**Table 1** Quantitative self-evaluation scores Cs and Ca

|  |  |  |  |
| --- | --- | --- | --- |
| Judgement basis (Cs) | Quantitative value (score) | Familiarity (Ca) | Quantitative value (score) |
| Practical experience | 5.0 | Very familiar | 5.0 |
| Theoretical analysis | 4.0 | Familiar | 4.0 |
| Understanding of relevant progress at home and abroad | 3.0 | General familiarity | 3.0 |
| Reference | 2.0 | Not very familiar | 2.0 |
| Subjectivity | 1.0 | Unfamiliar | 1.0 |

**Table 2** Basic situation of the sample

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Unit | | Working years | | | | Professional title | Positional title |
|  | Hospital | Enterprise | 5-10 years | 11-20 years | More than 20 years | | Advanced or above | Middle or above |
| **First round** | 15 | 15 | 15 | 2 | | 13 | 13 | 17 |
| **Second round** | 25 | 0 | 0 | 5 | | 20 | 25 | 23 |
| **Third round** | 20 | 0 | 0 | 2 | | 18 | 20 | 20 |

**Table 3** Expert positive coefficient

|  |  |  |  |
| --- | --- | --- | --- |
|  | First round | Second round | Third round |
| Issued | 30 | 25 | 20 |
| Received | 25 | 20 | 20 |
| Expert positive coefficient | 83.3% | 80.0% | 100.0% |

**Table 4** Degree of concentration of expert opinions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Indicators | M | K | Q+-Q- | extreme value difference |
| 1.3 Technical solutions | 4.429 | 0.524 | 2 | ≤2 |
| 2.4 Device installation | 4.857 | 0.857 | 1 | ≤2 |
| 3.1 Maintenance system | 4.571 | 0.619 | 2 | ≤2 |
| 3.7 Maintenance response | 4.810 | 0.810 | 1 | ≤2 |
| 3.16 Maintenance quality | 4.619 | 0.476 | 1 | ≤2 |
| 3.3 Complaint handling | 4.048 | 0.333 | 4 | >2 |
| … | … | … | … | … |

**Table 5** Quantitative measures in the first round

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Second level**  **indicators** | Initial number of indicators | Average Score M >4 | K>0.3 | Q+-Q-<=2 | Number of indicators at the end of first round |
| 35 | 32 | 33 | 23 | 34 |
| **Third level**  **indicators** | 88 | 78 | 77 | 63 | 82 |

**Table 6** Quantitative measures in the second round

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Second level**  **indicators** | Initial number of indicators | Average Score M >4 | K>0.3 | Q+-Q-<=2 | Number of indicators at the end of second round |
| 34 | 25 | 25 | 23 | 30 |
| **Third level**  **indicators** | 82 | 76 | 61 | 63 | 76 |

**Table 7** Statistical results of indicators identified under Delphi method

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| second-level indicators | third-level indicators | M | Standard deviation | Coefficient of variation | K | Q+-Q- | Cr |
| 1.1 Product display | | 4.000 | 0.837 | 0.209 | 0.286 | 3 | 4.000 |
|  | 1.1.1 In-hospital training demonstration | 3.952 | 0.805 | 0.204 | 0.238 | 3 |  |
|  | 1.1.2 Out-of-hospital training demonstration | 3.476 | 1.078 | 0.310 | 0.143 | 4 |  |
| 1.2 Technical information | | 4.429 | 0.676 | 0.153 | 0.524 | 2 | 4.476 |
|  | 1.2.1 Technical information | 4.524 | 0.602 | 0.133 | 0.571 | 2 |  |
| 1.3 Technical solutions | | 4.476 | 0.750 | 0.167 | 0.571 | 3 | 4.405 |
|  | 1.3.1 Providing technical solutions | 4.619 | 0.740 | 0.160 | 0.714 | 3 |  |
|  | 1.3.2 Program completeness | 4.381 | 0.865 | 0.197 | 0.571 | 3 |  |
| 1.4 Requirement Demonstration | | 4.190 | 1.030 | 0.246 | 0.476 | 4 | 4.000 |
|  | 1.4.1 Requirement Demonstration | 3.952 | 1.161 | 0.294 | 0.429 | 4 |  |
| 1.5 Sales system | | 3.143 | 0.573 | 0.182 | 0.000 | 2 | 3.119 |
|  | 1.5.1 Product category | 3.333 | 0.730 | 0.219 | 0.095 | 3 |  |
| 1.6 New technology promotion | | 3.571 | 0.926 | 0.259 | 0.143 | 3 | 3.571 |
|  | 1.6.1 Popularization and trial | 3.714 | 0.902 | 0.243 | 0.190 | 3 |  |
| 2.1 Configuration project | | 4.619 | 0.740 | 0.160 | 0.714 | 3 | 4.405 |
|  | 2.1.1 Programme effectiveness | 4.619 | 0.740 | 0.160 | 0.714 | 3 |  |
| 2.2 Timeliness of arrival | | 4.381 | 0.590 | 0.135 | 0.429 | 2 | 4.476 |
|  | 2.2.1 Contract arrival | 4.571 | 0.598 | 0.131 | 0.619 | 2 |  |
|  | 2.2.2 Logistics services | 4.000 | 0.949 | 0.237 | 0.381 | 3 |  |
| 2.3 Installation manual | | 4.476 | 0.680 | 0.152 | 0.571 | 2 | 4.429 |
|  | 2.3.1 Accompanying documentation | 4.571 | 0.598 | 0.131 | 0.619 | 2 |  |
| 2.4 Device installation | | 4.857 | 0.359 | 0.074 | 0.857 | 1 | 4.524 |
|  | 2.4.1 Device installation | 4.857 | 0.359 | 0.074 | 0.857 | 1 |  |
|  | 2.4.2 Installation efficiency | 4.190 | 0.814 | 0.194 | 0.381 | 3 |  |
|  | 2.4.3 Installation report | 4.190 | 0.873 | 0.208 | 0.476 | 2 |  |
|  | 2.4.4 Installation service | 4.286 | 0.717 | 0.167 | 0.429 | 2 |  |
| 2.5 Equipment commissioning and quality control | | 4.667 | 0.730 | 0.156 | 0.810 | 2 | 4.500 |
|  | 2.5.1 Installation and commissioning | 4.714 | 0.561 | 0.119 | 0.762 | 2 |  |
|  | 2.5.2 Quality inspection | 4.333 | 0.966 | 0.223 | 0.619 | 3 |  |
|  | 2.5.3 Quality control record | 4.571 | 0.870 | 0.190 | 0.762 | 3 |  |
|  | 2.5.4 Quality control service satisfaction | 4.381 | 0.740 | 0.169 | 0.524 | 2 |  |
| 2.6 Equipment acceptance | | 4.810 | 0.402 | 0.084 | 0.810 | 1 | 4.643 |
|  | 2.6.1 Acceptance process | 4.714 | 0.561 | 0.119 | 0.762 | 2 |  |
|  | 2.6.2 Acceptance Time | 4.238 | 0.944 | 0.223 | 0.476 | 3 |  |
|  | 2.6.3 Unacceptable processing | 4.429 | 0.676 | 0.153 | 0.524 | 2 |  |
|  | 2.6.4 Acceptance service | 4.429 | 0.676 | 0.153 | 0.524 | 2 |  |
| 2.7 Data protocol | | 4.190 | 0.873 | 0.208 | 0.476 | 2 | 4.048 |
|  | 2.7.1 Data opening | 3.952 | 0.921 | 0.233 | 0.381 | 2 |  |
| 2.8 Primary operational training | | 4.667 | 0.577 | 0.124 | 0.714 | 2 | 4.429 |
|  | 2.8.1 Normative training | 4.381 | 0.740 | 0.169 | 0.524 | 2 |  |
|  | 2.8.2 Clinical training | 4.524 | 0.512 | 0.113 | 0.524 | 1 |  |
|  | 2.8.3 Medical training | 4.429 | 0.676 | 0.153 | 0.524 | 2 |  |
| 3.1 Maintenance system | | 4.571 | 0.598 | 0.131 | 0.619 | 2 | 4.714 |
|  | 3.1.1 Engineer qualification | 4.429 | 0.746 | 0.169 | 0.571 | 2 |  |
|  | 3.1.2 Maintenance scale | 4.000 | 0.775 | 0.194 | 0.286 | 2 |  |
|  | 3.1.3 Maintenance and certification | 4.095 | 0.768 | 0.188 | 0.333 | 2 |  |
|  | 3.1.4 Maintenance system | 4.095 | 0.768 | 0.188 | 0.333 | 2 |  |
|  | 3.1.5 Maintenance implementation normative | 4.476 | 0.750 | 0.167 | 0.619 | 2 |  |
|  | 3.1.6 Maintenance response time | 4.905 | 0.301 | 0.061 | 0.905 | 1 |  |
|  | 3.1.7 Troubleshooting time | 4.714 | 0.561 | 0.119 | 0.762 | 2 |  |
| 3.2 Post-sales service personnel | | 4.571 | 0.746 | 0.163 | 0.714 | 2 | 4.500 |
|  | 3.2.1 Post-sales team | 3.905 | 0.700 | 0.179 | 0.190 | 2 |  |
|  | 3.2.2 Team training | 4.429 | 0.746 | 0.169 | 0.571 | 2 |  |
|  | 3.2.3 Satisfaction with team service | 4.524 | 0.602 | 0.133 | 0.571 | 2 |  |
|  | 3.2.4 Satisfaction with maintenance service | 4.619 | 0.498 | 0.108 | 0.619 | 1 |  |
| 3.3 Complaint handling | | 4.048 | 0.973 | 0.241 | 0.333 | 4 | 4.167 |
|  | 3.3.1 Complaint procedure | 3.952 | 0.865 | 0.219 | 0.190 | 4 |  |
|  | 3.3.2 Complaint record | 3.714 | 0.902 | 0.243 | 0.143 | 4 |  |
|  | 3.3.3 Complaint handling | 4.095 | 0.995 | 0.243 | 0.381 | 4 |  |
|  | 3.3.4 Convenience of complaints | 4.238 | 0.889 | 0.210 | 0.476 | 3 |  |
|  | 3.3.5 Complaint feedback | 4.238 | 0.831 | 0.196 | 0.429 | 3 |  |
| 3.4 Adverse event monitoring | | 4.190 | 0.750 | 0.179 | 0.381 | 2 | 4.214 |
|  | 3.4.1 Adverse event monitoring | 4.190 | 0.928 | 0.222 | 0.476 | 3 |  |
|  | 3.4.2 Report of adverse events | 4.048 | 0.865 | 0.214 | 0.333 | 3 |  |
|  | 3.4.3 Adverse event handling | 4.095 | 0.768 | 0.188 | 0.333 | 2 |  |
|  | 3.4.4 Adverse event record | 4.429 | 0.676 | 0.153 | 0.524 | 2 |  |
| 3.5 Product recall | | 4.000 | 0.949 | 0.237 | 0.381 | 3 | 3.952 |
|  | 3.5.1 Product recall | 3.619 | 0.740 | 0.204 | 0.048 | 3 |  |
| 3.6 Maintenance and use manual | | 4.714 | 0.644 | 0.137 | 0.810 | 2 | 4.429 |
|  | 3.6.1 Operation manual | 4.667 | 0.730 | 0.156 | 0.810 | 2 |  |
|  | 3.6.2 Service manual | 4.524 | 0.814 | 0.180 | 0.667 | 3 |  |
|  | 3.6.3 Openness of technical data | 4.429 | 0.746 | 0.169 | 0.571 | 2 |  |
| 3.7 Maintenance response | | 4.810 | 0.402 | 0.084 | 0.810 | 1 | 4.619 |
|  | 3.7.1 PM program | 4.571 | 0.598 | 0.131 | 0.619 | 2 |  |
|  | 3.7.2 Satisfaction with PM service | 4.476 | 0.602 | 0.134 | 0.524 | 2 |  |
|  | 3.7.3 Satisfaction with maintenance hotline | 4.143 | 0.727 | 0.175 | 0.333 | 2 |  |
|  | 3.7.4 Satisfaction of Maintenance Response | 4.476 | 0.680 | 0.152 | 0.571 | 2 |  |
|  | 3.7.5 Satisfaction with troubleshooting | 4.667 | 0.577 | 0.124 | 0.714 | 2 |  |
| 3.8 Maintenance accessories | | 4.714 | 0.463 | 0.098 | 0.714 | 1 | 4.619 |
|  | 3.8.1 Quality of maintenance accessories | 4.619 | 0.498 | 0.108 | 0.619 | 1 |  |
|  | 3.8.2 Speed of arrival of repair accessories | 4.524 | 0.512 | 0.113 | 0.524 | 1 |  |
|  | 3.8.3 Satisfaction with maintenance price | 4.571 | 0.598 | 0.131 | 0.619 | 2 |  |
|  | 3.8.4 Satisfaction with payment method | 4.143 | 0.854 | 0.206 | 0.429 | 2 |  |
| 3.9 Standby machine | | 4.381 | 0.669 | 0.153 | 0.476 | 2 | 4.405 |
|  | 3.9.1 Whether to provide a standby machine | 4.524 | 0.750 | 0.166 | 0.667 | 2 |  |
|  | 3.9.2 Satisfaction with standby service | 4.333 | 0.730 | 0.169 | 0.476 | 2 |  |
| 3.10 Warranty contract | | 4.619 | 0.498 | 0.108 | 0.619 | 1 | 4.619 |
|  | 3.10.1 Contract Integrity | 4.524 | 0.602 | 0.133 | 0.571 | 2 |  |
|  | 3.10.2 Satisfaction with contract economy | 4.476 | 0.512 | 0.114 | 0.476 | 1 |  |
|  | 3.10.3 PM Satisfaction in Contract | 4.333 | 0.658 | 0.152 | 0.429 | 2 |  |
|  | 3.10.4 Satisfaction with contract indicators | 4.429 | 0.676 | 0.153 | 0.524 | 2 |  |
|  | 3.10.5 Satisfaction with Contract evaluation | 4.286 | 0.717 | 0.167 | 0.429 | 2 |  |
| 3.11 Maintenance and repair report | | 4.476 | 0.750 | 0.167 | 0.571 | 3 | 4.524 |
|  | 3.11.1 Satisfaction with reporting quality | 4.524 | 0.512 | 0.113 | 0.524 | 1 |  |
|  | 3.11.2 Satisfaction with report completion rate | 4.333 | 0.577 | 0.133 | 0.381 | 2 |  |
| 3.12 Retraining of clinical operations | | 4.238 | 0.831 | 0.196 | 0.476 | 2 | 4.214 |
|  | 3.12.1 Satisfaction with operational retraining | 4.190 | 0.814 | 0.194 | 0.429 | 2 |  |
| 3.13 Retraining in clinical application | | 4.286 | 0.784 | 0.183 | 0.476 | 2 | 4.119 |
|  | 3.13.1 Satisfaction with application retraining | 4.286 | 0.717 | 0.167 | 0.429 | 2 |  |
| 3.14 Technical support | | 4.333 | 0.658 | 0.152 | 0.429 | 2 | 4.238 |
|  | 3.14.1 Technical support | 4.143 | 0.573 | 0.138 | 0.238 | 2 |  |
| 3.15 Scientific research cooperation | | 3.714 | 1.102 | 0.297 | 0.286 | 4 | 3.976 |
|  | 3.15.1 Scientific research cooperation | 3.714 | 1.056 | 0.284 | 0.238 | 4 |  |
| 3.16 Maintenance quality | | 4.619 | 0.498 | 0.108 | 0.619 | 1 | 4.619 |
|  | 3.16.1 Probability of the same fault occurrence | 4.524 | 0.602 | 0.133 | 0.571 | 2 |  |
|  | 3.16.2 Satisfaction with equipment Performance | 4.476 | 0.512 | 0.114 | 0.476 | 1 |  |

**Table 8** Weighting of indicators using AHP and percentage method

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| First-level categories | Weight | second-level indicators | Weight |  | Third-level indicators | Weight |
| Pre-sale service | 0.1345 | 1.1 Technical information | 0.0669 |  | 1.1.1 Technical information | 0.0669 |
|  |  | 1.2 Technical solutions | 0.0676 |  | 1.2.1 Providing technical solutions | 0.0347 |
|  |  |  |  |  | 1.2.2 Program completeness | 0.0329 |
| Sale service | 0.2568 | 2.1 Configuration project | 0.0324 |  | 2.1.1 Programme effectiveness | 0.0324 |
|  |  | 2.2 Timeliness of arrival | 0.0307 |  | 2.2.1 Contract arrival | 0.0164 |
|  |  |  |  |  | 2.2.2 Logistics services | 0.0143 |
|  |  | 2.3 Installation manual | 0.0314 |  | 2.3.1 Accompanying documentation | 0.0314 |
|  |  | 2.4 Device installation | 0.0340 |  | 2.4.1 Device installation | 0.0094 |
|  |  |  |  |  | 2.4.2 Installation efficiency | 0.0081 |
|  |  |  |  |  | 2.4.3 Installation report | 0.0081 |
|  |  |  |  |  | 2.4.4 Installation service | 0.0083 |
|  |  | 2.5 Equipment commissioning and quality control | 0.0327 |  | 2.5.1 Installation and commissioning | 0.0086 |
|  |  |  |  |  | 2.5.2 Quality inspection | 0.0079 |
|  |  |  |  |  | 2.5.3 Quality control record | 0.0083 |
|  |  |  |  |  | 2.5.4 Quality control service satisfaction | 0.0080 |
|  |  | 2.6 Equipment acceptance | 0.0337 |  | 2.6.1 Acceptance process | 0.0089 |
|  |  |  |  |  | 2.6.2 Acceptance Time | 0.0080 |
|  |  |  |  |  | 2.6.3 Unacceptable processing | 0.0084 |
|  |  |  |  |  | 2.6.4 Acceptance service | 0.0084 |
|  |  | 2.7 Data protocol | 0.0293 |  | 2.7.1 Data opening | 0.0293 |
|  |  | 2.8 Primary operational training | 0.0327 |  | 2.8.1 Normative training | 0.0107 |
|  |  |  |  |  | 2.8.2 Clinical training | 0.0111 |
|  |  |  |  |  | 2.8.3 Medical training | 0.0109 |
| post-sale service | 0.6087 | 3.1 Maintenance system | 0.0445 |  | 3.1.1 Maintenance scale | 0.0064 |
|  |  |  |  |  | 3.1.2 Maintenance and certification | 0.0068 |
|  |  |  |  |  | 3.1.3 Maintenance system | 0.0068 |
|  |  |  |  |  | 3.1.4 Maintenance implementation normative | 0.0069 |
|  |  |  |  |  | 3.1.5 Maintenance response time | 0.0076 |
|  |  |  |  |  | 3.1.6 Troubleshooting time | 0.0083 |
|  |  | 3.2 Post-sales service personnel | 0.0445 |  | 3.2.1 Post-sales team | 0.0099 |
|  |  |  |  |  | 3.2.2 Team training | 0.0113 |
|  |  |  |  |  | 3.2.3 Satisfaction with team service | 0.0115 |
|  |  |  |  |  | 3.2.4 Satisfaction with maintenance service | 0.0118 |
|  |  | 3.3 Complaint handling | 0.0394 |  | 3.3.1 Complaint record | 0.0099 |
|  |  |  |  |  | 3.3.2 Complaint handling | 0.0099 |
|  |  |  |  |  | 3.3.3 Convenience of complaints | 0.0102 |
|  |  |  |  |  | 3.3.4 Complaint feedback | 0.0102 |
|  |  |  |  |  |  |  |
|  |  | 3.4 Adverse event monitoring | 0.0408 |  | 3.4.1 Adverse event monitoring | 0.0102 |
|  |  |  |  |  | 3.4.2 Report of adverse events | 0.0098 |
|  |  |  |  |  | 3.4.3 Adverse event handling | 0.0100 |
|  |  |  |  |  | 3.4.4 Adverse event record | 0.0108 |
|  |  | 3.5 Maintenance and use manual | 0.0459 |  | 3.5.1 Operation manual | 0.0157 |
|  |  |  |  |  | 3.5.2 Service manual | 0.0152 |
|  |  |  |  |  | 3.5.3 Openness of technical data | 0.0149 |
|  |  | 3.6 Maintenance response | 0.0468 |  | 3.6.1 PM program | 0.0096 |
|  |  |  |  |  | 3.6.2 PM service satisfaction | 0.0089 |
|  |  |  |  |  | 3.6.3 Satisfaction with maintenance hotline | 0.0087 |
|  |  |  |  |  | 3.6.4 Satisfaction with Maintenance Response | 0.0094 |
|  |  |  |  |  | 3.6.5 Satisfaction with troubleshooting | 0.0098 |
|  |  | 3.7 Maintenance accessories | 0.0459 |  | 3.7.1 Quality of maintenance accessories | 0.0119 |
|  |  |  |  |  | 3.7.2 Speed of arrival of repair accessories | 0.0116 |
|  |  |  |  |  | 3.7.3 Satisfaction with maintenance price | 0.0117 |
|  |  |  |  |  | 3.7.4 Satisfaction with payment method | 0.0106 |
|  |  | 3.8 Standby machine | 0.0426 |  | 3.8.1 Whether to provide a standby machine | 0.0218 |
|  |  |  |  |  | 3.8.2 Satisfaction with standby service | 0.0208 |
|  |  | 3.9 Warranty contract | 0.0449 |  | 3.9.1 Contract Integrity | 0.0092 |
|  |  |  |  |  | 3.9.2 Satisfaction with contract economy | 0.0084 |
|  |  |  |  |  | 3.9.3 PM Satisfaction in Contract | 0.0088 |
|  |  |  |  |  | 3.9.4 Satisfaction with contract indicators | 0.0090 |
|  |  |  |  |  | 3.9.5 Satisfaction with Contract evaluation | 0.0087 |
|  |  | 3.10 Maintenance and repair report | 0.0435 |  | 3.10.1 Satisfaction with reporting quality | 0.0222 |
|  |  |  |  |  | 3.10.2 Satisfaction with report completion rate | 0.0213 |
|  |  | 3.11 Retraining of clinical operations | 0.0412 |  | 3.11.1 Satisfaction with operational retraining | 0.0412 |
|  |  | 3.12 Retraining in clinical application | 0.0417 |  | 3.12.1 Satisfaction with application retraining | 0.0417 |
|  |  | 3.13 Technical support | 0.0422 |  | 3.13.1 Technical support | 0.0422 |
|  |  | 3.14 Maintenance quality | 0.0449 |  | 3.14.1 Probability of the same fault occurrence | 0.0226 |
|  |  |  |  |  | 3.14.2 Satisfaction with equipment Performance | 0.0223 |