efficiency with quality requirements and regulatory compliance. Manufacturing records must demonstrate statistical process control with trend analysis and continuous improvement protocols.

Evidence encompasses statistical process validation documentation demonstrating manufacturing capability and consistent quality achievement for traditional medicine products, comprehensive quality assurance system implementation with appropriate analytical methods and release criteria for traditional medicine products, critical process parameter validation and control strategy establishment ensuring therapeutic potency and quality consistency, manufacturing risk management and hazard analysis documentation specific to traditional medicine production challenges, design of experiments results and process optimization analysis balancing efficiency with therapeutic efficacy preservation, and statistical process control implementation with trend analysis and continuous improvement protocols for traditional medicine manufacturing. Documentation should establish validated manufacturing process with statistical control appropriate for traditional medicine commercial production, comprehensive quality assurance ensuring therapeutic efficacy and regulatory compliance and effective risk management addressing traditional medicine manufacturing challenges.

Assessment examines whether manufacturing process has been systematically validated with statistical control and demonstrated capability for traditional medicine products, whether quality assurance systems are comprehensive and appropriate for traditional medicine manufacturing requirements, whether critical process parameters and risk management protocols effectively address traditional medicine production challenges, and whether process validation demonstrates readiness for commercial-scale production with consistent quality and regulatory compliance. Successful completion requires statistically validated manufacturing process with demonstrated capability for traditional medicine products, comprehensive quality assurance systems appropriate for traditional medicine requirements, effective risk management addressing traditional medicine manufacturing challenges, and process validation demonstrating commercial production readiness with regulatory compliance.

4.5 MRL 5: Manufacturing Demonstrated in Production-Relevant Environment

Manufacturing process is demonstrated at scale approaching commercial production under conditions that simulate industrial manufacturing environment. Production capability is validated with quality maintenance, yield optimization, and cost verification under realistic operating conditions. For traditional medicine innovations, this includes pilot-scale manufacturing demonstration at volumes approaching commercial production with quality maintenance and therapeutic efficacy preservation, validation of manufacturing process performance under realistic industrial conditions including environmental controls and production scheduling constraints, demonstration of yield optimization and cost verification for traditional medicine manufacturing with competitive cost analysis, and integration testing with supporting infrastructure including utilities, quality control laboratories, and regulatory compliance systems.

Production-relevant environment demonstration requires successful manufacturing at pilot scale with consistent quality achievement under conditions that approximate commercial production. Manufacturing process must maintain therapeutic efficacy and product quality while achieving target yields and cost objectives. Environmental controls and production scheduling must be validated for traditional medicine requirements including temperature and humidity control, cross-contamination prevention, and appropriate handling of sensitive traditional ingredients.

Supporting infrastructure integration must be demonstrated including utility requirements, quality control laboratory capability, waste management systems, and regulatory compliance protocols. Supply chain integration should be tested with realistic raw material procurement, inventory management, and finished product distribution. Cost verification must demonstrate commercial viability with competitive positioning in traditional medicine markets.

Production scheduling and workflow optimization must address traditional medicine manufacturing complexities including seasonal raw material availability, multi-ingredient formulation requirements, specialized processing equipment, and extended production cycles typical of traditional preparations. Quality control integration must ensure consistent monitoring and release testing appropriate for traditional medicine products.

Evidence includes pilot-scale manufacturing demonstration results at production-relevant volumes with quality maintenance and therapeutic efficacy preservation for traditional medicine products, manufacturing process performance validation under realistic industrial conditions including environmental controls and production scheduling, yield optimization and

cost verification documentation demonstrating commercial viability and competitive positioning for traditional medicine manufacturing, supporting infrastructure integration testing including utilities, quality control, and regulatory compliance systems, supply chain integration validation including raw material procurement and finished product distribution testing, and production scheduling and workflow optimization analysis addressing traditional medicine manufacturing complexities and requirements. Documentation should prove manufacturing capability at production-relevant scale with maintained quality and cost competitiveness, successful infrastructure integration supporting commercial production, and validated supply chain and production workflow appropriate for traditional medicine requirements.

Assessment evaluates whether manufacturing process has been successfully demonstrated at production-relevant scale with maintained quality and therapeutic efficacy for traditional medicine products, whether yield optimization and cost verification demonstrate commercial viability and competitive positioning, whether supporting infrastructure integration is effective and appropriate for traditional medicine manufacturing requirements, and whether supply chain and production workflow are validated for commercial production with traditional medicine complexities. Success requires successful pilot-scale demonstration with maintained quality and cost competitiveness for traditional medicine products, effective infrastructure integration supporting commercial production requirements, validated supply chain and production workflow addressing traditional medicine complexities, and demonstrated readiness for commercial-scale manufacturing with competitive economics.

4.6 MRL 6: Manufacturing System Proven for Commercial Production

Complete manufacturing system is demonstrated as capable of meeting commercial volume, cost, and quality requirements simultaneously with proven reliability and consistency. All manufacturing components are integrated and validated for sustained commercial production. For traditional medicine innovations, this includes commercial production capability demonstration with simultaneous achievement of volume, cost, and quality targets for traditional medicine products, complete manufacturing system integration and validation including production equipment, quality control systems, and regulatory compliance infrastructure, demonstration of manufacturing system reliability and consistency for sustained commercial production of traditional medicine products with appropriate maintenance and quality assurance protocols, and validation of manufacturing scalability and capacity expansion capability for traditional medicine market growth requirements.

Commercial production capability requires demonstration that manufacturing system can consistently meet all production targets including volume throughput, cost objectives, and quality specifications for traditional medicine products. Manufacturing system integration must be comprehensive including production equipment, material handling systems, quality control laboratories, environmental controls, and information management systems. System reliability must be proven with appropriate maintenance protocols and failure prevention strategies.

Manufacturing scalability validation must demonstrate capability for capacity expansion to meet market growth while maintaining quality and cost competitiveness. Process capability indices must be established and maintained for all critical quality attributes. Manufacturing system performance must be consistent across different production campaigns and seasonal variations typical of traditional medicine manufacturing.

Quality system integration must ensure continuous monitoring and control of all critical parameters with appropriate corrective action protocols. Regulatory compliance infrastructure must be validated for traditional medicine requirements including good manufacturing practices, quality system standards, and international regulatory requirements for export markets.

Evidence encompasses commercial production capability demonstration with simultaneous achievement of volume, cost, and quality targets for traditional medicine products, complete manufacturing system integration and validation documentation including all production components and supporting infrastructure, manufacturing system reliability and consistency demonstration with maintenance protocols and quality assurance systems appropriate for traditional medicine production, manufacturing scalability and capacity expansion validation demonstrating capability for market growth and demand variations, process capability analysis and statistical control documentation for all critical quality attributes, and quality system and regulatory compliance infrastructure validation ensuring traditional medicine manufacturing standards and international market requirements. Documentation should establish complete manufacturing system capability for commercial production of traditional medicine products, proven system reliability and scalability for market demands, and comprehensive quality and regulatory compliance supporting commercial operations.

Assessment focuses on whether complete manufacturing system has been proven capable of meeting commercial volume, cost, and quality requirements simultaneously for traditional medicine products, whether system integration and reliability are comprehensive and appropriate for sustained commercial production, whether manufacturing scalability and

capacity expansion capability are validated for market growth requirements, and whether quality system and regulatory compliance infrastructure support commercial traditional medicine manufacturing. Successful completion requires proven commercial manufacturing system capability with simultaneous achievement of all production targets for traditional medicine products, comprehensive system integration and reliability for sustained commercial production, validated scalability for market growth and demand variations, and complete quality and regulatory compliance infrastructure supporting commercial traditional medicine operations.

4.7 MRL 7: Commercial Manufacturing System Operational with Supply Chain

Complete manufacturing system is operational with qualified supply chain partners and mature quality management systems compliant with regulatory standards. Low-rate initial commercial production begins with full traceability and quality assurance. For traditional medicine innovations, this includes operational commercial manufacturing system with qualified suppliers and comprehensive supply chain management for traditional medicine raw materials including seasonal sourcing and quality standardization, implementation of mature quality management systems compliant with traditional medicine regulatory standards including good manufacturing practices and international quality certifications, initiation of low-rate commercial production with full traceability and quality assurance systems ensuring therapeutic efficacy and regulatory compliance, and validation of packaging, labeling, and distribution systems appropriate for traditional medicine products with stability and shelf-life confirmation.

Commercial manufacturing system operation requires fully functional production capability with all supporting infrastructure including qualified supplier networks specifically for traditional medicine raw materials. Supply chain management must address unique traditional medicine requirements including seasonal availability, geographical sourcing, quality standardization, and authentication of traditional ingredients. Supplier qualification must be comprehensive including quality audits, capability assessments, and long-term partnership agreements.

Quality management system maturity must meet all relevant regulatory standards including good manufacturing practices, ISO certifications, and traditional medicine specific quality requirements. Quality assurance systems must be fully operational with validated analytical methods, statistical process control, and comprehensive documentation systems supporting regulatory compliance and market authorization.

Low-rate commercial production initiation requires successful production campaigns with full quality release and market distribution. Traceability systems must be complete from raw

material sourcing through finished product distribution. Packaging and labeling must comply with regulatory requirements and market expectations for traditional medicine products including stability validation and shelf-life establishment.

Evidence includes operational commercial manufacturing system documentation with qualified supplier networks and comprehensive supply chain management for traditional medicine raw materials, mature quality management system implementation with regulatory compliance certification including good manufacturing practices and international quality standards, low-rate commercial production records with full traceability and quality assurance including therapeutic efficacy validation and regulatory compliance, packaging and labeling system validation with stability testing and shelf-life confirmation for traditional medicine products, supplier qualification documentation including quality audits and long-term partnership agreements for traditional medicine raw materials, and regulatory compliance certification and market authorization documentation supporting commercial traditional medicine production. Documentation should establish operational commercial manufacturing with qualified supply chain and mature quality systems, successful commercial production initiation with regulatory compliance, and complete packaging and distribution capability for traditional medicine markets.

Assessment examines whether commercial manufacturing system is fully operational with qualified suppliers and comprehensive supply chain management appropriate for traditional medicine requirements, whether quality management systems are mature and compliant with all relevant regulatory standards, whether low-rate commercial production has been successfully initiated with full traceability and quality assurance, and whether packaging, distribution, and regulatory compliance systems support commercial traditional medicine operations. Success requires fully operational commercial manufacturing system with qualified traditional medicine supply chain, mature quality management systems meeting all regulatory standards, successful commercial production initiation with complete traceability and compliance, and validated packaging and distribution systems supporting traditional medicine market requirements.

4.8 MRL 8: Full Commercial Production Capability Demonstrated

Manufacturing system demonstrates capability to consistently produce at full commercial volumes while maintaining quality specifications and cost targets. Production scaling is proven with regulatory compliance and market supply capability. For traditional medicine innovations, this includes demonstration of full commercial production capability with consistent quality

achievement and therapeutic efficacy maintenance at maximum production volumes, validation of production scaling capability while maintaining traditional medicine quality standards and regulatory compliance across all target markets, confirmation of cost target achievement and competitive positioning in traditional medicine markets with sustained profitability demonstration, and establishment of market supply capability with distribution network validation and customer satisfaction confirmation for traditional medicine products.

Full commercial production capability requires demonstrated ability to operate at maximum design capacity while consistently meeting all quality specifications and cost targets. Production scaling validation must prove that quality standards are maintained across the full range of production volumes with consistent therapeutic efficacy for traditional medicine products. Manufacturing system performance must be stable and predictable with appropriate process control and quality assurance.

Regulatory compliance must be maintained across all production volumes with validated quality systems and documentation supporting market authorization in all target jurisdictions. Cost performance must meet competitive targets while maintaining quality standards and regulatory compliance. Market supply capability must be demonstrated with reliable delivery performance and customer satisfaction.

Production efficiency metrics must be established and maintained including overall equipment effectiveness, yield optimization, and waste minimization. Continuous improvement processes must be active and effective in maintaining competitive advantage. Manufacturing system must demonstrate resilience and reliability with appropriate contingency planning and risk management.

Evidence encompasses full commercial production capability demonstration with consistent quality achievement and therapeutic efficacy maintenance at maximum volumes, production scaling validation maintaining traditional medicine quality standards and regulatory compliance across all target markets, cost target achievement and competitive positioning confirmation with sustained profitability demonstration for traditional medicine markets, market supply capability establishment with distribution network validation and customer satisfaction confirmation, production efficiency metrics and continuous improvement process documentation demonstrating competitive advantage maintenance, and regulatory compliance validation and market authorization confirmation supporting full commercial operations across all target jurisdictions. Documentation should establish full commercial production capability with consistent quality and cost performance, proven market supply capability with customer satisfaction, and comprehensive regulatory compliance supporting traditional medicine commercial operations.

Assessment considers whether manufacturing system has demonstrated capability to consistently produce at full commercial volumes while maintaining quality specifications and cost targets for traditional medicine products, whether production scaling is proven with regulatory compliance maintained across all target markets, whether cost targets are achieved with competitive positioning and sustained profitability in traditional medicine markets, and whether market supply capability is established with validated distribution and customer satisfaction. Successful completion requires demonstrated full commercial production capability with consistent quality and cost performance for traditional medicine products, proven production scaling with maintained regulatory compliance across all markets, achieved cost targets with competitive positioning and sustained profitability, and established market supply capability with validated customer satisfaction and distribution network performance.

4.9 MRL 9: Commercial Production Validated with Market Success

Commercial manufacturing achieves sustained market success with consistent quality and cost performance meeting all targets. Production operations demonstrate reliability and customer satisfaction with proven market acceptance. For traditional medicine innovations, this includes validation of commercial production success with sustained market acceptance and customer satisfaction for traditional medicine products, demonstration of consistent quality and cost performance meeting all commercial targets while maintaining therapeutic efficacy and regulatory compliance, confirmation of production system reliability and operational excellence with proven track record of successful market supply, and establishment of competitive advantage and market leadership position through manufacturing excellence and traditional medicine product quality.

Commercial production validation requires sustained successful operation over extended periods with consistent achievement of all performance targets including quality, cost, delivery, and customer satisfaction. Market success must be demonstrated through sales performance, market share growth, customer retention, and competitive positioning in traditional medicine markets. Production system reliability must be proven with minimal disruptions and consistent performance.

Quality performance must consistently meet or exceed all specifications with maintained therapeutic efficacy and regulatory compliance across all markets. Cost performance must maintain competitive positioning with sustained profitability and market growth capability. Customer satisfaction must be high and sustained with strong loyalty and retention rates for traditional medicine products.

Manufacturing excellence must be demonstrated through industry recognition, regulatory compliance maintenance, and continuous improvement effectiveness. Production operations must show operational maturity with effective management systems, trained workforce, and sustained performance improvement. Market leadership position should be established through quality reputation and competitive advantage.

Evidence includes commercial production success validation with sustained market acceptance and customer satisfaction for traditional medicine products, consistent quality and cost performance documentation meeting all commercial targets while maintaining therapeutic efficacy, production system reliability and operational excellence demonstration with proven market supply track record, competitive advantage and market leadership establishment through manufacturing excellence and traditional medicine product quality, customer satisfaction and loyalty metrics with sustained performance and market growth, and industry recognition and regulatory compliance maintenance demonstrating manufacturing excellence and operational maturity. Documentation should prove sustained commercial production success with market acceptance, consistent performance meeting all targets with maintained quality, and established market leadership through manufacturing excellence.

Assessment evaluates whether commercial manufacturing has achieved sustained market success with consistent quality and cost performance for traditional medicine products, whether production system reliability and operational excellence are proven with successful market supply track record, whether competitive advantage and market leadership have been established through manufacturing excellence, and whether customer satisfaction and market performance demonstrate sustained commercial success. Success requires sustained commercial production success with proven market acceptance and customer satisfaction, consistent performance meeting all targets while maintaining traditional medicine quality and efficacy, proven production system reliability with operational excellence, and established competitive advantage and market leadership through manufacturing excellence and product quality.

4.10 MRL 10: Manufacturing Excellence Achieved with Continuous Improvement

Manufacturing operations achieve world-class performance with institutionalized continuous improvement culture and ongoing innovation integration. Competitive advantage is sustained through manufacturing excellence and operational optimization. For traditional medicine innovations, this includes achievement of manufacturing excellence with world-class performance metrics and industry leadership in traditional medicine production,

institutionalization of continuous improvement culture with active innovation integration and operational optimization while preserving traditional medicine authenticity, demonstration of sustained competitive advantage through manufacturing excellence and cost leadership in traditional medicine markets, and establishment of thought leadership and industry recognition for manufacturing innovation and traditional medicine quality excellence.

Manufacturing excellence requires achievement of world-class performance across all operational metrics including quality, cost, delivery, safety, and environmental performance. Continuous improvement culture must be institutionalized with active employee engagement, systematic problem-solving, and ongoing innovation integration. Manufacturing operations must demonstrate sustained competitive advantage with industry leadership position.

Innovation integration must enhance manufacturing capability while preserving traditional medicine authenticity and therapeutic efficacy. Operational optimization must achieve cost leadership while maintaining quality excellence and regulatory compliance. Manufacturing system must demonstrate flexibility and adaptability to market changes and new product requirements.

Industry recognition should be achieved through awards, certifications, and thought leadership in traditional medicine manufacturing. Manufacturing organization must demonstrate maturity with effective leadership, skilled workforce, and sustainable practices. Competitive advantage must be sustained through ongoing innovation and operational excellence.

Evidence encompasses manufacturing excellence achievement with world-class performance metrics and industry leadership in traditional medicine production, continuous improvement culture institutionalization with innovation integration and operational optimization while preserving traditional medicine authenticity, sustained competitive advantage demonstration through manufacturing excellence and cost leadership in traditional medicine markets, thought leadership and industry recognition establishment for manufacturing innovation and traditional medicine quality excellence, employee engagement and organizational maturity metrics demonstrating sustained manufacturing excellence culture, and innovation integration and operational flexibility demonstration maintaining competitive advantage and market leadership. Documentation should establish world-class manufacturing performance with industry leadership, institutionalized continuous improvement culture preserving traditional medicine authenticity, sustained competitive advantage through operational excellence, and recognized thought leadership in traditional medicine manufacturing innovation.

Assessment focuses on whether manufacturing operations have achieved world-class performance with sustained competitive advantage in traditional medicine production, whether continuous improvement culture is institutionalized with effective innovation integration while preserving traditional medicine authenticity, whether thought leadership and industry recognition have been established for manufacturing excellence, and whether organizational maturity and employee engagement support sustained manufacturing excellence. Successful completion requires achievement of world-class manufacturing performance with industry leadership in traditional medicine production, institutionalized continuous improvement culture with innovation integration preserving traditional medicine authenticity, sustained competitive advantage through manufacturing and operational excellence, and established thought leadership and industry recognition for traditional medicine manufacturing innovation and quality excellence.

Table 3: Manufacturing Readiness Level (MRL) Assessment Framework for Commercial Production

Purpose: This table provides comprehensive guidance for evaluating manufacturing capability and commercial production readiness across the ten MRL levels. Use this table to assess current manufacturing maturity, identify gaps in production capability, plan manufacturing scale-up activities, and ensure alignment with commercial launch timelines.

MRL	Definition	Key Decision Questions	Typical Evidence & Deliverables
1	Commercial manufacturing requirements identified	Have commercial production requirements and constraints been identified?	Commercial production feasibility assessment, manufacturing requirement analysis, preliminary cost estimates
2	Manufacturing approach and process concepts developed	Has manufacturing approach been designed for commercial production requirements?	Manufacturing process concept design, production method evaluation, preliminary process flow
3	Manufacturing process proven at laboratory/pilot scale	Can manufacturing process produce commercial-quality products at small scale?	Laboratory/pilot scale production validation, quality verification, process reproducibility confirmation

MRL	Definition	Key Decision Questions	Typical Evidence & Deliverables
4	Manufacturing process validated for commercial production	Is manufacturing process validated with statistical control and quality assurance?	Process validation documentation, statistical process control, quality system validation
5	Manufacturing demonstrated in production-relevant environment	Has manufacturing process been demonstrated at scale approaching commercial production?	Production-scale demonstration, quality maintenance validation, yield and cost verification
6	Manufacturing system proven for commercial production	Can manufacturing system meet commercial volume, cost, and quality requirements?	Commercial production capability demonstration, cost and quality targets achievement, system reliability validation
7	Commercial manufacturing system operational with supply chain	Is complete manufacturing system operational with qualified suppliers and quality systems?	Commercial manufacturing system operation, supplier qualification, quality management system certification
8	Full commercial production capability demonstrated	Can manufacturing system consistently produce at full commercial volumes and specifications?	Full-scale production validation, commercial quality and cost achievement, regulatory compliance confirmation
9	Commercial production validated with market success	Is commercial manufacturing achieving market success with consistent quality and cost performance?	Commercial production performance data, market success metrics, quality and cost targets sustained
10	Manufacturing excellence achieved with continuous improvement	Has manufacturing achieved world-class performance with ongoing optimization and innovation?	Manufacturing excellence metrics, continuous improvement results, competitive advantage demonstration

Table 4: MRL-TRL Integration Matrix for AYUSH Innovation Categories

Purpose: This matrix guides stakeholders in understanding the relationship between innovation development (TRL) and manufacturing readiness (MRL) for each AYUSH Innovation category. Use this table to plan synchronized TRL-MRL advancement and set realistic expectations for production capability at different innovation maturity levels.

Innovation Category	TRL 1-3	TRL 4-5	TRL 6-7	TRL 8-9	Dominant MRL Ceiling	Notes
Clinical Therapeutics & Medical Solutions	MRL 2-4	MRL 4-6	MRL 6-8	MRL 8-10	10	Full pharmaceutical/device manufacturing required
Consumer Health & Wellness Products	MRL 2-4	MRL 4-6	MRL 6-8	MRL 8-10	10	Consumer product manufacturing chain
Professional Services & Knowledge Solutions	MRL 1-2	MRL 2-3	MRL 3-4	MRL 4	4	Limited manufacturing; service delivery focus
Agricultural & Environmental Applications	MRL 2-4	MRL 4-6	MRL 6-8	MRL 8-10	10	Agricultural input manufacturing
Manufacturing & Production Services	MRL 4-6	MRL 6-8	MRL 8-10	MRL 10	10	Manufacturing service excellence required
Digital Technology & Solutions	MRL 1-2	MRL 2-3	MRL 3-5	MRL 5-6	6	and hardware components

5. SERVICE READINESS LEVEL ASSESSMENT

The Service Readiness Level scale assesses service delivery capability and operational excellence from initial service concept through optimized service delivery with continuous improvement. Each level represents specific service maturity milestones with defined assessment criteria and evidence requirements focused on commercial service delivery and market success.

Service development progresses through systematic capability building stages, beginning with market need identification and service concept formulation, advancing through service prototype development and validation, continuing through operational service delivery and scalability demonstration, and culminating in service excellence with continuous improvement and market leadership. Each advancement requires specific evidence of service capability and delivery readiness.

5.1 SRL 1: Market Need Identified and Service Concept Formulated

Initial service development begins with identification of clear market need and formulation of compelling service concept for target customers. Basic understanding of user requirements and service potential is developed through market research and stakeholder consultation with focus on commercial viability and competitive positioning. For traditional medicine services, this includes identification of unmet needs in traditional healthcare delivery with commercial opportunity assessment, understanding of patient and practitioner requirements for traditional medicine services, recognition of opportunities for service innovation and market differentiation, and preliminary assessment of service feasibility and commercial value proposition.

Service need identification requires systematic analysis of current market gaps and user requirements with commercial opportunity evaluation. Target user populations must be identified and characterized with specific needs and willingness to pay.

Basic service concept must be articulated with clear commercial value proposition and competitive differentiation. Initial stakeholder mapping should identify key participants, influencers, and potential customers. Preliminary feasibility assessment should indicate service viability and commercial development potential.

Evidence includes comprehensive service need assessment documenting market gaps and commercial opportunities, target user identification and characterization with requirement analysis and willingness to pay assessment, basic service concept articulation with clear commercial value proposition and competitive positioning, stakeholder mapping identifying key participants and potential customers, preliminary feasibility assessment indicating service viability and commercial potential, and initial market analysis supporting service development and revenue projections. Documentation should demonstrate clear understanding of market service need and commercial opportunity, realistic assessment of user requirements and competitive positioning, and logical foundation for service concept development with commercial viability.

Assessment examines whether service need has been clearly identified and validated through appropriate market research, whether target users and their requirements are well understood with commercial implications, whether basic service concept is compelling and commercially feasible, and whether preliminary assessment supports service development investment. Success requires clear identification and validation of market service need with commercial opportunity, comprehensive understanding of user requirements and competitive landscape, compelling service concept with clear commercial value proposition, and positive feasibility assessment supporting further development investment.

5.2 SRL 2: Service Model Designed with Commercial Value Proposition

Building upon identified market need, comprehensive service delivery models are developed with detailed commercial value propositions and customer experience design. Service architecture moves from basic concept to structured delivery approach with defined processes, resources, and value creation mechanisms. For traditional medicine services, this includes development of comprehensive service delivery models incorporating traditional approaches, design of customer experience and practitioner interaction protocols, creation of detailed value propositions addressing specific customer segments, and development of preliminary business models including revenue streams and cost structures.

Service model development requires detailed design of service delivery processes and customer touchpoints. Value propositions must be compelling and differentiated for each customer segment. Customer journey mapping should identify all interaction points and value

delivery moments. Resource requirements and operational processes must be defined with cost implications. Business model framework should outline revenue generation, cost structure, and profitability pathways.

Evidence encompasses comprehensive service design documentation including delivery processes and customer experience protocols, detailed value proposition development for target customer segments with competitive differentiation, customer journey mapping identifying all touchpoints and value delivery moments, resource requirement analysis and operational process definition with cost implications, preliminary business model framework outlining revenue generation and profitability pathways, and competitive analysis demonstrating service differentiation and market positioning. Documentation should provide clear service delivery vision with compelling value creation, thorough understanding of customer needs and competitive dynamics, and realistic business model framework supporting commercial development.

Assessment focuses on whether comprehensive service delivery model has been designed with clear value propositions for target customers, whether customer experience and journey mapping are thorough and compelling, whether resource requirements and operational processes are realistic and cost-effective, and whether business model framework supports commercial viability and profitability. Successful completion requires development of comprehensive service delivery model with differentiated value propositions, thorough customer experience design with clear value delivery, realistic resource and operational planning, and viable business model framework supporting commercial success.

5.3 SRL 3: Service Prototype Developed and Customer-Tested

Active service development initiates with creation of minimum viable service offering and initial customer testing to validate service concept and delivery approach. Service prototyping involves real customer interactions in controlled settings to test assumptions and refine service delivery. For traditional medicine services, this includes development of minimum viable service offering incorporating traditional approaches, initial customer testing with representative user groups in controlled settings, collection and analysis of customer feedback for service refinement, and iterative service design improvement based on user experience data.

Service prototype development requires creation of functional service offering that delivers core value proposition to customers. Customer testing should involve representative users in realistic service interactions. Feedback collection must be systematic and comprehensive

across all service dimensions. Service refinement should address identified issues and opportunities for improvement. Quality metrics should be established for service performance measurement.

Evidence includes service prototype documentation describing functional service offering and delivery processes, customer testing results with representative user groups showing engagement and satisfaction, systematic feedback collection and analysis identifying service strengths and improvement opportunities, iterative service design documentation showing refinement based on user feedback, quality metrics establishment for service performance measurement, and preliminary customer acceptance validation indicating service market potential. Documentation should demonstrate functional service prototype with validated customer acceptance, systematic approach to feedback collection and service improvement, and evidence of service refinement based on real customer interactions.

Assessment examines whether functional service prototype has been developed that delivers core value proposition to customers, whether customer testing has been conducted systematically with representative users, whether feedback collection and analysis have been thorough and actionable, and whether service refinement demonstrates responsive improvement based on customer input. Success requires development of functional service prototype with demonstrated customer value delivery, systematic customer testing with representative users, comprehensive feedback analysis and actionable insights, and evidence of service improvement based on customer input and market learning.

5.4 SRL 4: Service Validated with Quality Standards and Customer Acceptance

Service delivery is systematically validated in controlled environments with defined quality metrics and customer acceptance criteria. Performance standards are established and consistently achieved with documented service quality and customer satisfaction. For traditional medicine services, this includes validation of service delivery consistency and quality in controlled settings, establishment of service quality standards and performance metrics appropriate for traditional medicine, documentation of customer acceptance and satisfaction with service quality, and development of service level agreements defining performance expectations and quality commitments.

Service validation requires establishment of comprehensive quality standards and performance metrics for all service dimensions. Service delivery must consistently meet defined standards in controlled testing environments. Customer acceptance criteria must be established and systematically measured. Service level agreements should define performance commitments and quality expectations. Quality assurance processes must be implemented and validated for consistent service delivery.

Evidence encompasses controlled environment service validation results demonstrating consistent quality and performance, establishment of comprehensive quality standards and performance metrics with measurement systems, customer acceptance and satisfaction documentation with systematic measurement and analysis, service level agreement development defining performance expectations and quality commitments, quality assurance process implementation and validation with consistency demonstration, and service performance data showing achievement of quality standards and customer acceptance criteria. Documentation should prove service delivery consistency and quality achievement, systematic quality measurement and management, and strong customer acceptance with satisfaction validation.

Assessment considers whether service delivery has been systematically validated in controlled environments with consistent quality achievement, whether quality standards and performance metrics are comprehensive and appropriate for service requirements, whether customer acceptance and satisfaction are consistently high and well-documented, and whether quality assurance processes ensure reliable service delivery performance. Successful completion requires demonstration of consistent service quality and performance in controlled environments, establishment of comprehensive quality standards and measurement systems, validated customer acceptance and satisfaction with service delivery, and effective quality assurance processes ensuring reliable performance.

5.5 SRL 5: Service Demonstrated in Commercial Operational Environment

Service delivery is successfully demonstrated in realistic commercial operational environments with actual customers and market conditions. Service performance is validated under real-world constraints with supporting infrastructure and operational processes. For traditional medicine services, this includes demonstration of service delivery in realistic commercial settings with paying customers, validation of service performance under actual market conditions and operational constraints, integration with supporting infrastructure and commercial systems, and confirmation of service delivery protocols and operational processes under real-world conditions.

Commercial environment demonstration requires successful service delivery to actual customers in realistic market settings. Service performance must be maintained under real-world operational constraints and market conditions. Supporting infrastructure and systems must be integrated and functional. Operational processes must be validated with actual service delivery teams. Customer adoption and satisfaction should be demonstrated in commercial environment.

Evidence includes commercial environment service demonstration results with actual customers showing successful delivery and satisfaction, service performance validation under realistic market conditions and operational constraints, supporting infrastructure and system integration validation with operational functionality, operational process validation with actual service delivery teams and commercial requirements, customer adoption and satisfaction documentation in commercial environment with paying customers, and commercial feasibility confirmation including cost structure and revenue validation. Documentation should establish service delivery success in commercial environment, operational process effectiveness under real conditions, and commercial viability with actual customer acceptance and revenue generation.

Assessment evaluates whether service delivery has been successfully demonstrated in commercial operational environment with actual customers, whether service performance is maintained under realistic market conditions and constraints, whether supporting infrastructure and operational processes are effective in commercial settings, and whether customer adoption and commercial feasibility are validated. Success requires successful service delivery demonstration in commercial environment, maintained service performance under real-world conditions, effective operational processes and supporting infrastructure, and validated customer adoption with commercial feasibility confirmation.

5.6 SRL 6: Service System Operational with Proven Commercial Scalability

Complete service system is operational with demonstrated commercial scalability and multi-location deployment capability. Service delivery infrastructure supports growth and expansion with validated resource models and operational efficiency. For traditional medicine services, this includes operation of complete service system with demonstrated scalability across multiple locations, validation of resource models and operational processes supporting growth and expansion, demonstration of commercial viability and revenue model effectiveness at scale, and confirmation of service delivery consistency and quality across multiple deployment contexts.

Service system scalability requires successful operation across multiple locations or customer segments with consistent quality and performance. Resource models must support efficient scaling without proportional cost increases. Operational processes must be systematized and replicable across different contexts. Revenue model effectiveness must be demonstrated at commercial scale. Service delivery consistency must be maintained across all deployment contexts.

Evidence encompasses complete service system operation demonstration with multi-location deployment and consistent performance, commercial scalability validation including resource model effectiveness and operational efficiency, revenue model validation at commercial scale with demonstrated profitability and growth potential, service delivery consistency documentation across multiple deployment contexts and customer segments, resource optimization analysis showing efficient scaling and cost management, and commercial expansion feasibility confirmation with market demand validation. Documentation should prove service system operational effectiveness and scalability, revenue model viability at commercial scale, and consistent service delivery across multiple contexts with growth potential.

Assessment focuses on whether complete service system is operational with demonstrated scalability across multiple contexts, whether resource models and operational processes support efficient growth and expansion, whether commercial viability and revenue model effectiveness are proven at scale, and whether service delivery consistency is maintained across all deployment contexts. Successful completion requires operational service system with proven scalability and multi-location capability, validated resource models supporting efficient growth, demonstrated commercial viability and revenue effectiveness at scale, and maintained service quality and consistency across all deployment contexts.

5.7 SRL 7: Service Delivery Proven Across Multiple Markets with Quality Assurance

Consistent service delivery is proven across diverse commercial markets and customer segments with comprehensive quality assurance systems and standardized procedures. Service excellence is systematically maintained across all operational contexts. For traditional medicine services, this includes demonstration of consistent service delivery across diverse markets and customer segments, implementation of comprehensive quality assurance systems ensuring service excellence, establishment of standardized procedures and training systems for service delivery consistency, and validation of service performance across different cultural and market contexts while maintaining traditional medicine authenticity.

Multi-market service delivery requires consistent performance across diverse customer segments, geographic markets, and cultural contexts. Quality assurance systems must be comprehensive and systematically applied across all service delivery contexts. Standardized procedures and training programs must ensure consistent service excellence. Performance measurement and management systems must maintain service quality across all markets and contexts.

Evidence includes multi-market service deployment data demonstrating consistent performance across diverse commercial contexts, comprehensive quality assurance system implementation with systematic application across all service delivery, standardized procedure documentation and training system validation ensuring consistent service excellence, service performance measurement across different markets and customer segments showing maintained quality and customer satisfaction, cultural adaptation validation maintaining service effectiveness while preserving traditional medicine authenticity, and quality management system certification and compliance documentation. Documentation should establish consistent service excellence across diverse markets, comprehensive quality assurance with systematic application, and maintained service effectiveness across different cultural and market contexts.

Assessment examines whether consistent service delivery has been proven across diverse commercial markets and customer segments, whether quality assurance systems are comprehensive and systematically applied, whether standardized procedures and training ensure service excellence consistency, and whether service performance is maintained across different cultural and market contexts. Success requires demonstration of consistent service excellence across diverse markets, comprehensive quality assurance systems with systematic application, effective standardized procedures and training for consistency, and maintained service performance across all cultural and market contexts.

5.8 SRL 8: Service System Qualified for Large-Scale Commercial Deployment

Service system is qualified for large-scale commercial deployment with proven sustainability model and comprehensive deployment readiness. All systems and processes are validated for major market expansion with financial sustainability and regulatory compliance. For traditional medicine services, this includes qualification of service system for large-scale deployment with comprehensive market expansion capability, validation of financial sustainability model and profitability at scale, confirmation of regulatory compliance and quality system certification for major market deployment, and establishment of comprehensive deployment infrastructure supporting rapid market expansion.

Large-scale deployment qualification requires comprehensive validation of all service system components for major market expansion. Financial sustainability model must be proven with demonstrated profitability at scale. Regulatory compliance and quality system certification must be comprehensive and maintained across all deployment contexts. Deployment infrastructure must support rapid scaling and market expansion with operational excellence.

Evidence encompasses service system qualification documentation for large-scale deployment with comprehensive validation across all components, financial sustainability model validation with demonstrated profitability and scalability at major market scale, regulatory compliance certification and quality system validation for large-scale deployment across multiple jurisdictions, comprehensive deployment infrastructure establishment supporting rapid market expansion and operational excellence, market expansion readiness assessment with validated demand and competitive positioning, and stakeholder preparation completion including partnership development and organizational capability building. Documentation should confirm service system readiness for large-scale deployment, financial sustainability at major scale, comprehensive regulatory compliance and quality certification, and complete deployment infrastructure and market expansion capability.

Assessment considers whether service system is fully qualified for large-scale commercial deployment with comprehensive validation, whether financial sustainability model is proven with demonstrated profitability at major scale, whether regulatory compliance and quality certification are comprehensive and maintained, and whether deployment infrastructure supports rapid market expansion with operational excellence. Successful completion requires complete service system qualification for large-scale deployment, proven financial sustainability model with major scale profitability, comprehensive regulatory compliance and quality certification, and complete deployment infrastructure supporting rapid market expansion.

5.9 SRL 9: Service System Optimized with Continuous Improvement and Market Leadership

Service system achieves optimization with continuous improvement processes and competitive market leadership position. Sustained service excellence is maintained with ongoing innovation integration and customer loyalty. For traditional medicine services, this includes achievement of service system optimization with demonstrated market leadership in traditional medicine service delivery, implementation of continuous improvement processes ensuring sustained competitive advantage and service excellence, integration of ongoing innovation and service enhancement maintaining market differentiation, and establishment of strong customer loyalty and market expansion with sustained business growth.

Service system optimization requires achievement of market leadership position with sustained competitive advantage. Continuous improvement processes must be active and effective in maintaining service excellence and competitive differentiation. Innovation integration should enhance service delivery while preserving traditional medicine authenticity. Customer loyalty and retention must be high with sustained business growth and market expansion.

Evidence includes market leadership metrics and competitive positioning data demonstrating service excellence and market dominance, continuous improvement process implementation with documented results and sustained competitive advantage, innovation integration protocols and service enhancement evidence maintaining market differentiation and traditional medicine authenticity, customer loyalty and retention measurement with high satisfaction and advocacy levels, sustained business growth documentation with market expansion and financial performance excellence, and industry recognition and thought leadership establishment demonstrating service excellence and market leadership. Documentation should prove sustained market leadership with competitive advantage, effective continuous improvement maintaining service excellence, successful innovation integration preserving traditional medicine authenticity, and strong customer loyalty with sustained business growth.

Assessment evaluates whether service system has achieved optimization with market leadership and competitive advantage, whether continuous improvement processes are effective in maintaining service excellence and differentiation, whether innovation integration enhances service delivery while preserving traditional medicine authenticity, and whether customer loyalty and business growth are sustained over time. Successful completion requires achievement of market leadership with sustained competitive advantage, effective continuous improvement processes maintaining service excellence, successful innovation integration preserving traditional medicine authenticity, and demonstrated customer loyalty with sustained business growth and market expansion.

Table 5: Service Readiness Level (SRL) Assessment Framework for Commercial Service Delivery

Purpose: This table provides systematic guidance for evaluating commercial service delivery readiness across nine SRL levels. Use this table to assess current service maturity, identify service development needs, plan service delivery improvements, and ensure alignment with commercial launch and scaling objectives.

SRL	Definition	Key Assessment Criteria	Typical Evidence & Deliverables
1	Market need identified and service concept formulated	Has clear market need been identified with compelling service concept for target customers?	Market need validation, service concept development, customer segment analysis, preliminary value proposition
2	Service model designed with commercial value proposition	Has comprehensive service delivery model been designed with clear commercial value and customer experience?	Service design documentation, customer journey mapping, commercial value proposition, business model development
3	Service prototype developed and customer-tested	Has minimum viable service been developed and tested with target customers?	Service prototype development, customer testing results, feedback analysis, service refinement documentation
4	Service validated with quality standards and customer acceptance	Has service delivery been validated with defined quality metrics and customer satisfaction?	Service validation testing, quality standards documentation, customer satisfaction metrics, service level agreements
5	Service demonstrated in commercial operational environment	Has service delivery been successfully demonstrated with customers in commercial settings?	Commercial environment demonstration, customer adoption evidence, operational performance validation, service delivery protocols
6	Service system operational with proven commercial scalability	Has complete service system been demonstrated as commercially viable and scalable?	Commercial scalability demonstration, multi-location deployment, resource optimization, revenue model validation

SRL	Definition	Key Assessment Criteria	Typical Evidence & Deliverables
7	Service delivery proven across multiple markets with quality assurance	Has consistent service delivery been proven across diverse commercial markets with quality systems?	Multi-market deployment data, quality assurance systems, standardized procedures, performance consistency validation
8	Service system qualified for large-scale commercial deployment	Is service system ready for large-scale commercial deployment with proven sustainability and profitability?	Commercial deployment readiness, financial sustainability validation, operational scalability confirmation, market expansion planning
9	Service system optimized with continuous improvement and market leadership	Has service achieved optimization with continuous improvement and competitive market leadership?	Market leadership metrics, continuous improvement systems, customer loyalty measurement, innovation integration protocols

Table 6: SRL-TRL Integration Matrix for Commercial Innovation Categories

Purpose: This matrix demonstrates the relationship between innovation development (TRL) and service readiness (SRL) across different commercial categories. Use this table to plan coordinated TRL-SRL development and ensure that service delivery capabilities support commercial success.

Table 6: SRL-TRL Integration Matrix for Commercial Innovation Categories

Purpose: This matrix demonstrates the relationship between innovation development (TRL) and service readiness (SRL) across different commercial categories. Use this table to plan coordinated TRL-SRL development and ensure that service delivery capabilities support commercial success.

Innovation Category	TRL 1-3	TRL 4-5	TRL 6-7	TRL 8-9	Corresponding SRL Range	Service Priority
Clinical Therapeutics & Medical Solutions	SRL 2-3	SRL 3-5	SRL 5-7	SRL 7-8	2-8	Clinical Support Services
Consumer Health & Wellness Products	SRL 2-3	SRL 3-5	SRL 5-7	SRL 7-8	2-8	Customer Experience Services
Professional Services & Knowledge Solutions	SRL 1-2	SRL 2-4	SRL 4-7	SRL 7-9	1-9	Primary Service Delivery
Agricultural & Environmental Applications	SRL 2-3	SRL 3-5	SRL 5-7	SRL 7-8	2-8	Agricultural Extension Services
Manufacturing & Production Services	SRL 3-4	SRL 4-6	SRL 6-7	SRL 7-8	3-8	B2B Manufacturing Services
Digital Technology & Solutions	SRL 2-4	SRL 4-6	SRL 6-8	SRL 8-9	2-9	Platform, User Services & Biotech Integration Services

6. INTEGRATED INNOVATION ASSESSMENT FRAMEWORK

6.1 Innovation Decision Matrix

The integrated assessment framework employs a systematic decision matrix approach to ensure accurate categorization and appropriate readiness level evaluation across all three dimensions focused on commercial success and market readiness.

Table 7: Innovation Categorization Decision Matrix

Purpose: This decision matrix provides step-by-step guidance for accurately identifying the primary commercial category for any AYUSH innovation. Use this table as a systematic approach to ensure consistent categorization focused on commercial applications and market opportunities.

Focus	Primary Category	Target Market	Revenue Model	Assessment Approach
Developing products for healthcare provider use requiring clinical expertise	Clinical Therapeutics & Medical Solutions	Healthcare providers, hospitals, clinics	Professional sales, healthcare reimbursement	TRL-MRL Primary, Moderate SRL
Creating products for direct consumer purchase and personal use	Consumer Health & Wellness Products	Individual consumers, wellness markets	Direct sales, retail distribution	TRL-MRL Primary, Moderate SRL

Focus	Primary Category	Target Market	Revenue Model	Assessment Approach
Delivering expertise, training, or professional services	Professional Services & Knowledge Solutions	Professionals, institutions, organizations	Service fees, consulting, training	SRL Primary, TRL Support, Limited MRL
Providing agricultural inputs, farming solutions, or food processing	Agricultural & Environmental Applications	Farmers, agricultural businesses, food processors	Agricultural sales, B2B services	Full Integration Required
Offering manufacturing, production, or B2B services	Manufacturing & Production Services	AYUSH companies, manufacturers	Manufacturing services, B2B contracts	MRL Primary, TRL-SRL Support
Building digital platforms, software, or technology solutions biotech convergence applications	Digital Technology & Solutions	Multiple stakeholders, platform users	Software subscriptions, platform fees	TRL-SRL Primary, Limited MRL

6.2 Comprehensive AYUSH Readiness Matrix

Table 8: Innovation Lifecycle and Readiness Progression Matrix

Purpose: This comprehensive matrix shows commercial readiness level progressions across all three dimensions for each innovation category throughout the commercialization lifecycle. Use this table for business planning, investment decisions, milestone setting and commercial progress tracking.

Innovation Category	Concept Stage (TRL 1-3)	Development Stage (TRL 4-5)	Market Validation (TRL 6-7)	Commercial Launch (TRL 8-9)	Key Commercial Milestones
Clinical Therapeutics & Medical Solutions	TRL 1-3, MRL 2-4, SRL 2-3	TRL 4-5, MRL 4-6, SRL 3-5	TRL 6-7, MRL 6-8, SRL 5-7	TRL 8-9, MRL 8-10, SRL 7-8	Regulatory approval, clinical adoption, market penetration
Consumer Health & Wellness Products	TRL 1-3, MRL 2-4, SRL 2-3	TRL 4-5, MRL 4-6, SRL 3-5	TRL 6-7, MRL 6-8, SRL 5-7	TRL 8-9, MRL 8-10, SRL 7-8	Brand recognition, retail distribution, consumer loyalty
Professional Services & Knowledge Solutions	TRL 3-4, MRL 1-2, SRL 1-2	TRL 4-5, MRL 2-3, SRL 2-4	TRL 5-7, MRL 3-4, SRL 4-7	TRL 7-8, MRL 4, SRL 7-9	Professional recognition, service excellence, market leadership
Agricultural & Environmental Applications	TRL 1-3, MRL 2-4, SRL 2-3	TRL 4-5, MRL 4-6, SRL 3-5	TRL 6-7, MRL 6-8, SRL 5-7	TRL 8-9, MRL 8-10, SRL 7-8	Agricultural validation, farmer adoption, sustainable growth
Manufacturing & Production Services	TRL 4-5, MRL 4-6, SRL 3-4	TRL 5-6, MRL 6-8, SRL 4-6	TRL 6-7, MRL 8-10, SRL 6-7	TRL 7-9, MRL 10, SRL 7-8	Production excellence, client satisfaction, competitive advantage
Digital technology, platform solutions and biotech convergence	TRL 2-3, MRL 1-2, SRL 2-4	TRL 4-5, MRL 2-3, SRL 4-6	TRL 6-7, MRL 3-5, SRL 6-8	TRL 8-9, MRL 5-6, SRL 8-9	User adoption, platform scaling, ecosystem development

7. COMMERCIAL SUCCESS METRICS AND VALIDATION

7.1 Innovation Performance Indicators

Commercial success validation requires comprehensive performance measurement across financial, market, operational, and innovation dimensions. Financial performance indicators include revenue growth and profitability achievement, market share expansion and competitive positioning improvement, return on investment realization and commercial viability demonstration, cost structure optimization and operational efficiency gains, and customer acquisition cost reduction with lifetime value maximization. Market acceptance measures encompass customer satisfaction and retention rate improvement, market penetration and expansion success, brand recognition development and competitive differentiation, customer testimonials and case study generation, and market leadership establishment with industry recognition.

Operational excellence metrics include production efficiency and quality consistency maintenance, supply chain reliability and cost optimization achievement, service delivery performance and customer experience enhancement, regulatory compliance maintenance and quality assurance effectiveness and scalability demonstration with international expansion capability. Innovation advancement indicators encompass intellectual property development and competitive protection, technology leadership and competitive advantage maintenance, continuous improvement and product evolution success, partnership development and ecosystem building achievement, and thought leadership establishment with industry influence.

7.2 Commercial Readiness Validation Framework

Commercial readiness validation employs systematic assessment of market readiness, operational capability, financial sustainability and competitive positioning.

Market readiness evaluation includes customer demand validation and purchase intent confirmation, competitive analysis completion and differentiation assessment, pricing strategy optimization and value proposition validation, distribution channel development and partnership establishment, and marketing and sales strategy effectiveness demonstration.

Operational readiness assessment encompasses production capability and quality system validation, supply chain reliability and vendor relationship strength, service delivery capacity and customer support readiness, regulatory compliance and approval status confirmation, and team capability and organizational readiness evaluation. Financial sustainability validation includes business model viability and revenue projection accuracy, funding adequacy and financial planning robustness, cost structure optimization and profitability pathway clarity, cash flow management and financial controls effectiveness, and investment returns and stakeholder value creation demonstration.

8. IMPLEMENTATION GUIDANCE FOR INNOVATORS AND ENTREPRENEURS

8.1 Self-Assessment and Development Planning

Innovators and entrepreneurs should initiate comprehensive self-assessment using the commercial innovation decision matrix to identify their primary category and understand specific assessment requirements. Complete detailed evaluation across TRL, MRL and SRL dimensions using category-specific criteria and evidence requirements. Document current readiness levels with supporting evidence and identify critical development gaps requiring immediate attention. Develop integrated advancement roadmap with realistic timelines, resource requirements, and milestone targets aligned with commercial objectives and market opportunities.

Strategic development planning should prioritize activities advancing multiple readiness dimensions simultaneously, optimize resource allocation across technology, manufacturing, and service development, establish clear success criteria and measurement systems for each advancement stage, identify partnership and collaboration opportunities accelerating development progress and create contingency plans addressing potential development challenges and market changes.

8.2 Investment Readiness and Funding Strategy

Investment readiness requires systematic preparation of framework-based assessment documentation, clear articulation of commercial value proposition and market opportunity, comprehensive competitive analysis and differentiation strategy, detailed financial projections and business model validation, and demonstrated progress across relevant readiness dimensions with clear advancement pathway and milestone achievement.

Funding strategy development should align funding requirements with readiness level progression needs, identify appropriate funding sources for each development stage, prepare milestone-based funding proposals with clear advancement targets and success metrics, demonstrate return on investment potential and commercial viability, and establish investor communication and reporting systems using framework metrics and progress indicators for ongoing stakeholder management.

Market readiness evaluation includes customer demand validation and purchase intent confirmation, competitive analysis completion and differentiation assessment, pricing strategy optimization and value proposition validation, distribution channel development and partnership establishment, and marketing and sales strategy effectiveness demonstration.

Operational readiness assessment encompasses production capability and quality system validation, supply chain reliability and vendor relationship strength, service delivery capacity and customer support readiness, regulatory compliance and approval status confirmation, and team capability and organizational readiness evaluation. Financial sustainability validation includes business model viability and revenue projection accuracy, funding adequacy and financial planning robustness, cost structure optimization and profitability pathway clarity, cash flow management and financial controls effectiveness, and investment returns and stakeholder value creation demonstration.

9. CONCLUSION AND COMMERCIALIZATION SUCCESS

This AYUSH Innovation Readiness Framework provides a comprehensive foundation for systematic assessment and advancement of traditional medicine commercialization across technology, manufacturing, and service readiness dimensions. The framework's innovation and entrepreneurship focus ensures practical applicability for startups, enterprises, and commercial organizations seeking to bring AYUSH innovations to market successfully.

The six commercial innovation categories reflect the actual landscape of AYUSH entrepreneurship and market opportunities, providing clear guidance for innovators across clinical therapeutics and medical solutions, consumer health and wellness products, professional services and knowledge solutions, agricultural and environmental applications, manufacturing and production services, and digital technology and platform solutions. Each category addresses specific commercial considerations, market dynamics, and success factors relevant to entrepreneurs and business developers.

The comprehensive assessment framework encompasses eight detailed reference tables supporting systematic evaluation and strategic planning. Table 1 guides initial category assessment and resource allocation. Tables 2, 3, and 5 provide detailed assessment criteria for each readiness dimension. Tables 4 and 6 demonstrate integration relationships between different readiness scales. Tables 7 and 8 support comprehensive commercial planning and milestone setting throughout the innovation lifecycle.

Implementation of this framework will accelerate AYUSH commercialization by providing clear progression pathways from innovation concept through market leadership, objective evaluation criteria supporting investment and partnership decisions, systematic development guidance optimizing resource allocation and minimizing commercial risks, and standardized communication tools facilitating stakeholder collaboration and market development.

The framework serves as a bridge between traditional medicine wisdom and commercial success, enabling entrepreneurs to develop safe, effective, and culturally authentic products and services that achieve market acceptance while preserving traditional medicine integrity. Regular framework application and continuous improvement will

3. Manufacturing Scalability and Quality Assurance – Many AYUSH innovations rely on natural ingredients and traditional preparation methods, which pose unique challenges when scaling up to mass production. A high TRL might indicate a remedy works in the lab or clinic, but it does not tell if that remedy can be produced reliably at commercial volumes. Defining a Manufacturing Readiness Level compels rigorous assessment of production viability – ensuring stable raw material supply, repeatable processes, quality control and cost-effective scaling for the innovation. This is crucial in AYUSH, where materials like herbs have seasonal variability and batch-to-batch inconsistency and where traditional techniques must be translated into industrial processes. MRL criteria shine light on these issues (e.g. raw material standardization, preservation of traditional preparation principles during scale-up, supply chain development), which are recognized challenges in traditional medicine manufacturing. In short, MRL fills the gap by confirming that an innovation can be manufactured to consistent standards and sufficient quantities – a facet of readiness that TRL alone would miss.

4. Service Delivery and Operational Readiness – A great number of AYUSH innovations are delivered as services or require significant service infrastructure around the core product. Whether it is a new Ayurvedic therapy protocol, a wellness clinic model, or a digital platform connecting practitioners with patients, the success hinges on service delivery capabilities – trained personnel, standardized protocols, customer support, distribution networks, etc. TRL does not account for any of these practical deployment factors. The Service Readiness Level was introduced to measure readiness of the service model and market rollout: it evaluates whether an innovation has proven its delivery processes, workforce training, user adoption strategies and operational scalability in real-world conditions. For instance, an AYUSH telehealth platform might be technically complete (high TRL), but SRL would reveal whether clinics and practitioners are actually prepared to implement it, whether patients can easily access and trust it and whether support systems are in place. By explicitly assessing service readiness, the framework ensures that an innovation is not deemed “ready” for commercialization until the last-mile delivery mechanisms are also mature – a critical necessity in domains like healthcare and wellness where execution quality determines outcomes.

5. Alignment with Regulatory and Quality Requirements – AYUSH products and services must satisfy regulatory standards and quality benchmarks before they can be widely commercialized. TRL focuses on functionality and efficacy of a technology, but overlooks compliance and quality system readiness. By incorporating MRL and SRL, the framework forces innovators to address these non-negotiable aspects of maturity. For example, MRL evaluation includes confirming that manufacturing processes meet Good Manufacturing Practice (GMP) standards and that all production steps comply with applicable regulations – in fact, at the earliest levels MRL calls for identifying regulatory and compliance requirements specific to traditional medicine manufacturing.

Annexure-I

Need for an MRL and SRL framework also along with TRL

1. Comprehensive Commercialization Assessment – Relying on TRL alone provides an incomplete view of an AYUSH innovation's maturity, as TRL measures only technical development (MRL is considered TRL6 level up). AYUSH products and services must not only work in principle, but also be manufacturable at scale and deliverable to end-users in real settings. By defining MRL and SRL alongside TRL, the framework ensures a holistic maturity profile covering technology, production and service delivery. These three dimensions together give a comprehensive assessment of readiness for the market, enabling more objective evaluation and informed decision-making than a one-dimensional TRL score. In essence, TRL by itself is insufficient – an innovation can be technically proven yet still fail commercially if manufacturing and service capabilities are not equally mature.

2. Diverse Modalities Require Multiple Readiness Dimensions – The AYUSH sector comprises a wide range of innovation types: clinical therapeutics, consumer wellness products, digital health platforms, agricultural inputs, professional training services and more. Each modality has distinct complexities and maturation pathways. For example, a herbal medicinal product must meet vastly different development milestones (e.g. cultivation of medicinal plants, formulation standardization) compared to a digital yoga therapy app or a practitioner training program. A single TRL scale cannot capture these divergent requirements. Introducing MRL and SRL provides tailored axes of assessment for each innovation type – manufacturing-intensive products are evaluated on industrial scalability, while service or platform innovations are evaluated on delivery model readiness. This flexible, multi-axis approach reflects the commercial complexity of AYUSH innovations and avoids the misjudgement that would result from a one-size-fits-all metric.

3. Manufacturing Scalability and Quality Assurance – Many AYUSH innovations rely on natural ingredients and traditional preparation methods, which pose unique challenges when scaling up to mass production. A high TRL might indicate a remedy works in the lab or clinic, but it does not tell if that remedy can be produced reliably at commercial volumes. Defining a Manufacturing Readiness Level compels rigorous assessment of production viability – ensuring stable raw material supply, repeatable processes, quality control and cost-effective scaling for the innovation. This is crucial in AYUSH, where materials like herbs have seasonal variability and batch-to-batch inconsistency and where traditional techniques must be translated into industrial processes. MRL criteria shine light on these issues (e.g. raw material standardization, preservation of traditional preparation principles during scale-up, supply chain development), which are recognized challenges in traditional medicine manufacturing. In short, MRL fills the gap by confirming that an innovation can be manufactured to consistent standards and sufficient quantities – a facet of readiness that TRL alone would miss.

4. Service Delivery and Operational Readiness – A great number of AYUSH innovations are delivered as services or require significant service infrastructure around the core product. Whether it is a new Ayurvedic therapy protocol, a wellness clinic model, or a digital platform connecting practitioners with patients, the success hinges on service delivery capabilities – trained personnel, standardized protocols, customer support, distribution networks, etc. TRL does not account for any of these practical deployment factors. The Service Readiness Level was introduced to measure readiness of the service model and market rollout: it evaluates whether an innovation has proven its delivery processes, workforce training, user adoption strategies and operational scalability in real-world conditions. For instance, an AYUSH telehealth platform might be technically complete (high TRL), but SRL would reveal whether clinics and practitioners are actually prepared to implement it, whether patients can easily access and trust it and whether support systems are in place. By explicitly assessing service readiness, the framework ensures that an innovation is not deemed “ready” for commercialization until the last-mile delivery mechanisms are also mature – a critical necessity in domains like healthcare and wellness where execution quality determines outcomes.

5. Alignment with Regulatory and Quality Requirements – AYUSH products and services must satisfy regulatory standards and quality benchmarks before they can be widely commercialized. TRL focuses on functionality and efficacy of a technology, but overlooks compliance and quality system readiness. By incorporating MRL and SRL, the framework forces innovators to address these non-negotiable aspects of maturity. For example, MRL evaluation includes confirming that manufacturing processes meet Good Manufacturing Practice (GMP) standards and that all production steps comply with applicable regulations – in fact, at the earliest levels MRL calls for identifying regulatory and compliance requirements specific to traditional medicine manufacturing. Similarly, SRL assessment involves verifying service quality standards, certifications and protocol adherence for AYUSH services, ensuring that a new therapy or service model can integrate with healthcare regulations and maintain consistent quality of care. This regulatory readiness dimension is essential for stakeholder confidence: regulators can see that an innovation's manufacturing and service delivery approach has been vetted for compliance and investors or adopters are assured that the innovation's maturity includes meeting legal and quality obligations – something a TRL number alone would not guarantee.

6. Preservation of Traditional Integrity at Scale – AYUSH innovations often originate from traditional knowledge and practices that carry important cultural and therapeutic value. Scaling these innovations into mass-market products or services is not just a technical exercise; it demands maintaining the authenticity and efficacy of the traditional elements. A purely technological readiness view could encourage changes that inadvertently dilute the core principles (for instance, altering a formulation for ease of manufacturing, or modifying a therapy for scalability). The inclusion of MRL and SRL embeds checkpoints for preserving traditional integrity during scale-up. MRL criteria explicitly consider whether manufacturing scale-up is achieved without sacrificing the traditional preparation methods or ingredient potency that make the innovation effective. Likewise, SRL looks at whether the service delivery retains the essence of the traditional practice (such as personalized patient interaction or adherence to classical protocols) even as it is systematized for wider delivery. By safeguarding authenticity in the readiness evaluation, the framework ensures AYUSH innovations remain true to their traditional efficacy and cultural context when they reach the market – a factor of success that TRL alone would overlook.

7. Stakeholder-Centric Risk Mitigation and Planning – Different stakeholders in the AYUSH ecosystem – innovators, manufacturers, service providers, regulators, investors – each require specific assurances that go beyond technical merit. TRL alone might signal that a prototype works, but an innovator or startup could be misled into launching without realizing that they lack manufacturing capability or service support, leading to failure. By defining MRL and SRL, the framework provides stakeholder-aligned clarity on an innovation's progress: innovators and startups can self-assess and plan development milestones across product development, production ramp-up and service deployment; manufacturers see a clear roadmap for scaling production and improving quality systems; service providers understand what is needed to integrate a new solution into their delivery workflows; regulators obtain a structured view of how the innovation will comply with production and delivery regulations; and investors gain a 360-degree risk assessment covering technology, market and operational readiness. In practice, this means decisions about funding, approvals and go-to-market timing are based on a nuanced understanding of all aspects of readiness, not just the allure of a high TRL. The result is better-aligned expectations, targeted risk mitigation and more effective allocation of resources to address any gaps, ultimately increasing the likelihood of successful commercialization in the complex AYUSH sector.

Annexure-II

AYUSH Innovation Readiness Framework Summary

This annexure presents a consolidated view of the AYUSH Innovation Readiness Framework, structured around three core dimensions:

Dimension	Purpose	Key Assessment Focus
Technology Readiness Level (TRL)	Evaluates innovation maturity from concept to market deployment	Technical feasibility, validation, regulatory approval
Manufacturing Readiness Level (MRL)	Assesses industrial scalability and production capability	Raw material standardization, GMP compliance, cost-effective scaling
Service Readiness Level (SRL)	Measures service delivery capability and operational excellence	Workforce training, protocol standardization, customer adoption

Each innovation is classified under one of six Innovation Thematic Categories:

1. Clinical Therapeutics & Medical Solutions
2. Consumer Health & Wellness Products
3. Professional Services & Knowledge Solutions
4. Agricultural & Environmental Applications
5. Manufacturing & Production Services
6. Digital Technology & Platform Solutions

These categories guide the application of TRL-MRL-SRL scales, ensuring tailored assessment and strategic planning.

Annexure-III

Rationale for TRL-MRL-SRL Integration

This annexure outlines the necessity of a multi-dimensional readiness framework:

Beyond TRL: TRL alone cannot capture manufacturing viability or service delivery maturity.

Manufacturing Complexity: AYUSH innovations often rely on seasonal, variable natural inputs requiring MRL validation.

Service Infrastructure: SRL ensures readiness of delivery models, especially for therapies, clinics, and digital platforms.

Regulatory Alignment: MRL and SRL embed compliance checkpoints for GMP, service protocols, and quality assurance.

Preservation of Tradition: Both MRL and SRL safeguard authenticity during scale-up and systematization.

Stakeholder Confidence: A 360° readiness view supports informed decisions by investors, regulators, and institutions.

Glossary of Terms

TRL (Technology Readiness Level) - A scale measuring the maturity of technology development from concept to commercial deployment.

MRL (Manufacturing Readiness Level) - A scale assessing the capability to manufacture innovations at commercial scale with consistent quality and compliance.

SRL (Service Readiness Level) - A scale evaluating the readiness of service delivery models, including operational infrastructure, workforce, and customer adoption.

Ayush - Acronym for Ayurveda, Yoga & Naturopathy, Unani, Siddha, Sowa-Rigpa and Homeopathy—India's traditional medicine systems.

Innovation Thematic Categories - Six mutually exclusive domains used to classify AYUSH innovations based on business model and market focus.

GMP (Good Manufacturing Practice) - Regulatory standards ensuring consistent quality and safety in manufacturing processes.

Minimum Viable Service - The simplest version of a service that delivers core value and can be tested with real users.

Commercial Scalability - The ability of a product or service to expand operations while maintaining quality, cost-effectiveness, and customer satisfaction.

Regulatory Compliance - Adherence to legal, safety, and quality standards required for commercialization.