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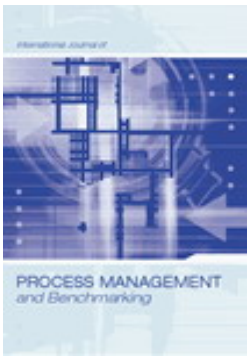

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Modelling of RFID-enables jewellery hallmark transparency attributes inter-relationship and ranking performance criterion in supply chain responsiveness: using ISM-AHP approach

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Modelling of RFID-enables jewellery hallmark transparency attributes inter-relationship and ranking performance criterion in supply chain responsiveness: using ISM-AHP approach

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Abstract: In the recent era, RFID-tags enabled hallmark transparency potential (RFID-TEHTP) attributes, in addition to the hallmark transparency values in jewellery supply chain responsiveness (JSCR). Tanishq Jewellery's manufacturing and marketing business are based on 4P strategies, namely product innovation strategy, price strategy, place strategy, and promotion planning strategy. ISM approach is use to develop inter-relationships among transparency potential attributes and MICMAC analysis provides the precise analysis relationship among the driving and dependence power linkages ability in JSCM. AHP approach is use to evaluate the weight priority of RFID-TEHTP performance criterion in JSCR. The ranking sequence orders of jewellery RFID-TEHTP performance criterion weights are the following: cost-effectiveness (CE) > break-even tag price decision (BETPD) > effective lead-time reduction (ELTR) > efficient customer response (ECR) > SC visibility, and trust and traceability (SCV&T). Jewellery managers can benefit from overcoming financial losses such as reduction of operation handling costs, misplacement error reduction, inventory inaccuracy problems, etc.

Keywords: supply chain responsiveness; jewellery SC; ISM; RFID-tags; e-retail; efficient consumer response; ECR; jewellery supply chain responsiveness; JSCR.

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1 Introduction

In the recent era, lack of transparency and visibility in jewellery supply chain (JSC), which is admits by Indian jewellery organisations. Most of the companies are keen interest that gold transparency about the origin of their products sources, offers to products sustainable and do not have conflicts with issues in product specifications and customer responsiveness. Jewellery organisations do not have adequate information on product manufacturing configurations, quality assurance of gold composition (22 to 24 Karats), and cultural specific design products. Kimberley Process (Diamonds) notices that trade-off between the operational costs and quality conflicts b/w the different design of diamonds and specifications concerning costs incurred. Due to lack of transparency aspects competitiveness of customer responsiveness companies do not reveal the true origin of their materials or if their products have made from conflict design stones. Indian jewellery organisations have keen interests in transparency aspects adaptation and sharing information publicity to gain responsive customer trust and reliability. The inadequate information on the exact source of the gemstones used in their jewellery supply chain responsiveness (JSCR). The source of information on the gemstone products is being ethical and traceable in JSCR. Saradesh and Vinodkumar (2020a) reveals that hardening of 22 Karat gold jewellery manufacturing, it has focused on jewellery hardness of final products. The optimisation of various process parameters, which pertains to industrial scale and producing hard 22 Karat golds inclosing Ti through age hardening process. The industry is performed by melting and casting trials of 22 Karat gold with addition of 0.5wt % of Ti obtained for max yields. The performing of annealing and cold-working operations were accompanied to Ti-22 Karat golds that production of hand-made bangles (Ti-22 Karat gold bangle > 150 HV). Wyld (2010) noticed that the unique value presented by RFID-tags enable jewellery retailer's inventory management. RFID tags enabled jewellery retailing is attached to (manufacturing and selling) date by innovative companies around the world. The research has focused on the RFID-tags enabled inventory tracking and visibility well-suited to the jewellery industry responsiveness of a variety of factors and configuration of design, the origin of sources, sizes and factors of jewellery transparency of items. The adaptation of RFID enables jewellery retailers can have benefited to inventory tracking and visibility and control inventory inaccuracy management, heightened security and enhanced business intelligence. The block chain and RFID technology is a marvellous choice to find out the authenticity of product development of each step of the process. These modern technologies keep digital secure and tam pure – proof records of products at each step of the process and vital role-play to enhance the visibility and transparency of the jewellery business. The JSC process is complex in nature of upstream channels of industrial gold mines, artisanal gold mines, gold bar traders, exporters and bank supports, refines, and logistics activities as well as similarly downstream channels of manufacturing (casting, shell moulding) and RFID tags driven semi-finished to finished good products of design (make to orders and make to stock) availability. It is depicted that Figure 1, which shows that 'Titan' Company's growth trends of the profile in jewellery and accessories business revenues in billion rupees. It is explores that Indian JSC responsiveness in visibility of transparency and reliable trust in ECR. Saradesh and Vinodkumar (2020b) investigate that (24 Karat and 22 Karat) gold productions have considered the grain refined examines by the master alloy (Au-6wt % Ti) and mechanism of grains refinements. The gold are shown better

refinement by addition of lowest composition Ti (0.1 wt.%). It is observed that the both (24 Karat gold and 22 Karat) golds presented efficient grain refinements at the lowest addition of Ti studied. The composition of master alloy are addition level to (0.2% to 0.3%) wt Ti coarsening in the grain size in both (24 Karat and 22 Karat), but more reliable in the case of 24 Karat gold due to recalescence effect. López-Cabarcos et al. (2020) notices that most of the investment decision shows that negative correlation relationship with major financial assets, where, gold is deliberated an effective hedge portfolio diversifier as well. Indian investors a sense of security hence, Physical golds in the form of jewellery has longer been one of the preferred inventory avenues of investors. Gold is long fundamentals currency and specific characterises includes such as liquidity attributes, value stability, and mitigation risk ability through hedge against inflation, portfolio diversification and safe haven asset has converted into a popular investment among the investors. Isha Shankar and Shukla (2017) notices that gold jewellery purchasing to investment decision by Indian householders are influenced by socio-economic and cultural factors. The Indian householders are prefer to invest in gold jewellery and excellent inheritance passes on future generations, hedge against inflation, financial risk hedging, liquidity management, social status, etc. Due to financial aspects, they have emotional attaches and religious quotient attached to it. These are specific reason influences that India the second-largest consumer of gold in the world. Prior research evidences admitted that gold grains refines process and value addition through lowest composition Ti (0.1 wt.%) addition, the optimisation of various process parameters and with addition of 0.5wt % of Ti obtained for max yields (Saradesh and Vinodkumar, 2020a). The prior research work less evidences have admitted that JSC transparency (22 to 24 Karats gold,) and traceability (source of gold grains availability information data) potential attributes in JSCR. Lack of transparency aspects in competitiveness customer responsiveness companies do not reveal the true origin of their materials source information and composition of gold jewellery build quality assurance in SC. Novelty of this research work is to explore that SC transparency and traceability (SCTAT) potential attributes employed in Indian jewellery e-retail business. The addition of value in jewellery e-retail business, which pertains to jewellery inventory accuracy, transparency of shop-floor activities, visibility in multi-tiers JSC stakeholders and hallmarks for efficient customer response (ECR). The case study is focuses on Indian Tanishq Jewellery manufacturing and marketing business 4P strategies implementations namely product innovation strategy, price strategy, place strategy, promotion planning strategy. It incorporates the integrated 4P business strategies with transparency potential linkages in ECR through bride the trust, transparency and traceability alignment abilities in JSCR. RFID enabled hallmark transparency and traceability attributes are addition values through lean manufacturing of jewellery organisations, shop floor operational activities visibility of jewellery manufacturing and mitigates the volatility of market demands, reducing jewellery inventory record inaccuracy, customers-centric responsiveness in JSCR.

The objectives of this research paper are following:

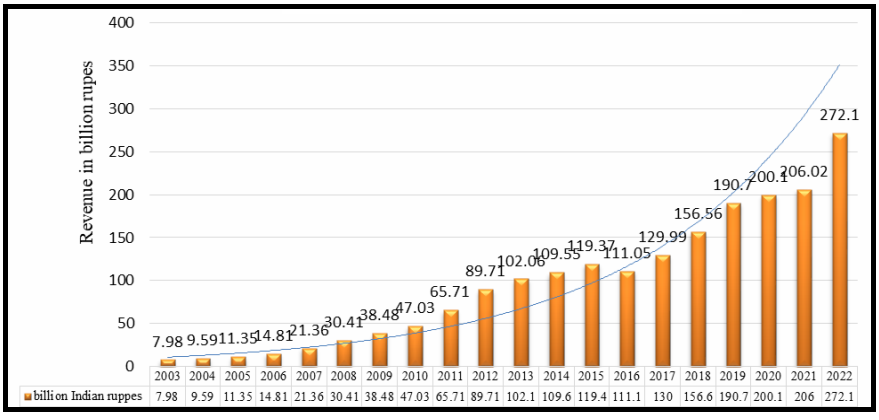
1 To identify the cause and effect analysis and inter-relationship among the RFID enabled hallmark transparency and traceability potential attributes in JSCR for ECR.

2 To proposed a case study on the Tanishq jewellery of 4P business strategies implementing in RFID enable transparency and traceability in JSCR.

3 To establish the contextual relationships among the MICMAC analysis among the driving and dependence powers of JSCR.

4 To identify the ranking preference orders of the hallmark transparency performance criterion in JSCR.

Figure 1 Revenue in Titan company growth trends (see online version for colours)



The research paper is organised as following sections: Section 2 – literature review work of RFID enabler's transparency potential in JSC responsiveness, Section 3 – jewellery e-retail supply chain model (with and without RFID); Section 3.1 – RFID-tags enabled jewellery retail supply chain model (with and without RFID), Section 3.2 – case study on Indian Tanishq JSCR, Section 4 – questionnaire conducted in various Indian retailing jewellery organisations, Section 4.1 – universal and sampling size analysis in Indian jewellery retailing SCs, Section 5 – ISM methodology; Section 5.2 – the number of steps in ISM approach, Section 5.3 –MICMAC analysis, Section 6 – analytical hierarchy process (AHP), Section 7 – result and discussion; Section 7.1 – conclusions.

2 Literature review of RFID enabled hallmark transparency potential in JSCR

In the recent era, most of Indian jewellery organisations are admits that the lack of SCTAT concerns from ECR assurances and traceability in gold products source visibility. The develop of trust credibility and quality assurances incorporates in JSC flows of mining minerals and sources of suppliers. RFID-tags enable gold hallmark transparency and traceability potential is in JSCR. Attaran (2020) reveals that digital SC performances are governed by real-time asset management, logistic system, transportation and transits monitoring, etc. Prior literature reviews have anecdote that digital drivers namely, AI and robotics, cloud computing, 3D printing, Advanced analytics, blockchain, AR, RFID, IoT, and cloud technology. It resolves the inter-organisational transparency potential barriers overcome by digital procurement in SCs.

2.1 RFID-driven tracking and tracing in JSC

Kumar (2007) investigates that RFID technology improves the connection and enhancing the SC performance. Zelbst et al. (2010) notices that RFID technology integrates with SC information system (IS), which enhances the overall performance of the SCs. Zelbst et al. (2010) investigates that RFID utilisation are an improved the overall performance of JSC. It has provided enormous possibilities to resolve the operational concerns in JSCs. RFID enables of jewellery tracking systems are strengthen them performance in contrast of tracking and tracing via multi-scanning items, therefore, jewellery supplier can be stock upgrades instantly for increase the production in shop floors workers. The technology is provides the opportunity to real-time monitors the process of jewellery products each day with complete reliable security. De Giovanni (2020) noticed that block chain with smart contracts are enhanced the performance of SCM. Game theory approach is employed in two firm's where, one supplier and one retailer. Firms are facing the major business risk of namely, due to delay of delivery and services, associated of higher transaction costs. Block chain adaptation can be beneficial for investment cost as well as variable cost control in SCs. The firms gain the potential of visibility, transparency and security in consideration of tokens. Nebil et al. (2009) investigates that activity-based costing (ABC) systems are performed by an extensive data collections and estimated input data necessary information is too costly. It provides the excellent opportunity to improve the ABC cost drive data collection process, and manufacturing environments. The results found that benefits of integrated implementation steps, use of RFID technology to support the improving ABC cost driver data collection process and the use of ABC systems for costing RFID projects. Gao et al. (2019) notices that internet of things (IoT), which is driven by intelligence fish farming and tracking control system development. Forecast approach is used to enables them automatic water quality assessment and ensure the tracking, breeding and selling of freshwater fishes. The proposed framework has based on water quality indicator examines through forecasting methods for a fishponds intelligence management module. It is detects and eliminates the abnormal data consumption the outlines factors (LOF) after compared with DBSCAN (Ageron et al., 2012).

2.2 Customer and stakeholders demand visibility

The purposed business process is to comply with demand visibility requirements of its participants (Koplin et al., 2007). Rocha et al. (2007) investigates that essential need of transparency in supply chain. Trust and social standards are increasing customer satisfaction also add legitimacy to the supply chain. It can be say that demand from consumers serves as the main reason for a transparent supply chain (Matos and Hall, 2007). Kovacs et al. (2021) reveals that digitalisation of jewellery production, which is subjected to data-driven maintenance in multiple level of data analytics application and analytics methods based on available data. It is implemented in maintenance perspective in jewellery industry practices. The data canvas is encompasses for relevant data sources in jewellery productions. Chanchaichujit et al. (2020) reveals that RFID enabled tools have used for manages the SCs. The literature review work is focused on RFID enable potential benefits, drivers in implementing RFID technology (benefit-drivers), link to competitive advantages. The comprehensive literatures have based on:

1 corporate-driven

2 customer-driven benefit-drivers from RFID implementation.

The 2C categorisation of benefit-drivers is novel approach and practitioners in RFID implementation. The links among the benefit-drivers and competitive advantage is proposed the conceptual framework. The framework provides the good academics and practitioners to learn the potential opportunities in supply chain adoption by RFID.

2.3 Mapping the supplier's availability and quality inspection

Ageron et al. (2012) geo-mapping of supplier's location can be help to accomplish the SC transparency and sustainability. Since it helps to permit the suppliers locations for strides of supply chains operational issues such as tracking and tracing of operational activities, distinguish the critical zones, reducing expenses and empowering chains to target perceivability. SC partners may be resistant to changes but beginning of partner's sales issues consider and also major steps towards the sustainability (Kumar and Rahman, 2015). The suppliers and industrial locations are key role-play in fashion industry, which depends upon the ingredient of cotton yarns industry, home base labourers, shopping malls and wet processors. Chen et al. (2013) reveals that lean manufacturing with RFID technologies are used for efficient and effective of SCM. Value stream mapping (VSM) approach is used to current state mapping and state mapping (with lean production and RFID) with material, information and time flows. The integration of RFID and lean approaches is to help saving the operation times enhanced 89% within the cross-docking. The utilising of RFID technology can be significant reduced the optional operational and maintain services capacity in supply chain. Rocha (2018) notices that jewellery industry can be enhanced through encompasses of both analysing and improving the management process as well as productions control. The combination of lean thinking philosophy and beta version of MES software have used for implement new strategies to reducing the waste and continuous improvement of customer satisfactions responsiveness. By restoring tools have used for markets holding improvement in the process namely, improved productive company, workers awarded with industrial practices and control of the entire production process. Oke et al. (2023) investigates that applicability and barriers of RFID adoptions are successful implements of construction projects sustainability. The quantitative approach is using a structured questionnaire survey. The results found that high cost of RFID implementation, and top ranked barriers are namely lack of security, maintenance, power availability and inadequate training. Dominguez-Péry et al. (2013) reveals that IT-driven service innovation with an in-depth cases study which is pertain to RFID enable in JSC. The proposed framework is enhanced IT-driven service innovation, lack of service science procedures, method and tools for developing new services. The managers may be benefited by in-depth of IT-driven service innovation for RFID technology. The proposed framework is combination of strategic and operational dimensions, which are helps to managers anticipate key challenges and pitfalls in service innovation projects. Chongwatpol and Sharda (2013) reveal that RFID-based traceability systems are used to improve production scheduling. Information visibility-based scheduling (VBS) rules, which provides the real-time traceability system for tracking work in processes (WIPs), various parts and components, and raw materials visibility to

production schedules. The results of simulation suggest that RFID-based scheduling rule enhances the performance compared to conventional scheduling rules with regards to cycle time, machine utilisations, backlogs and penalty costs. The value of information visibility is required for demand varies widely or operational disruption occurs.

2.4 Top management commitment and financial support

Kannabiran and Bhaumik (2005) investigate that Indian jewellery manufacturers are focused on the SC integration in jewellery-manufacturing organisation. It can be achieved the superior performance through SC planning and implementation phases. The combination of SC planning with business planning, top management commitments and develop a cross-functional teams are implemented for a key examines of SCM. Brands have corporate social responsibility towards in clients, SC members as well as suppliers. Brands must be guarantee that their suppliers have fostered to imperatives the information flows, training and encompasses to SC transparency. Ageron et al. (2012) highlights that the senior management commitments role plays, it is subjected domains of internal integration and acceptances level of social and ethical standards across the sustainable SCs. In addition company also encompasses of top management commitments, which is a key influences of SCs members targets the goal achievements (Nakano and Hirao, 2011; Darnall et al., 2008). Pool et al. (2018) investigates that RFID technology encompasses to improve the process efficiency in hospitality settings. The technology-organisation-environment (TOE) framework and technology acceptance model (TAM) are employed in the RFID enable hotel industry. The results found that TOE framework and TAM have positive effects on the intentions to use RFID technology. The proposed study is based on conceptualisation, shed significant and key factors associated with hotels 'adoption of RFID.

2.5 Joint effort and planning for effective JSCs

A concerted effort with planning includes are integrated for technology developments, jointly setting of supply chain objectives, and performing joint tasks to increase the capacity of the overall supply chains (Lambert, 2014; Rao and Holt, 2005). Collaborative efforts could be help to resolve the environmental concerns (Vachon, 2007); Rocha (2018) introduces the new product innovations (Olorunniwo and Li, 2010) setting goals (Matos and Hall, 2007), technological developments and distribution (Kumar and Rahman, 2015), design (Ciliberti et al., 2008), asset integration (Kumar and Rahman, 2015), revitalisation of audit standards (Rao and Holt, 2005) and processes (Rocha et al., 2007). Integrated development and planning in long-term relationships are possible through by trusted supply chain partners. Collaborative development is important in the sustainability of the supply chain over time (Hong et al., 2009).

2.6 RFID enabled traceability and visibility in JSCs

Alfian et al. (2020) notices that the integration of RFID with IoT sensors are incorporated for traceability system in monitoring products from the perishable supply chain (PSC). The implementation of RFID for better performing the traceability system as well as IoT

sensors for continuous monitoring the measured temperature and humidity during storage and transportation. The proposed system helps to identify the perishable SC performance and also managers and customers benefited significantly by real-time product information with complete temperature humanity monitors. With the addition of a machine-learning model with an RFID gate, tagged products that move in and out through gate can be monitored and correctly identified as well as enhances the efficiency of the traceability system. Centobelli et al. (2021) notices that blockchain technology is used to bridge the trust, traceability and transparency among design in circular block chain platforms. The proposed framework consists of integrated triple retry framework for design of circular blockchain platforms. The result found that blockchain technology enable provides the capability to control the movement of wastes and products return management activities. Roth (2008) notices that RFID traceability has linked with SCM, where 'a necessary of quality management system'. Traceability and verification of the processes are main enablers of moments of truth in transparency efforts. Operational information from suppliers could be help to performance at each progression, pinpointing the process and improves to overall efficiency. It is ability to detail historical data pertains to manufacturing of local components, building materials and products across in SCs. The historical information data is helped in written and recorded identification (ISO 2000) which is supports in reduction of uncertainty and diminishing process in production systems (Cheng and Simmons, 1994).

2.7 External pressure to transparency adaptation in JSC

Peters et al. (2011) notices that company external pressure are played a significant role in SC transparency. The other agencies of involvements, which can be pressurises organisation target of SC transparency encompasses with trade unions namely, human rights organisations (Bitzer et al., 2008), governments through various laws and regulations, communities (Zhu et al., 2008), NGO (Eltayeb et al., 2011), other competitors (Diabat and Govindan, 2011) and society (Clemens and Douglus, 2006). Result found these external and internal pressures are influences by organisations to stimulate a SC transparency. Pant et al. (2015) notices that dairy SC network, it is admits to transparency and traceability needs in Indian milk SCs. The proposed framework is helps to enhance the safety, transparency, traceability, and quality of fat information flow in Indian milk supply chains to meet the end customer domestic demands. It is help to successful implementation of food safety standards (FSSAI 2011) and also enhances the overall quality and infrastructure supports requirements. Neubert et al. (2011) notices that inter-organisational alignment level needs which enhances through IT driven services innovation in JSC. Firms may be notices that lack of effective competitive, where IS and business strategies are not aligned. Henderson and Venkatraman (1993) proposed strategic alignment model (SAM), they have admitted to standalone challenges b/w the single company and its IS. The supply chain structure is consists of a middle-sized retailer (MSR), 80 retails stores, and one single supplier, logistic service providers (LSP). The combination of RFID projects framework and SAM are used to evaluate the dynamics of alignment and highlights the various sequences in different phases of the projects.

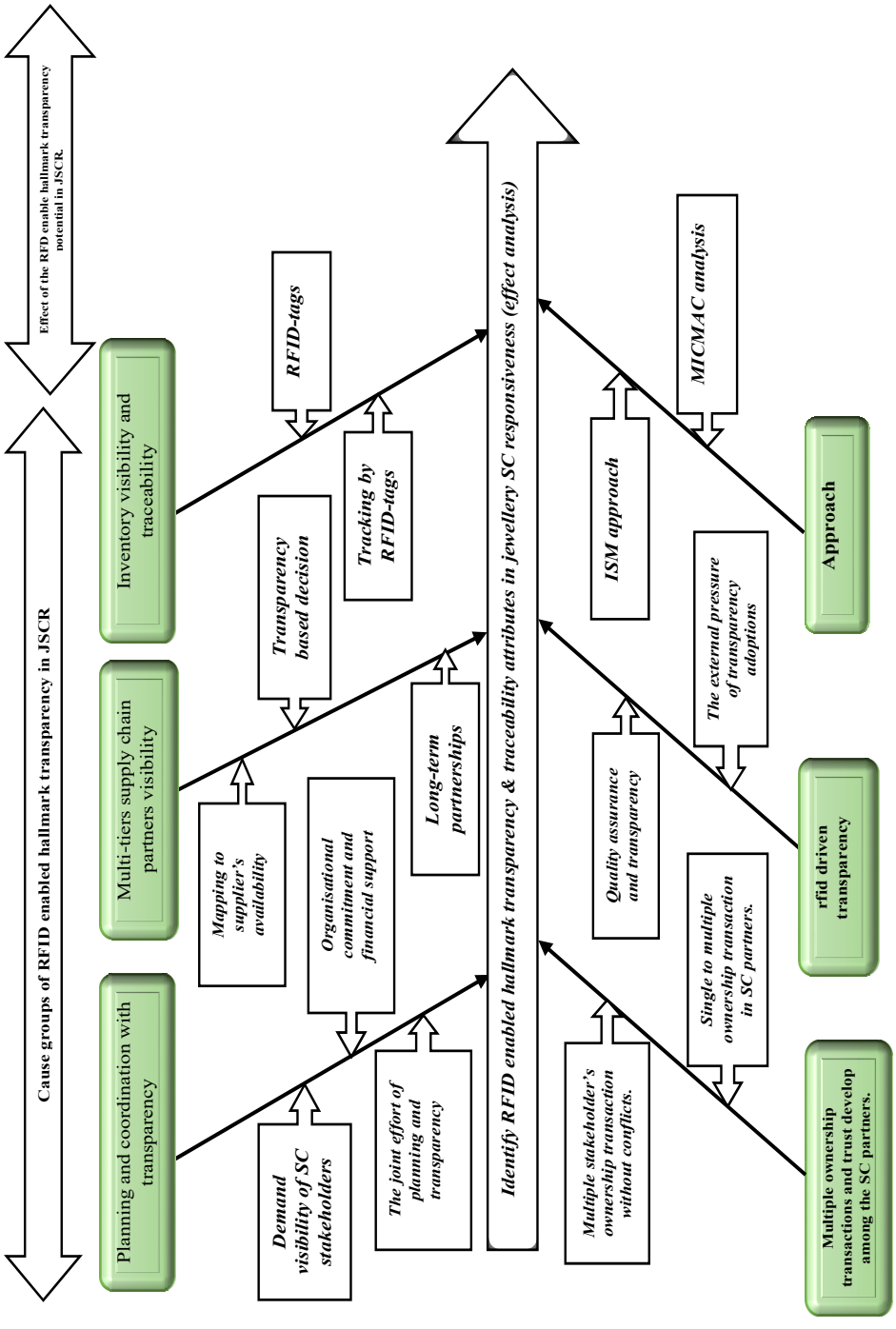
2.8 Quality assurance and transparency in JSC

Greenwald and Bateman (2016) investigates that International Cyanide Management Code, it is used by voluntary program for best practices in cyanide produces gold where manufacturers and transporters of cyanide. The multi-stakeholder process is used to develop the program and providers an overview of its requirements. The program's evolution is subjected to benefits and cost of code implementations and also support by industry and other stakeholders. The awareness program of transparency among the business partnership is a key needs to re-acceptance. While adoption of transparency, it is help to reduce the resistances of purchases through partners and develop a long-term-relationships (Seuring and Müller, 2008). In addition to stimulation of awareness program of transparency are help to improves supply chain efficiencies and resilience. Market leadership is help to justify the commitment to transparency among the SC partners. Saradesh and Vinodkumar (2020a) reveal that hardening of 22 Karat gold jewellery manufacturing, it has focused on jewellery hardness of final products. The optimisation of various process parameters which pertains to industrial scale and producing hard 22 Karat golds inclosing Ti through age hardening process. The industry is performed of melting and casting trials of 22 Karat gold with addition of 0.5 wt % of Ti obtained for max yields. The performing of annealing and cold-working operations were accompanied to Ti-22 Karat golds that production of hand-made bangles (Ti-22 Karat gold bangle > 150 HV).

2.9 Long-term partnerships with visibility among the supply chain partners

Bai and Sarkis (2010) notices that develop a relationships b/w the SC partners lead to transparent supply chains. Long-term partnership enhances the trust among the SC partners and communication with SC stakeholders. Build a strong relationship b/w the SC partners to improves the decision making ability, transparency adoption helps to minimise the uncertain issues, SC partners always benefit to update each-other process information (Klassen and Vachon, 2003; Hong et al., 2009). A long-term partnership programmes are enhanced the trust among SC partners through technology feasibility decision (economic-and time wise), which provides the effective visibility from mass public context (Keating, 2008). Dominguez et al. (2013) notices that RFID-enables JSCs, it has focused on inter-organisational strategic alignments needs. The SAM is employed to design the different routes of retails JSCR for strategic alignments b/w two SC partners. A maximum number of partners have participating in complex design through different RFID tags-enabled JSCs. The result has found that these incremental alignments needs to combined with inter and intra-organisational alignments. Further research focused on inter-organisational strategic alignment. Hossain (2014) investigates that behaviour of technology innovation which pertains to IS through RFID enabled technology adoptions. TOE factors are influences by RFID adoption, while extension decision is influenced by TOE factors, self-efficacy and situational factors. The developed a diffusion of innovation model in the agriculture agencies and farms sectors.

Figure 2 Cause and effect analysis to identify RFID-enabled hallmark transparency potential in JSCR (see online version for colours)



2.10 RFID enables multi-ownership transaction decision in JSC partners

Luo and Yang (2020) reveals that mobile RFID authentication are used to groups of tags attached with multiple owners at end of SC stakeholders. The study proposed a secure and high threshold performance with multi-tags ownership transfer protocol achieved through mobile-enabled RFID environments, where multi-tags ownership transfer environments pertain to structural capabilities and security. The mobile RFID provides the potential of RFID tags-based ability to efficiently manage the ownership transfer of cargo applications. Kapoor and Piramuthu (2011) notices that RFID tags enables performed smoothly ownership transfers in SCs. The physical ownership transfer has performed a more complex and strict process. But, the performance of RFID-tags enables more transparency with wireless communications in streamlined directions and quicker. The multi-tags ownership are shared with multi-entities in ASCs networks. RFID-tags enabled ownership transfer from single to multiple stages in SCs. The result outcomes pertain to immediate transfer of ownership in multi-tags between owners. The unavailability of trusted third party (TTP) intervention is a challenging task to achieve ownership transfers.

Cause and effect analysis is to explore that extensive view of root causes of major potential attributes in RFID-enabled hallmark transparency and traceability in e-retail SC models for SC responsiveness. It is depicted on Figure 2. It is evaluate that cause groups of hallmark potential attributes are namely, planning and coordination transparency, multiple-SC partner's visibility, inventory visibility and traceability. Similarly, the effect groups of potential attributes are namely, multiple ownership transactions and trust develop in the SC partners, RFID-tags driven transparency, approach or mechanism.

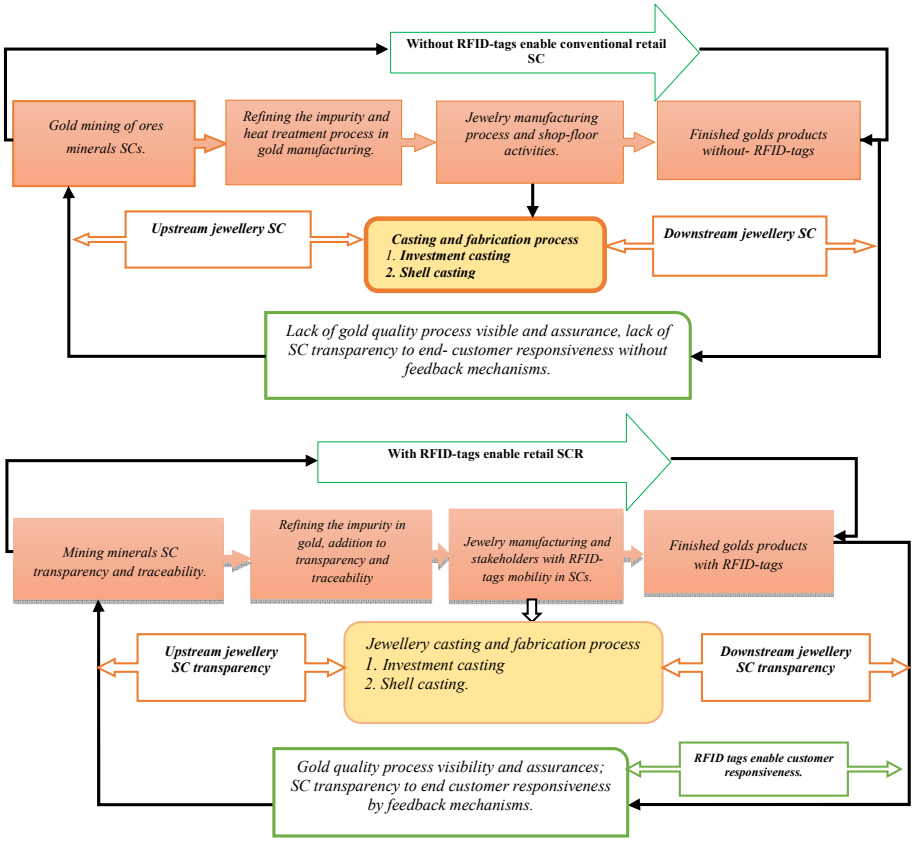
3 Jewellery e-retail supply chain model (with and without RFID)

Jewellery e-retail industry is admits that SCTAT attributes needs into global consumer's product responsiveness and small scale sizes of inventories configurations of the production capacity. The gold compositions (22 to 24 Karat) are build quality for ECR. E-retail supply chain models are performed through traced the gold hallmarked inventories and operational handling accuracy visibility and control the safety and financial losses control through inventory inaccuracy and misplacement errors. RFID-tags enabled hallmark transparency and traceability attributes are opportunities such as, smoothly connected and controls the financial losses without human errors, security concerns in JSCR. Without RFID-tags enabled JSC has admits that lack of hallmark transparency, tracking, tracing potential and human errors within handing operational activities. The investment cost pertains to inventory holding and operation cost during display and showing activities. RFID-tags enabled e-retail sectors have admits that benefits of comparison of conventional e-retail SCs. Where SC transparency and visibility of inventory items demands, tracking and tracing of gold quality composition of items assurances, control the financial losses in inventory holding and inaccuracy errors, the readiness of trust developed in jewellery e-retail SC partners. RFID-tags enables JSC has provided the end-to-end transparency solutions from manufacturing products in end customer with more visibility and quality assurances. The jewellery items are tagged with RFID, which provides more visibility and traceability of upstream to downstream JSC transparency, exact information of jewellery inventory

handling at any remote locations and resources, and also the competitiveness of ECR with trust-based quality assurances. It provides the multi-tags ownership transactions visibility in single to multi-JSC partners. It provides the leverage of SC transparency and visibility in a multi-owners transaction with trusted SC partners. RFID tags enable more traceability with security, otherwise, it is difficult and complex in various sizes of configurations and costs associated with holding and bearing total cost expenses. Therefore, it helps to enhance the working condition and efficiency of organisational performance.

3.1 RFID-tag enabled retail JSC model (with and without RFID)

Figure 3 With and without RFID-enable to jewellery retail supply chain models (see online version for colours)



3.2 Case study on Indian 'Tanishq' JSCR

The group of Tata Companies pioneer of Titan Watches limited are joint venture Company in Tamil Nadu Industrial Development Corporation Limited (TIDCO). The paradigm shift of 'trust value' admitted at since 1995, they incorporated that transparency of 'Titan Watches Ltd' to 'Titan Industry Ltd'. Where trust value capture to change in

market trends and continuous upgrade the market of watch manufacturers with fashion accessories in manufacturing brands. Later on, being's enter into the Indian jewellery business. The top Indian leading watch manufacturers and Tanishq Gold jewellery, diamond stones, smartwatches design. Tanishq shows continuous growth trend in the jewellery segments in India. It provides the especially in art, peculiar design culture and the quality of products specification. Mr. Xerxes Desai proposes the terms of 'Tan' and 'Nishk' body and ornamentation of gold jewellery respectively. The company was established at since 1994 and develop a partnership among Tata Groups and Tamil Nadu Industrial Development Corporation. It is established as a brand, which facilitates the high-quality, diamond jewellery designs (make-to-orders and make – to-stock), and incorporates classical looks. The initiative started with a family jewellery program after being transformed into a reliable product in India's largest jewellery business. The marketing strategy of 4Ps in Tanishq jewellery explores and analyses the brand (product, price, place, promotion). Product innovation, pricing strategy, promotion planning and trust in customer responsiveness are few examples of marketing strategies. The product strategy of jewellery has based on luxury and the middle class. But the company understood that their extensive view of the requirement for all customers. According to Tanishq brand to shift for a variety of jewellery proposed.

- *Small designs:* they understand the needs of every customer centric trust and high quality designs for small art objects items namely, pendant, nose pins, rings, ear rings, etc.
- *Assets:* Indian people choose to turn their liquid assets into valuable goods.
- *Large jewellery:* some valuable customer demands specific large jewellery segments namely, specialising into build necklaces, sets and a variety of bracelets in design and styles namely, diamonds, and gold.

Tanishq brand has focused on other designs and culture segments. They have to create products from Indian culture and textures. It is more attention to modern and traditional designs. The low price component has been recognised in various consumers' specific demands in festivals and also maintains a very good balance in various price segments. It is shown in Figure 4, which explores the Tanishq business strategy in various 4Ps marketing strategies:

1 product innovation strategy

2 price strategy

3 place strategy

4 promotion planning strategy.

Which is an emphasis on every segment of the business strategy in Tanishq Jewellery as a brand in the Indian jewellery organisation.

- *Pricing strategy:* Tanishq offers premium quality of product segments where the company see the price of its discounts and targets audiences. They trade off b/w the high quality of products and low quality of products segments in various customer demand segments requirements. The price strategy focuses on the traditional and simple design to bring out the uniqueness and reliable quality responsiveness in customers. Tanishq brand are focused on customers responsive to addition that

expensive jewellery to budget segments earning, trust and product quality will remains. The high-quality products to the end of the richest category and also similarly low-quality products to large audience. They proposed a smart Investment policy for married women and people looking first for the gold artefact. Its name was the golden harvest jewellery purchase plan.

- *Place strategy:* Tanishq has focused on the retail sales segments. It explores buying jewellery and expensive things offline. They confirm their purchase by checking the quality. The online sources have associated to risks and concerns about each part of the job sections and making delivery the riskiest part of the process. The more than 395 stores in retail sectors and 200 provinces. The online platform can visit their websites to continue exploring the wide variety and configurations of their perfect selections. Tanishq's footprint starts from Chennai markets in the southern part of India. Tanishq showroom expansion has started throughout the southern region of the country.
- *Promotion strategy:* it has become a well-known brand of the Indian parent company and aggressive footprint adoption in marketing strategy. The company's marketing strategy showcases its products to their full potential by promoting brand awareness programmes by various advertising platforms. Tanishq's partnership with Maruti Udyog limited 20 rupees Gold as a gift to provide Maruti Car buyers in 1999. Combined trading companies have developed a result. Due to competitiveness, Tanishq incorporates precise planning, support, strategies and campaigns to enhance the quality of photography and increase growth.
- *Trust and dignity:* Tanishq is a trusted brand known of all Indians. It is proper marketing and campaigns programmes as well as dealing with expensive goods and jewellery, originality play a big role to a target the dignity of the product. Tanishq is sub-company of Titan comp, which is a joint venture of India's most important companies of Tata group.
- *The distributed series of vendors:* Tanishq distribution channels have located more than 300 stores in strategic locations across the country. It contributed large revenue scopes and made 40% Titan total revenue in TATA Group.
- *The campaigns and promotions:* the Tanishq art and marketing team always achieves its goals of gaining audiences and branding status with inefficient consumer responsiveness.
- *Marketing budget of Tanishq:* Tanishq is adopted to an excellent strategy for its marketing and marketing campaigns.

In 2017, Tanishq launched the Rivaah collection, which admitted a wide range of jewellery configurations due to the wide range of customer responsiveness. The yearly budgets of advertising cost 200 million in various segments of prominent positions such as Happily, Rivaah made a pact with Vivaah. The Mia of Tanishq countered a 65% advertisement marketing budget through the digital platform and plans for 20 different kinds of short campaigns. Tanishq Oct. 2020 proposed an Aprajita, campaign for the festival of Durga Puja to overtake the East India market and promote their festival collection. A budget of 450 crores was spent in marketing campaigns. It is shown in Figure 5 which explores the net sales of Titan from financial year 2017-to-2021.

Figure 4 Explores the Tanishq business strategy (see online version for colours)

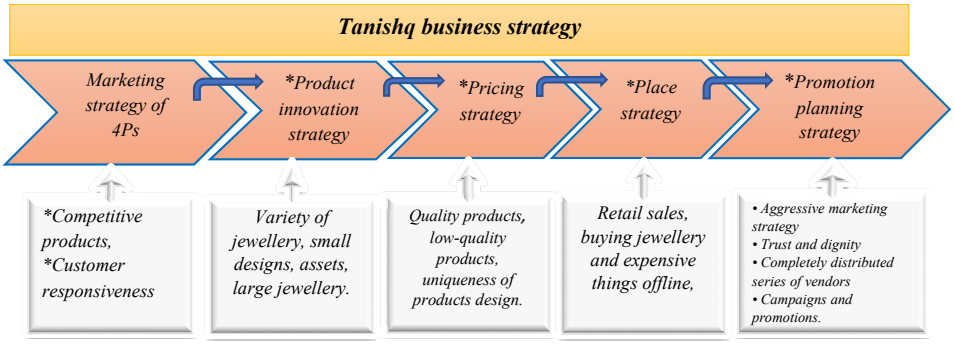
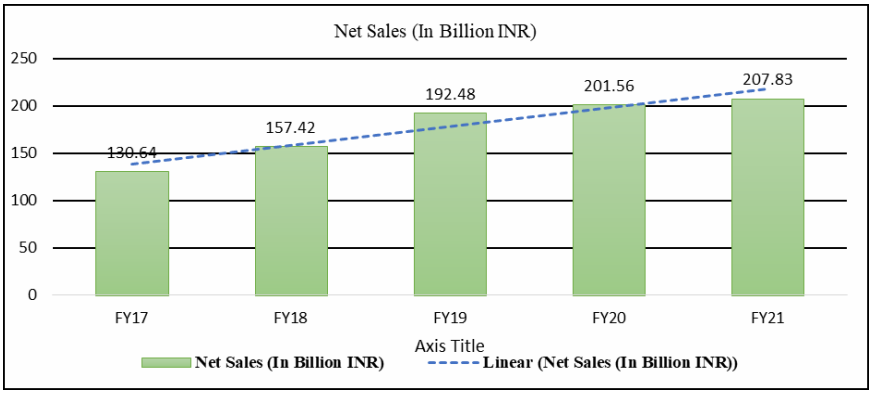


Figure 5 The net sales (in billion) of Titan from financial years (2017 to 2021) (see online version for colours)



4 Questionnaire conducted in various Indian retailing jewellery organisations

On the basis of literature review findings and experts' opinion, a structured framework questionnaire was constituted. According to comprehensive questionnaire session was conducted to identify the JSCR issues in Indian E-retailing Supply chain. A total of 610 questionnaires were conducted and sharing e-mail to either the managing director or the chief executive officer of gold jewellery e-retailing, PC jewellery, OP jewellery, Tanishq, etc. In spite of continuous reminders, phone calls, and e-mails, these information tools were used for finding the questionnaire responses. Moreover, the reminder of e-mails to send and also received 163 valid questionnaires responses. The non-relevant responses of 26, which responses discarded. According to overall collection of responses rate of 22.95% received. The survey response rate of 20% is acceptance level of positive assessments from data sampling reliable needs (Malhotra and Grover, 1998). Experts from e-retailing JSC, e-business, PC jewellery, OP jewellery, Tanishq, and various other jewellery industry sectors were reviewed into the first draft preparations. The draft design

was constructed by appropriate questionnaires and elimination of the overlaps and fitness of sectors domains in RFID tags to enable jewellery retailing SC responsiveness.

The second step is to identify the RFID enables in transparency attributes retails JSC responsiveness aspects needs, which is tested and validation conducted through encompasses into the selected questionnaire. The frame questionnaire validity is ensured through the statistical data analysis approaches and also ensures the reliable data fitness test (Sekaran, 2003). The reliability of data tests and precessions has been gauged through an assessment based on data on the internal stability and consistency performance of each variable of items (Hair et al., 2009). The validation of existing variables has been examined by pre-tested reliability by experts' opinions from various inter-organisational and industry levels. The conducting of reliability assessments were pretested by 'Cronbach's alpha coefficients' on the various experts. The 'α' coefficients are falls within the internal consistence scale range (0.60 to 0.80) which considers to internal acceptance levels of reliability (Nunnally, 1978). According to overall collection of sample responses, which validates through test the reliability and consistency of the transparency attributes in JSC. The Cronbach's α is used for each RFID enable transparency potential attributes by using SPSS 11.5 for Windows. The mean value of all RFID-enables hallmark transparency attributes are found that satisfactorily high which encompasses appropriates selection for transparency attributes in JSCR through the questionnaire responses. The results of statistical analysis are shown in Table 2. The detailed disruption of RFID enabled transparency attributes and complete questionnaire is beyond the scope of the paper, as the paper absolutely focuses on framework of RFID-enabled transparency attributes in JSCR by applying ISM approach.

4.1 Universal and sampling size analysis in Indian jewellery retailing SCs

The questionnaire survey was conducted by various e-retails jewellery sectors respondents, which examined through five point Likert linguistic scales. The research accompanied from April 2020 to September 2021 at the North India zones (Delhi and UP) of various e-retails JSC sectors. Their sample test was conducted on random sample procedure in Universal and sampling data analysis. Due to COVID-19 pandemic situation, the questionnaire survey reposes were carried out through the various e-retails jewellery brands organisations e-mails and virtual Google meet links responds. After, some level of samples through interviewing of various academicians, top/middle level of jewellery organisations sectors. The total response of 163 was received through interviews sessions and e-mails resources. The communication through e-mail questionnaires, it sent to various academicians, top/middle level of e-retails JSCR sectors. The establishments that compose the universe and sample size for transparency enable of jewellery stores. It can be shows in Table 1. The study of universe is composed of 163 jewellery outlets, 63 (38%) in Delhi and 100 (61.34%) in Uttar Pradesh Stores. It performs a random sampling with proportional allocation for each province respecting the proportional of the size of RFID enabled jewellery shops. The initial sample was composed of 96 outlets shops establishments 39 (40.62%) in Delhi and 57 (59.37%) which represent the response rate of the 41% and 59% respectively in jewellery retails SC responsiveness. The survey samples of both states (Delhi and UP), Which admits to sample size lower than we expected for, and representation of each RFID enable retailing shops is different from the proportion of its sample size in the universe of the sates. As a

final result, the sampling error obtained is higher observed then the initially expected. The total sample of 96 size considers, the sampling errors is 5.10%.

Table 1 Universe and sample size by India states (Delhi and Uttar Pradesh stores)

RFID enables hallmark transparency in reliable jewellery stores	*Delhi stores*		*Uttar Pradesh Stores*	
	Universe	*Sample*	*Universe*	*Sample*
Tanishq Jewellery	20	14	43	25
Titan world	10	6	13	6
Helious Watch	13	7	16	8
PC Jewellery	13	8	20	14
Tanishq Aliganj	7	4	8	4
Total shops	63	39	100	57

Table 2 Result of statistical analysis from RFID-tags enabled transparency attributes in JSCR

Identify the RFID-tags enablers' transparency and transparency in JSCR	*Total number of items responses (original)*	*Total number of items responses (eliminated or not supporting)*	*Absolute number of items (remaining)*	*Final Cronbach's 'α'*	*Range of correlations coefficient*
RFID-driven tracking and tracing in JSC.	14	5	9	0.9035	0.692–0.793
Customer and stakeholders demand visibility.	10	7	3	0.7706	0.772–0.857
Mapping the supplier's availability inspection.	11	6	5	0.8670	0.729–0.823
Top organisation commitments and financial supports.	8	5	3	0.7689	0.730–0.890
Joint planning process for effective JSCR.	7	4	3	0.6390	0.512–0.885
RFID-tags enabled traceability and visibility in JSCs.	15	6	9	0.9287	0.762–0.919
External pressure to transparency adaptations in SC.	13	7	5	0.8988	0.683–0.924
Quality assurance and transparency in JSC.	13	6	7	0.8899	0.666–0.840
Long-term partnership with visibility among the SC partners.	9	3	6	0.8575	0.633–0.887
RFID enable multi-ownership transaction decision in JSC partners.	5	1	4	0.8669	0.647–0.890

The statistical data analysis, which was conducts based on available, retails organisational questionnaire survey responses and validate the data collections with the help Software package of Minitab version 16. It has shown in Table 2. The 5% ranges of the lowest and highest values data errors had omitted within the trimmed mean calculations. The sampling error (5.10%) for the total sample (96) was calculated from the expression of sample size (n) allocated proportionally according to Scheaffer et al. (2007). This expression is formulated by

$$\text{`}n\text{'} = \frac{\sum_{i=1}^{L} \frac{N_i^2 p_i q_i}{a_i}}{N^2 D + \sum_{i=1}^{L} N_i p_i q_i}$$

where N_i is the population size for the RFID enables hallmark transparency and traceability attributes retailing jewellery shops. p_i is the population for the RFID enables transparency and traceability attributes jewellery or smart watch retailing brands i. $q_i = (1 - p_i)$, a_i is the fraction of part observations allocated to the RFID enabled transparency in jewellery shops or brands i, and where $D = \frac{B^2}{4}$, where B is the sampling errors.

5 ISM methodology

Developing a structural self-interaction matrix (SSIM) represents pair-wise wise relationships among the linkages/drivers elements of the system. To understand the contextual relationship and interdependencies relations. Matrice impacts croises-multipication appliqu´ean classment (cross-impact matrix multiplication applied to classification) is abbreviated as MICMAC. The idea of MICMAC principle applies to the multiplications properties of matrices. Kumar et al. (2019) notices that VMI with consignment stock has adopted an imperfect production environment and competitive edges in multi-dimension aspects. The coordination mechanism helps to a vital role in an imperfect production and controls all stages. The proposed framework is to develop sustainable business practices in an imperfect vendor production process concerns and overcomes production loss by controlling the production stages. Etemadi et al. (2021) notices that cyber risks barriers from the blockchain/ distributed leader technology which pertains to innovation in supply chain cybersecurity. The proposed study is to identify and rank the significant barriers affecting the employed of block chain technology as a key components of cyber SC risk management (SCRM). The results shows that cryptocurrency volatility is major challenge to top level of hierarchy, and implementing weak driving power powers but strongly dependent on the others challenges influences such as poor regulatory provisions, technology immaturity, dependent on input information from external oracles, scalability and bandwidth issues, and smart contract issues are significant challenges to deal with adoptation of blackchain in cyber SCRM and location of driving powers of the level of hierarchy with driving powers. Kumar (2023a) investigates that Integration of RFID strategic value mechanisms have implemented in appeal SC. The comparison between the FAHP and FAHP-FTOPSIS approach to quantitative assessments from RFIDSVA mechanisms and IRTWTCTs

alternatives selection decisions, which enable them SC agility potential across multi-tier visibility in ASC networks. ASC stakeholders can be benefited by techno-economic feasibility decisions, RFID-enabled shop floor activities, multi-tags ownerships transfer in SCs and knowledge-based cryptography tags/items separation in SCs. The ISM methodology is employed for qualitative and interpretative approach to solve the complex problems based on structural mapping of the connection among the RFID enable hallmarks transparency and traceability attributes potential in JSCR (Kumar, 2023b).

5.1 Structural self-interaction matrix

Identify the RFID tags that enable transparency potential in JSCR and are classified with the help of the ISM approach. The contextual relationship is depicted in four symbols:

- *V:* variable i will tend to j variables achieve
- *A:* variable j will tend to i variable achieve
- *X:* variable i and j will tend to achieve mutually each other
- *O:* variable i and j are non-related to each other.
- *Reachability matrix:* SSIM approach has transferred into binary matrix (1, 0), where reachability matrix is substituting (V, A, X and O) to (1 to 0). The positioning of the cell (0) and (1) as the following.
  1 The cell (i, j) position entry in the SSIM is V, then cell (i, j) entry into the reachability matrix position tends to cell (i = 1, j = 0).
  2 The cell (i, j) position entry in the SSIM is A, then cell (i, j) entry into the reachability matrix position tends to cell (j = 0, i = 1).
  3 The cell (i, j) position entry in the SSIM is X, then cell (i, j) entry into the reachability matrix position tends to cell (j = 1, i = 1).
  4 The cell (i, j) position entry in the SSIM is X, then cell (i, j) entry into the reachability matrix position tends to cell (j = 1, i = 1).
  5 The cell (i, j) position entry in the SSIM is O, then cell (i, j) entry into the reachability matrix position tends to cell (j = 0, i = 0).

5.2 The number of steps in ISM approach

- Step 1: identify the RFID-tag enables transparency attributes in JSCR. The proposed framework has employed to RFID technology links from transparency and quality assurance of JSCR.
- Step 2: build a framework consists of identify RFID-tags enables transparency attributes in JSCR. The develop relationships among such as linkages, drivers, and mechanisms oriented.
- Step 3: Build a SSIM for identifying the RFID tags enables transparency in JSCR. It shows the pairwise relationship among existing elements.

- Step 4: build a reachability matrix by the SSIM approach and it is asserting the matrix of transitivity. Transitivity of the fabricated relation is consists of ISM methodology. Where, strategic value elements of states are following statements namely, X is pertains to Y; Y is pertained to Z; then Z pertains to X.
- Step 5: the reachability matrix is explores through different levels. It evaluates to RFID tags enables transparency attributes in JSCR decisions. It is based on linkages and drivers relationship among the reachability matrix. In the presence of a directed graph and converting transitivity links are examined through the ISM approach.
- Step 6: identify RFID-tags enables transparency attributes selection in JSCR and their various relations with the help of a reachability matrix, where a draw a directed graph and eliminates the transitive links.
- Step 7: finally, develop a framework and identify the RFID-tags enabled the transparency in JSCR. Government emphasis on the direction of e-retail JSCR. The MICMAC analysis is using to evaluate the linkages, drivers, dependent, and independent powers in digraph in ISM approach.
- Step 8: the proposed framework is help to identified as the technology enabled transparency in e-retail JSCR.

Table 3 Identify RFID-enabled hallmark SCTAT attributes in using for SSIM

Identify RFID-enabled hallmark transparency and traceability potential attributes in JSCR	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}
RFID-driven tracking and tracing in JSC.	V	X	X	X	X	X	X	X	X	X
Customers and stakeholders demand visibility.		V	X	O	X	A	O	A	X	X
Mapping the supplier availability quality inspection			X	O	X	V	V	X	A	X
Top management commitment and financial support.				O	A	X	O	O	O	A

Table 3 Identify RFID-enabled hallmark SCTAT attributes in using for SSIM (continued)

Identify RFID-enabled hallmark transparency and traceability potential attributes in JSCR	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}
Joint effort and planning for effective JSCs.				V	X	O	O	O		X
RFID-based JSC transparency in JSC.					X	X	V	X		X
External pressure for transparency adaptation in SC.						X	V	X		O
Transparency awareness and quality assurance in jewellery.							O	A		X
Long-term partnership between SC partners.								V		A
RFID enable multi-ownership transaction decision in JSC partners.										V

Figure 6 Flow diagram of ISM model in RFID enables transparency attributes in JSCR

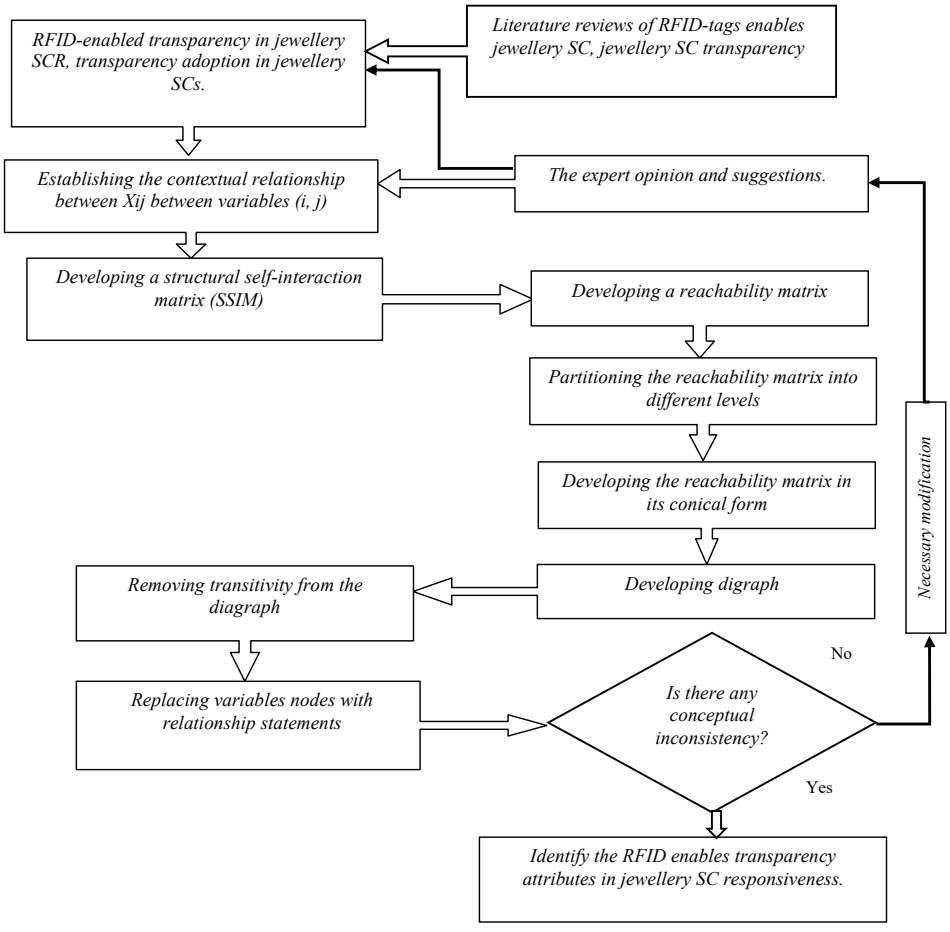


Table 4 Identify the RFID enabled hallmark SCTAT potential attributes in JSCR

	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}
T_1	V	X	X	X	X	X	X	X	X	X
T_2		V	X	O	X	A	O	A	X	X
T_3			X	O	X	V	V	X	A	X
T_4				O	A	X	O	O	O	A
T_5					V	X	O	O	O	X
T_6						X	X	V	X	X
T_7							X	V	X	O
T_8								O	A	X
T_9									V	A
T_{10}										V

Table 5 Identify RFID enabled hallmark SCTAT potential attributes in JSCR from initial reachability matrix

S. no.	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	*Driving power*
T_1	1	1	1	1	1	1	1	1	1	1	10
T_2	1	1	1	0	1	0	0	0	1	1	6
T_3	1	1	1	0	1	1	1	1	0	1	8
T_4	1	0	0	0	0	1	0	0	0	0	2
T_5	1	1	1	1	1	1	0	0	0	1	7
T_6	1	1	0	1	1	1	1	1	1	1	9
T_7	1	0	0	0	0	1	1	1	1	0	5
T_8	1	1	1	0	0	0	0	0	0	1	4
T_9	1	1	1	0	0	1	1	1	1	0	7
T_{10}	1	1	1	1	1	1	0	1	1	1	9
Dependence power	10	8	7	4	6	8	5	6	6	7	67

Table 6 Initial first reachability matrix of RFID enabled hallmark SCTAT attributes in JSCR

S. no.	*Reachability set (R)*	*Antecedent set (A)*	*Intersection set R ∩ A*	*Level*
T_1	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	I
T_2	1, 2, 3, 5, 9, 10	1, 2, 3, 5, 8, 9, 10	1, 2, 3, 5, 9, 10	
T_3	1, 2, 3, 5, 6, 7, 10	1, 2, 3, 5, 8, 9, 10	1, 2, 3, 5, 10	
T_4	1, 6	1, 5, 6, 10	1, 6	
T_5	1, 2, 3, 4, 5, 6, 10	1, 2, 3, 5, 6, 10	1, 2, 3, 5, 10	
T_6	1, 2, 4, 5, 6, 7, 8, 9, 10	1, 3, 4, 5, 6, 7, 9, 10	1, 4, 5, 6, 7, 9, 10	
T_7	1, 6, 7, 8, 9	1, 3, 6, 7, 9.	1, 6, 7, 9	
T_8	1, 2, 3, 10	1, 3, 6, 7, 9, 10	1, 3	
T_9	1, 2, 3, 6, 7, 8, 9.	1, 2, 6, 7, 9, 10	1, 2, 6, 7, 9	
T_{10}	1, 2, 3, 4, 5, 6, 8, 9, 10	1, 2, 3, 5, 6, 8, 10	1, 2, 3, 5, 6, 8, 10	

Table 7 The reachability matrix of RFID-enabled hallmark SCTAT attributes in JSC, second iterations reachability

S. no.	*Reachability set (R)*	*Antecedent set (A)*	*Intersection set R ∩ A*	*Level*
T_2	1,2, 3, 5, 9	1,2,3, 5, 8, 9	1, 2, 3, 5, 9	
T_3	1,2, 3, 5,6,7	1, 2,3, 5, 8, 9	1, 2, 3, 5	
T_4	1, 6	1, 5, 6, 10	1, 6	
T_5	1, 2, 3, 4, 5, 6	1, 2, 3, 5, 6	1, 2, 3, 5,	
T_6	1, 2, 4, 5, 6, 7, 8, 9	1, 3, 4, 5, 6, 7, 9	1, 4, 5, 6, 7, 9	II
T_7	1, 6, 7, 8, 9	1, 3, 6, 7, 9	1, 6, 7, 9	
T_8	1, 2, 3	1, 3, 6, 7, 9	1, 3	
T_9	1, 2, 3, 6, 7, 8, 9	1, 2, 6, 7, 9	1,2, 6, 7, 9	
T_{10}	1, 2, 3, 4, 5, 6, 8, 9	1, 2, 3, 5, 6, 8	1, 2, 3, 5, 6, 8	

Table 8 The third iterations reachability matrix of RFID enabled hallmark SCTAT attributes in JSCR

S. no.	*Reachability set (R)*	*Antecedent set (A)*	*Intersection set R ∩ A*	*Level*
T_2	1,2, 3, 5, 9	1,2,3, 5, 8	1, 2, 3, 5	
T_3	1,2, 3, 5,6,7	1, 2,3, 5, 8	1, 2, 3, 5	
T_4	1, 6	1, 5, 6, 10	1, 6	
T_5	1, 2, 3, 4, 5, 6	1, 2, 3, 5, 6	1, 2, 3, 5	
T_7	1, 6, 7, 8	1, 3, 6, 7	1, 6, 7	
T_8	1, 2, 3	1, 3, 6, 7	1, 3	
T_9	1, 2, 3, 6, 7, 8	1, 2, 6, 7	1,2, 6, 7	
T_{10}	1, 2, 3, 4, 5, 6, 8	1, 2, 3, 5, 6, 8	1, 2, 3, 5, 6, 8	III

Table 9 Final reachability matrix of RFID enabled hallmark SCTAT attributes in JSCR from 7th and 8th iterations reachability

S. no.	*Reachability set (R)*	*Antecedent set (A)*	*Intersection set R ∩ A*	*Level*
T_1	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	I
T_2	1, 2, 3, 5, 9, 10	1, 2, 3, 5, 8, 9, 10	1, 2, 3, 5, 9, 10	V
T_3	1, 2, 3, 5, 6, 7, 10	1, 2, 3, 5, 8, 9, 10	1, 2, 3, 5, 10	V
T_4	1, 6	1, 5, 6, 10	1, 6	VIII
T_5	1, 2, 3, 4, 5, 6, 10	1, 2, 3, 5, 6, 10	1, 2, 3, 5, 10	V
T_6	1, 2, 4, 5, 6, 7, 8, 9, 10	1, 3, 4, 5, 6, 7, 9, 10	1, 4, 5, 6, 7, 9, 10	II
T_7	1, 6, 7, 8, 9	1, 3, 6, 7, 9	1, 6, 7, 9	VI
T_8	1, 2, 3	1, 3, 6, 7, 9	1, 3	VII
T_9	1, 2, 3, 6, 7, 8, 9	1, 2, 6, 7, 9, 10	1, 2, 6, 7, 9	IV
T_{10}	1, 2, 3, 4, 5, 6, 9	1, 2, 3, 5, 6, 8	1, 2, 3, 5, 6	III

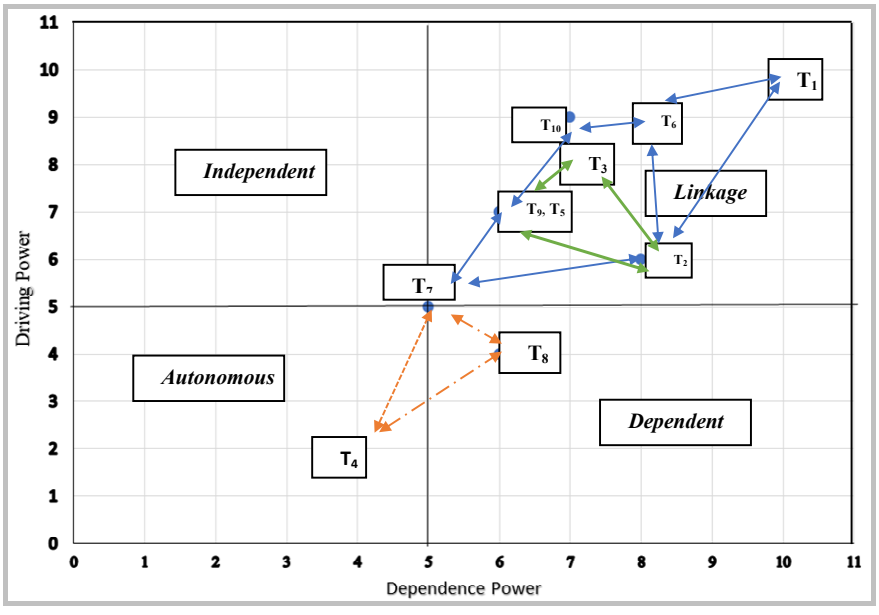
5.3 MICMAC analysis

MICMAC analysis is help to identify the RFID-enabled hallmark transparency and traceability potential in JSCR. The existing framework has been divided into four groups of clusters namely, autonomous factors, dependent factors, linkage factors and driving factors which is depicted in Figure 7.

- *Autonomous factors (cluster I):* RFID enabled hallmark transparency attributes in JSC, which pertains to low driving power and weak dependence power. It is consist of autonomous factors namely, top management commitment and financial support (T_4).
- *Dependent factors (cluster II):* RFID enabled hallmark transparency attributes in JSC, which pertains to weak driving power and high dependence power. The dependent factors cluster II namely quality assurance and transparency in JSCs (T_8).

- *Linkage factors (cluster III):* it is consist of RFID enabled hallmark transparency attributes in JSC, which pertains to high driving power as well as high dependence. Linkage factors cluster III namely: RFID-driven tracking and tracing in JSC (T_1); customer and stakeholders demand visibility (T_2); mapping the supplier availability quality inspection (T_3); joint planning for effective JSCR (T_5); RFID-enabled traceability and visibility in JSCs (T_6); external pressure for transparency adaptation in SC (T_7); long-term partnership with visibility among the SC partners (T_9); RFID enables multi-ownership transaction decision in JSC partners. (T_{10}).
- *Driving factors (cluster IV):*it is consist of driving the RFID enabled hallmark transparency attributes in JSCR, which pertains to high driving power and less dependence power.

Figure 7 MICMAC analysis of RFID-enabled hallmark SCTAT attributes in JSCR (see online version for colours)



6 Analytical hierarchy process

According to Saaty (1988) notices that AHP has few limitation work as follow:

1 The fitness of AHP method is mostly applicable in crisp decision applications.

2 In most the evidence, AHP method does not taken into account the uncertainty related with the mapping of one's judgement to a number.

3 The influence of subjective judgement, selection and preference of decision-makers significant impact of AHP results.

4 Priority of ranking of the AHP method is suitable rather than imprecision.

Figure 8 The framework of RFID enabled hallmark transparency and traceability attributes in JSCR

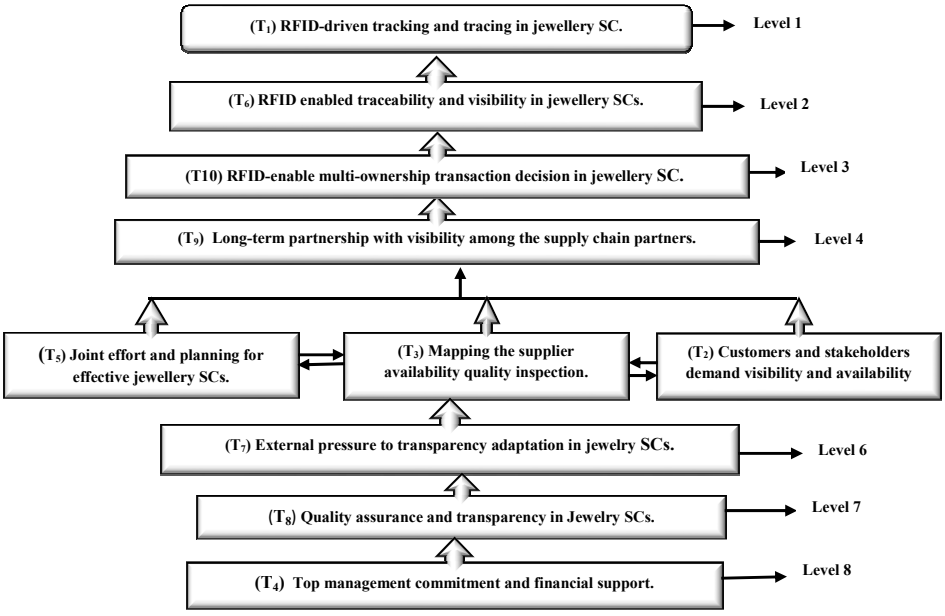
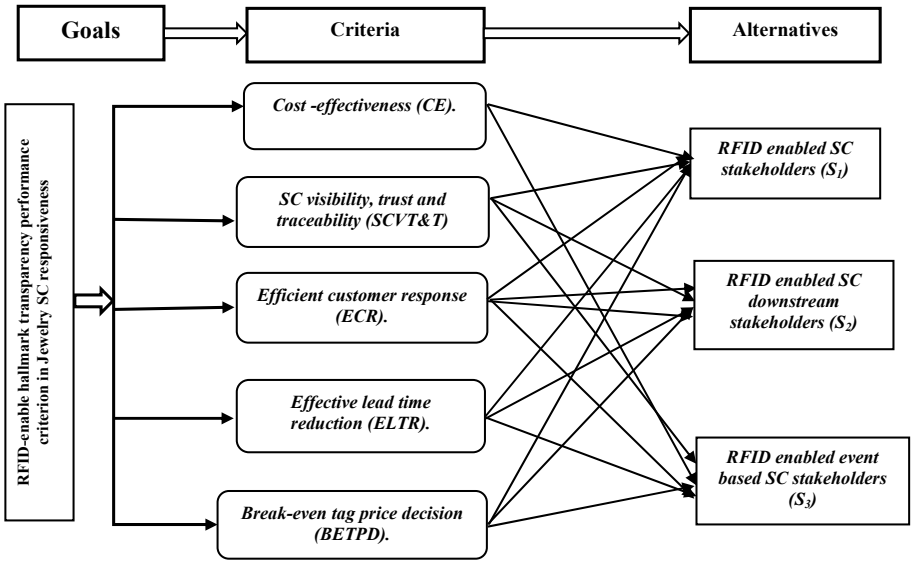


Figure 9 AHP model to evaluate the RFID-enable transparency SC performance in JSC responsiveness



To overcome of conventional AHP certain limitations Therefore, Van Laarhoven and Pedrycz (1983) proposed that FAHP, which is the combination of AHP and fuzzy theory. The method is creates and deal with unbalanced scale of judgement. Therefore, the traditional AHP approach seems inadequate information to capture the decision-makers

requirement explicitly (Kabir and Hasin, 2012; Kabir and Sumi, 2014). Figure 9 explore that AHP approach to evaluate the RFID-enable jewellery transparency performance criteria in SC Responsiveness. According to RFID enable transparency performance criterion in jewellery business are namely:

1 cost-effectiveness (CE)

2 SC visibility, trust and traceability (SCVT&T)

3 efficient consumer response

4 effective lead time reduction (ELTR)

5 break-even tag price decision (BETPD).

The three RFID enabled SC stakeholders are considered for alternatives selection decision.

Table 10 Ranking preference order of transparency performance criterion in JSCR

Criteria	*Weights*	*Sub criteria*	*Avg. criteria weight*	*Global criteria weights*	*Ranks*
Efficient customer response (ECR)	0.134	ECR1	0.633	0.0851	V
		ECR2	0.106	0.014	XIII
		ECR3	0.260	0.035	X
Break-even tag price decision (BETPD)	0.274	BT1	0.282	0.077	VI
		BT2	0.643	0.176	I
		BT3	0.073	0.020	XII
Cost-effectiveness (CE)	0.318	C1	0.169	0.054	VII
		C2	0.442	0.141	III
		C3	0.387	0.123	IV
SC visibility, trust and traceability (SCV&T)	0.0348	VT1	0.282	0.009	XIV
		VT2	0.643	0.022	XI
		VT3	0.073	0.002	XV
Effective lead time reduction (ELTR)	0.237	LT1	0.186	0.044	VIII
		LT2	0.655	0.155	II
		LT3	0.157	0.037	IX

7 Results and discussion

The proposed framework is consists that RFID-enabled hallmark SC transparency and traceability potential attributes incorporates in the Indian jewellery business. It provides the real time hallmark tags visibility (18< 20 < 22 Karats) of cost-effective and quality assurances in jewellery business organisation. Design of specific fashion gold jewelleries and domestic designs are pertains trust to transparency enables gold purity and quality assurances visibility of entries JSC stakeholders and end ECR. RFID-tags enables jewellery business performance are enhances through potential linkages such as, ECR, quality assurance, as well as visibility of multi-tags ownership transitions across multiple

SC stakeholders. RFID-tags enables jewellery e-retailers have continuous sharing inventory levels information from inter and intra organisational gold jewellery suppliers or vendors in multiple SC stakeholders. According to Srivastava (2010) and Kumar (2007) emphasis that RFID technology is captured the specific attention on transparency ability in SC organisations and also enhances the JSC performance. It is functional by RFID-tags enable technology driven in JSCR. E-retail SC capacity size can be defines through information sharing and overall improves the operational inventory costs reductions in the SC performance. In the Indian jewellery industry, the government policy has continuous push in hallmark transparency and quality assurance (18 to 22 Karat) in gold jewellery encompasses in retail stores. The government push is strengthen them ECR and stimulates that quality assurances through hallmarks visibility in gold jewellery configurations.

Tanishq jewellery is adoption of RFID enables transparency to minimise the holding cost expenses, continuous visibility of jewellery items demands information data transfers in manufacturing of JSC organisations. It is depicted in Figure 2, where, it is explores that cause and effect analysis of RFID enablers in transparency attributes in JSCR. Figure 3 are explores that trade-off relationship among the conventional and RFID-tags enables attributes jewellery e-retail SC models. The case study of 'Indian Tanishq JSCR, It explains 4Ps strategies in Indian jewellery industry segments. It is shown in Figure 4, which is explores that Tanishq business in various 4Ps marketing strategies:

1 product innovation strategy

2 price strategy

3 place strategy

4 promotion planning strategy.

It is emphasises that on every segments of the business strategy in Indian Tanishq Jewellery brand. Gold jewellery business items are attached with RFID-tags enables transparency driven by data transaction visibility in JSC partners, multi-tags ownership translations in JSC partners, physical and virtual inventory visibility in JSC stakeholders. The conventional e-retail JSC business has admitted financial losses in inventory inaccuracy and lack of trust in ECR. The non-RFID jewellery business organisations are admitted that huge financial losses due to inventory inaccuracy costs, physical inventory holding costs, human errors in handling and operating costs. Manual stock holding and services are difficult tasks from gold quality trust to transparency, traceability and inventory inaccuracy in conventional JSC performances. Human errors cannot provide accurate and reliable statistics. RFID enables transparency adoption decisions addition of trust to transparency in JSCR and it enhances the JSC performance through visibility of trust to transparency and traceability of Jewellery items significant information across the JSC actors and members in upstream and downstream JSC network.

ISM approach is used to develop a framework, which consists of RFID enable transparency attributes in JSC responsiveness. It helps to explore the inter-relationship among with and without RFID enables transparency attributes adoption decisions in Indian e-retail JSCR. It helps to examine that ten RFID-enablers in transparency attributes in e-retail JSC. MICMAC analysis is shows that in Figure 7, which explores that inter-relationship among driving and dependence powers in RFID-enabled hallmark

transparency and traceability attributes in JSCR. MICMAC analysis is divided into four groups of clusters.

- Autonomous factors (cluster I): RFID-enables transparency attributes in JSC, which pertains to low driving powers and weak dependence powers. It is consist of autonomous RFID-enables transparency attributes in JSCR namely, top management commitment and financial support (T_4).
- Dependent factors (cluster II): RFID enable transparency in JSC which pertains to weak driving powers and high dependence powers. The cluster II of RFID enables transparency attributes in JSCRs is namely quality assurance and transparency in JSCs (T_8).
- Linkage factors (cluster III): it is consist of linkage factors role in RFID-enables transparency attributes in JSC, which is pertain to high driving as well as high dependences powers. cluster III of RFID enables transparency in JSC are namely, RFID-driven tracking and tracing in JSC (T_1); customer and stakeholders demand visibility (T_2); mapping the supplier availability quality inspection (T_3); joint planning for effective JSCR (T_5), RFID-enabled traceability and visibility in JSCs. (T_6), external pressure for transparency adaptation in SC (T_7), long-term partnership with visibility among the JSC partners (T_9), RFID enable multi-ownership transaction decision in JSC partners (T_{10}).
- Driving factors (cluster IV): it is consists of driving power of RFID-enables transparency attributes in JSC, which is pertains to high driving and less dependence powers in JSCR.

The combination of ISM and MICMAC analysis is to understand the inter-relationship of ten RFID-enabled hallmark (24 to 22 karat) transparency addition in sustainable JSCR. ISM approach is shown in Figure 8, which explores that RFID enabled gold hallmark transparency potential attributes in JSCR. The proposed framework consists of eight level of position of potential linkages in the first level, which is (T_1) RFID-driven tracking and tracing in JSC. In the end of SC transparency linkages (T_1 and T_4) that occurs in the lowest level drivers.

Jewellery industry are foster to more customer responsiveness, which achieves through of hallmark transparency to identify the most significant RFID enabled transparency linkages in JSCR, which can be easily to value addition of hallmark transparency of digital SCM.

MICMAC analysis is explores in Figure 7, which is subjected to RFID enabled hallmark transparency in JSC responsiveness. It is depicted in group of cluster RFID enable transparency attributes relationship low driving and weak dependence power in JSCs. It is related to autonomous factors 'top management commitment and financial support (T_4)'. It is a key role play in transparency and traceability adoption decision in RFID-enable JSCR. The other factors significant influence of jewellery businesses (dependent and linkages) are pertains to high driving and high dependence powers in jewellery organisations. It is dominated by gold jewellery hallmark transparency potential attributes namely, quality assurance and transparency in JSCs (T_8); external pressure to transparency adaptation in jSCs (T_7); customer and stakeholders demand visibility (T_2); mapping the supplier availability quality inspection (T_3); joint planning for effective JSCR (T_5); RFID-enabled traceability and visibility in JSCs (T_6); external pressure for

transparency adaptation in SC (T_7); long-term partnership with visibility among the JSC partners (T_9); RFID enable multi-ownership transaction decision in JSC partners (T_{10}).

7.1 Conclusions

The research work is proposed a framework, which is consists of RFID tags enables SC transparency and traceability attributes potential in jewellery industry. The jewellery industries (expensive items, diamonds, and gams) are notices that lack of transparency and traceability from end customer trust and reliable quality assurances gaps in jewellery business. The jewellery organisation are observed that various operational inventory misplacement and financial losses challenges namely, inefficiencies and wastage of human resources, wastage of operational lead times, gold jewellery inventory inaccuracies, leading to staff in-efficiency of jewellery shop-floor activities. Therefore, RFID technology is way of gold transparency potential ability to transform the business organisation through gold quality visibility, accurate and high purity of golds (21 and 22 Karat) information source visibility in JSC stakeholders. The proposed framework to identify the RFID-enabled transparency in JSCR in the Indian jewellery industry. The RFID-enable transparency is a vital role play in jewellery business organisation. The product manufacturing and quality assurance information is a vital role play in JSCR for ECR. RFID-tags enable JSC business has pertained to ECR, Quality assurance, as well as visibility of multi-tags ownership transitions of SC stakeholders. Jewellery organisation has continuous sharing of inter and intra organisational information alignment of SC stakeholders. According to Srivastava (2010), emphasis that RFID technology has admitted transparency ability in SC organisation and also enhances the visibility of SC performance. It has driven by advanced autonomous system. The capacity of e-retail SC partners have enhanced through sharing and improving the overall SC performance. The continuous push in government-driven policy and competitiveness of quality assurance and visibility of jewellery items configurations. The JSCR are efficient role in upstream SC process visibility and downstream SCTAT in ECR through quality assurance and trust of reliability. The adoption of RFID enabled transparency in SC transparency drivers in the jewellery Indian industry. Tanishq jewellery industry has the adoption of RFID to enable transparency to minimise the holding cost expenses and continuous visibility of inventory stock demands and data of selling information circulation in JSCR. Figure 2 explores the cause and effect analysis to identify the RFID enablers in transparency JSCR. Figure 3 explores the conventional jewellery e-retail supply chain model and RFID tags enable the JSC model. The case study of Indian Tanishq JSCR has explored 4Ps strategies in Indian jewellery industry segments. It is shown in Figure 4, which explores the Tanishq business strategy in various 4Ps marketing strategies:

1 product innovation strategy

2 price strategy

3 place strategy

4 promotion planning strategy.

Which emphasises on every segment of the business strategy in Tanishq Jewellery brand an Indian jewellery organisation. The RFID tags enable transparency has driven data transaction visibility in JSC partners, multi-tags ownership translations in JSC partners

and stakeholders, and physical and virtual inventory visibility in JSC business. The convention JSC business organisation has admitted the financial losses in inventory inaccuracy and lack of trust in ECR. The inter and intra-organisation jewellery business has admitted that huge financial losses due to inventory inaccuracy costs and physical inventory holding costs as well as human errors in handling and operating costs. Human errors cannot provide accurate and reliable statistics. Manual stock holding and services are difficult tasks for traceability and inventory inaccuracy in conventional JSC performances. RFID enables transparency adoption decisions in JSCR and it enhances the JSC performance through the visibility of transparency and traceability of jewellery items across the JSC actors and members upstream and downstream in JSCR.

ISM approach is used to propose a framework, which pertains to RFID-enable JSC Responsiveness. It is explore the inter-relationship b/w with and without RFID enable transparency adoption decision in Indian E-retail JSCR. It helps to explore the ten enablers in RFID enable transparency in JSCR. MICMAC Analysis is shown in Figure 8; it is explore the inter-relationship among the framework of RFID-enabled transparency in JSCR. The MICMAC analysis is divided into four groups of cluster.

- Autonomous factors (cluster I): RFID enable transparency in JSC which pertains to low driving power and weak dependence power. It is consist of autonomous RFID enables transparency in JSCR namely, top management commitment and financial support (T4).
- Dependent factors (cluster II): RFID enable transparency in JSC which pertains to weak driving power and high dependence power. The cluster II of RFID enables transparency in JSCRs namely quality assurance and transparency in JSCs (T8).
- Linkage factors (cluster III): it is consist of linkage the RFID enable transparency in JSC, which pertains to high driving power as well as high dependence. Cluster III of RFID enables transparency in JSC namely, RFID-driven tracking and tracing in JSC (T_1); customer and stakeholders demand visibility (T_2); mapping the supplier availability quality inspection (T_3); joint planning for effective JSCR (T_5); RFID-enabled traceability and visibility in JSCs (T_6); external pressure for transparency adaptation in SC (T_7); long-term partnership with visibility among the JSC partners (T_9); RFID enable multi-ownership transaction decision in JSC Partners (T_{10}).
- Driving factors (cluster IV): it is consist of driving the RFID to enable transparency in JSC, which pertains to high driving power and less dependence power in JSCR.

AHP approach is used to prioritise the RFID enable transparency criterion which enhances the transparency in JSCR. The result has depicted in Table 10, which is explore the ranking preference order of RFID-enable transparency performance in JSCR which is also depicted in Figure 10. The transparency performance criteria of JSCR are namely, ECR; BETPD; CE; SCV&T; ELTR. The three RFID enable stakeholders alternatives are namely:

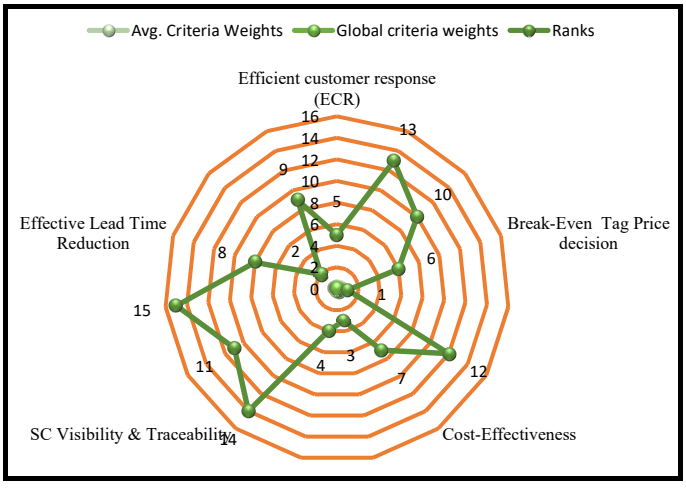
1 RFID enabled SC stakeholders

2 RFID enabled SC downstream stakeholders

3 RFID enabled event based SC stakeholders.

These RFID enabled SC stakeholders are incorporates to strengthen the transparency in the JSCR. ISM approach has used to identify the RFID enabled transparency potential in JSCR from ECR. The develop framework to explore the RFID enabled transparency and traceability potential inter-linkages in JSC business. AHP approach has used to identify the weight priority orders of RFID enable transparency performance criteria are shown in Figure 10 which explores the RFID enabled transparency performance criteria in JSCR in Tanishq organisations.

Figure 10 The ranking preference order of RFID-enable transparency performance criterion in JSCR (see online version for colours)



7.2 Jewellery business managers

The jewellery store managers can be benefited by handing of operational inventory visibility and traceability of upstream and downstream of JSC networks. It provides the extensive view of shop-floor activities visibility, each stages of jewellery (14, < 18 < 22) Karat gold purity and reliability centred. RFID-tags price are attached gold information data collections and real time tracking and traceability ability in JSC responsiveness.

- The RFID enabled hallmark transparency and traceability attributes can be benefited to upstream and downstream continuous information of real-time visibility of JSC stakeholders and gold quality assurances. It is help to build trust and transparency responsiveness for ECR.
- The jewellery stock managers can be addition of value readiness of transparency enable paradigm shift of gold jewellery hallmark (14 < 18 < 22 Karat) trust to transparency, ECR to digital transformation consumer response, more reliable jewellery making hallmark trust and transparency source information and quality composition. The jewellery composition of matrix and digital transformations consumer responses.
- The result outcomes of top management commitment and financial support attributes are significant influences to other attributes such as quality assurance and transparency in JSCs (T_8), external pressure to transparency adaptation in JSCs (T_7);

due to more readiness of customer and government push are reinforcement of direction of hallmark transparency (22 to 24 Karats) adoption decision encompasses in jewellery business. Customer and stakeholders demand visibility (T_2); mapping the supplier availability quality inspection (T_3); joint planning for effective JSCR (T_5); RFID-enabled traceability and visibility in JSCs (T_6); external pressure for transparency adaptation in SC (T_7); long-term partnership with visibility among the JSC partners (T_9); RFID enable multi-ownership transaction decision in JSC partners (T_{10}).

7.3 Research limitation

It has focused only on the RFID-enabled transparency and traceability potential in JSCR in the Tanishq organisations. The only ten potential attributes enablers have been considered in JSCR in the e-retail business. Moreover, RFID enabled JSC performance criteria weights ranking orders are identify through qualitative assessment by using AHP approach.

7.4 Future extension

The research extension in the direction of RFID with IoT in the multi-dimensional transparency aspects in digital SC responsiveness and ensure the ECR to digital transformations consumer responses (DTCR). It is validates through structure equation methodology (SEM) and quality function deployments (QFD) in digital SC operational activities in multi-layers e-retails JSC networks. The QFD and DEMATEL approach may be used for study the multi-layer digital JSC responsiveness in organisations transparency.

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Appendix

Table A1 Random index

N	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

Note: Consistency ratio (CR); CR = Consistency index (C.I.)/Random index (R.I) = 0.050102/1.12, = 0.04473 < 0.1.

Table A2 Pairwise comparison of experts criterion w.r.t ECR

	Expert 1	*Expert 2*	*Expert 3*	*Avg. criteria weight*
ECR1	1	5	3	0.633
ECR2	1/5	1	1/3	0.106
ECR3	1/3	3	1	0.260
		Calculating the consistency		
	Expert 1	*Expert 2*	*Expert 3*	*Weighted sum value/ avg. criteria weight*
ECR1	0.633	0.530	0.781	3.071
ECR2	0.126	0.106	0.086	3.011
ECR3	0.211	0.318	0.260	3.032

Notes: λ_{max} = (3.071973 + 3.011202 + 3.032969)/3 = 3.0387.
Consistency index (C.I.) = $(\lambda_{max} - n)/(n - 1)$ = (3.0387 – 3)/(3 – 1) = 0.019;
Consistency ratio (CR); CR = Consistency index (C.I.)/Random index (R.I) = 0.019/0.58; 0.033 < 0.05.

Table A3 Pairwise comparison of expert's criterion w.r.t CE

	Expert 1	*Expert 2*	*Expert 3*	*Avg. criteria weight*
CE1	1	1/3	5	0.282
CE2	3	1	7	0.643
CE3	1/5	1/7	1	0.073

Notes: λ_{max} = (3.0623 + 3.0623 + 3.0126)/3 = 3.045.
Consistency index (C.I.) = $(\lambda_{max} - n)/(n - 1)$ = (3.065512 – 3)/(3 – 1) = 0.0226;
Consistency ratio (CR), CR = Consistency index (C.I.)/Random index (R.I) = 0.0226/0.58; = 0.039 < 0.05.

Table A3 Pairwise comparison of expert's criterion w.r.t CE (continued)

Calculating the consistency				
	Expert 1	*Expert 2*	*Expert 3*	*Weighted sum value/ avg. criteria weight*
CE1	0.282	0.214	0.368	3.062
CE2	0.848	0.643	0.516	3.062
CE3	0.056	0.091	0.073	3.012

Notes: λ_{max} = (3.0623 + 3.0623 + 3.0126)/3 = 3.045.
Consistency index (C.I.) = $(\lambda_{max} - n)/(n - 1)$ = (3.065512 – 3)/(3 – 1) = 0.0226;
Consistency ratio (CR), CR = Consistency index (C.I.)/Random index (R.I)
= 0.0226/0.58; = 0.039 < 0.05.

Table A4 Pairwise comparison of expert's criterion w.r.t of SCVT&T

	Expert 1	*Expert 2*	*Expert 3*	*Avg. criteria value*
SCVT&T_1	1	1/3	1/2	0.169
SCVT&T_2	3	1	7	0.4428
SCVT&T_3	2	1	1	0.387
Calculating the consistency				
	Expert 1	*Expert 2*	*Expert 3*	*Weighted sum value/ avg. criteria weight*
SCVT&T_1	0.169	0.147	0.193	3.009
SCVT&T_2	0.509	0.442	0.387	3.025
SCVT&T_3	0.339	0.442	0.387	3.025

Notes: λ_{max} = (3.0093 + 3.02509 + 3.02509)/3 = 3.0183.
Consistency index (C.I.) = $(\lambda_{max} - n)/(n - 1)$ = (3.018309 – 3)/(3 – 1) = 0.009,
Consistency ratio (CR), CR = Consistency index (C.I.)/Random index (R.I)
= 0.0091545/0.58 = 0.0157 < 0.05.

Table A5 Pairwise comparison of expert's criterion w.r.t of break-even cost based tag price decisions (BECBTPD)

	Expert 1	*Expert 2*	*Expert 3*	*Avg. criteria weight*
BE1	1	1/3	5	0.2828
BE2	3	1	7	0.6433
BE3	1/5	1/7	1	0.0737
Calculating the consistency				
	Expert 1	*Expert 2*	*Expert 3*	*Weighted sum value/avg. criteria weight*
BE1	0.282	0.214	0.3688	3.0623
BE2	0.848	0.643	0.5164	3.1214
BE3	0.056	0.091	0.0737	3.0126

Notes: λ_{max} = (3.062 + 3.121 + 3.012)/3 = 3.065.
Consistency index (C.I) = $(\lambda_{max} - n)/(n - 1)$ = (3.065 – 3)/(3 – 1) = 0.032,
Consistency ratio (CR); CR = Consistency index (C.I.)/Random index (R.I)
= 0.032/0.58, = 0.05 ≤ 0.05.

Table A6 Pairwise comparison of experts criterion w.r.t of ELTR

	Expert 1	*Expert 2*	*Expert 3*	*Avg. criteria weight*
LT_1	1	1/3	1	0.186749
LT_2	3	1	5	0.655487
LT_3	1	1/5	1	0.157764

Calculating the consistency

	Expert 1	*Expert 2*	*Expert 3*	*Weighted sum value*	*Weighted sum value/ avg. criteria weight*
LT_1	0.1867	0.2184	0.1577	0.563	3.014
LT_2	0.5602	0.6554	0.7888	2.004	3.058
LT_3	0.1867	0.1310	0.1577	0.475	3.014

Notes: λ_{max} = (3.014782 + 3.058117 + 3.014698)/3 = 3.029.
Consistency index (C.I.) = $(\lambda_{max} - n)/(n - 1)$ = (3.029199 – 3)/(3 – 1) = 0.015.
Consistency ratio (CR); CR = Consistency index (C.I.)/Random Index (R.I)
= 0.015/0.58, = 0.025 < 0.05.

Table A7 Pairwise comparison matrix of performance criteria of transparency in JSCR

	ECR	*BECBTP*	*EC*	*SCVT&T*	*ELTR*
ECR	1	4	1	3	1
BECBTP	0.25	1	0.2	0.333	0.25
EC	1	5	1	3	3
SCVT&T	0.333	3	0.333	1	0.333
ELTR	1	4	0.333	3	1
Sum	3.583	17	2.866	10.33	5.583

Table A8 Normalised pairwise comparison matrix of performance criterion of transparency in JSCR

	ECR	*BECBTP*	*EC*	*SCVT&T*	*ELTR*	*Avg. criteria weight*
ECR	0.12	0.135	0.199	0.142	0.074	0.1344
BECBTP	0.24	0.270	0.399	0.238	0.223	0.2741
EC	0.24	0.270	0.399	0.238	0.446	0.318
SCVT&T	0.04	0.054	0.01	0.047	0.031	0.034
ELTR	0.36	0.270	0.02	0.333	0.223	0.237

Table A9 Calculating the consistency of transparency performance criterion in JSCR

	ECR	*BECBTP*	*EC*	*SCVT&T*	*ELTR*	*Weighted sum value/avg. criteria weight*
ECR	0.266	0.220	0.349	0.325	0.220	5.185
BECBTP	0.066	0.055	0.069	0.036	0.055	5.135
EC	0.266	0.275	0.349	0.325	0.660	5.135
SCVT&T	0.088	0.165	0.116	0.108	0.073	5.094
ELTR	0.266	0.220	0.116	0.325	0.220	5.221

Notes: λ_{max} = (5.185 + 5.1353 + 5.1353 + 5.094 + 5.221)/5 = 5.200;
Consistency index (C.I.) = $(\lambda_{max} - n)/(n - 1)$ = (5.200 – 5)/(5 – 1) = 0.050.