Root Cause Analysis Report

2023 American Royal Open BBQ Competition
Requested By: Rod Gray, CEO, The Kansas City Barbeque Society

Problem Statement

KCBS scoring breakdown during the 2023 American Royal Open BBQ Competition resulted in the delay of awards, and incorrect tabulation and reporting of BBQ team results across the Open Competition on 01 OCT 23. Contest results inconsistencies were identified between Sunday's reported results, and results posted to the KCBS website on Monday 02 OCT 23.

Fully audited correct results were re-uploaded to the KCBS website on Thursday 05 OCT 23.

Root Cause Identification Process

A full analysis of the problem was conducted by interviewing involved parties, back-tracing KCBScore data files, analyzing scoring workflow, process management, and technologies used.

Interviews conducted

Rod Gray: CEO, The Kansas City Barbeque Society

Rep-In-Charge, The Kansas City Barbeque Society, for the American Royal BBQ Competition

KCBS Board member, contributing KCBS Rep at the Open contest

Judge Room Environment Details

The Master KCBScore instance is used to aggregate all category scores into a Master contest file. This "Master" workstation is managed by the Rep-In-Charge.

Data entry is performed on multiple "Secondary" workstations by the rep team. Each workstation contains a local instance of KCBScore. An Export function enables the transport of this data to the Rep-In-Charge for merging into the Master contest file.

Summary: Identified Events & Issues

Ref	Item	Issue	Recommendation
		Command, Control & Auditing	
1	Contest Results Print-Out Chain of Custody	The Announcer Copy printed results were generated from multiple machines, at various stages in the scoring process. This led to differences between the printed copy and the master KCBScore file	Results should only be printed from final master KCBScore file, after a complete audit
2	Contest No-Show Tracking	A process failure led reps to mis-identify zero scores as error entries	Develop a standardized process for when and how no-show teams are removed from the contest
3	Contest Results Audit	Turn in volume and timing prevented the use of KCBS audit procedures	Implement Reps in pods with a balanced ratio of Keyers and Auditors to ensure 100% audit of the contest
4	Hardware Asset Tracking	A combination of Rep owned and KCBS owned laptops makes it difficult to trace data, audit results, and provide remote support of Reps	Only KCBS owned & controlled laptops should be used
5	Contest Scoring Management & Oversight	Score corrective actions were uncoordinated, and follow up attempts to either re-key or correct scores resulted in increased human error	Rep-In-Charge should coordinate all efforts and not participate in score tabulations
6	Post-Contest Auditability	Scoring data is scattered across rep owned computers, USB drives, and KCBS assets. The disparate data impedes auditability and traceability	Centralize all assets and create chain of custody processes. Only KCBS owned hardware should be used. Implement a process to track all Scoring assets (physical and digital) through the lifecycle of the contest

7	Merge File Inventory Control	8 tables of Ancillary category "sausage" were missing from the final contest results	Improve KCBScore functionality to identify existing merge files
KCBScore File Merge			
8	Judge Slips With >6 Teams	KCBScore "Team per Slip" selector defaults to 6. Where there are more than 6 teams at a table, and a Merge takes place, a blank row will appear. The rep must manually increase the number via the dropdown selector during the merge process	Update the KCBScore program to dynamically update table count during KCBScore file merge
9	Contest Merge File Naming	Some Merge files were missing the requested naming convention "[Contest Name]-[Category Code]-[Open|Invitational]-[Keyer name]"	KCBScore should auto inject the relevant information into the contest file
10	USB Drive Management	Failure to track USB drives used to transport merge files	Fresh USB Drives for Invitational & Open. USB drives should be labelled and turned into KCBS CEO after event for historical & auditing purposes
11	File Reuse During Contest Re-keying	The initial Score entry data file was re-used during the re-keying process. Adjusted results were merged into the original master file, overwriting existing contest data	If required, reps should start with a clean contest record for the re-key merge, preserving the original data for auditing
Technology Stack and Services			
12	Website Contest Results Instability	Increased website traffic on 02 OCT 23, specifically downloads of the Score Summary Sheet PDF, caused the page to intermittently crash	This issue was identified, and a patch has been implemented
13	Enhanced Logging Within KCBScore	The combination of repeated edits to Score Files, file-reuse, the number of workstations, and use of merge functions hindered the investigative process	Modify KCBScore to use a logging library to create human readable per-device transaction logs
14	Technical Support	Capable technical support staff were at the contest but were competing. Due to the perceived risk of conflict, support staff were unable to assist with scoring tabulations in the judging room	Have onsite or on call remote capable technical support

15	Alternate Table Numbers	Publicly displayed "Alternate Table Numbers" may be repeated across multiple tables	Improve the table number obfuscation algorithm within KCBScore to ensure distinct alternate numbers are generated

Identified Issues & Events Detail

1. Contest Result Print-Out Chain of Custody

Issue

The Announcer Copy printed results were generated from multiple machines, at various stages in the scoring process. This led to differences between the printed copy and the Master KCBScore file.
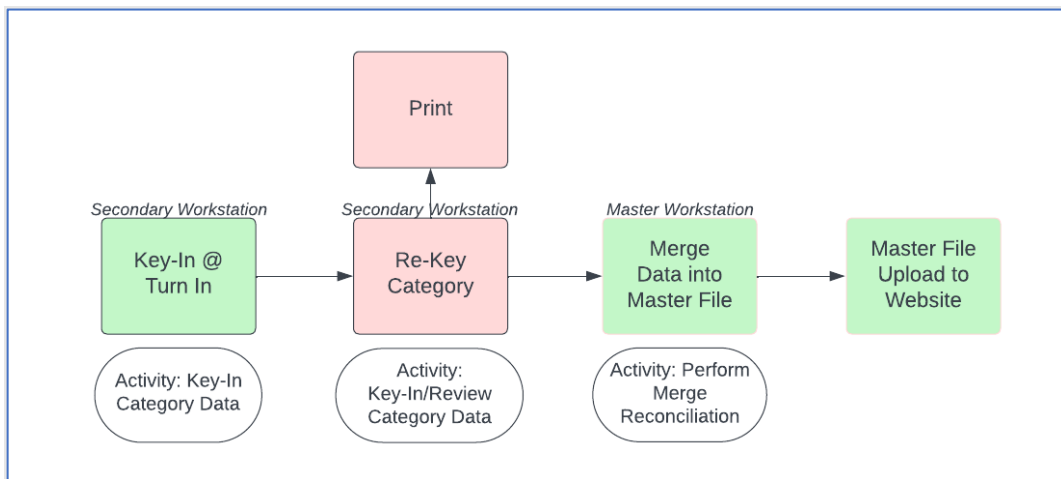
Detail

This issue was identified for multiple categories on 01 OCT 23.

Data entry and review occurred on a Secondary workstation. The Announcer Tally Sheet of results was printed from Secondary workstations; not from the Master workstation used to merge the files.

After the results were printed, a USB drive with the Merge files was moved to the Master KCBScore workstation to complete the merge operation.

This resulted in data entry errors between Master and Secondary files.

The Category Announcer copy was printed from Secondary machines. The Overall Announcer copy and the uploaded scores were generated from the Master Workstation.

Results should only be printed from the KCBScore Master contest file. A complete audit of scores should be performed prior to printing.

2. Contest No Show Tracking

Issue

A process failure led reps to mis-identify zero scores as error entries.

Detail

The unique nature of this contest caused an unusually high volume of teams not turning in entries. This generated an unexpected number of "0" scores. In total 20 registered teams did not pick up their boxes, and additional teams did not turn in all categories.

A list of dropped teams was identified, but not leveraged in the rush of activities. Reps raised concerns there was a system error and worked to identify the source of missing teams. The score card checklist was referenced but tables may be dropped if the contest does not have enough judges and there is no current process to track which tables are missing vs which ones were legitimately removed.

There was not enough time for the reps to sort out the missing teams prior to the next round of entries coming into the judging area, causing a backlog of unresolved scoring anomalies that later contributed to delay and scoring errors.

While judging Ribs, the table captain called out the wrong box number. The wrong box number was for a registered team not in attendance, who received scores for the entry in the system. During the review process, the mistake was corrected, giving the correct team the scores, but the wrong entry was not deleted from the KCBScore file.

Recommendation for Resolution

Develop a standardized process for when and how teams that do not pick up their boxes are removed from the contest.

3. Contest "On Site" Results Audit

Issue

Turn-In volume and contest timing prevented the use of KCBS audit procedures.

Detail

The KCBS audit procedures are a failsafe to correct for human error. During interviews conducted, it was determined that the majority, if not all, contests throughout the year perform

the KCBS audit procedure to correct human error and verify contest results. With "0"s appearing on the Royal's printed results, and after attempts to fix the "0" issue, the group of Keyers decided to rekey the entire contest, leaving them no time to audit.

Recommendation for Resolution

In speaking with the Rep-In-Charge, a concept was discussed about implementing a "Reps in pods" process. A pod would consist of 3 Keyers, and a pair of auditors. This new process would ensure that all files being transferred to the Master Score File would be 100% audited, prior to merging and subsequent results printing.

4. Hardware Asset Tracking

Issue

A combination of Rep-owned and KCBS-owned hardware makes it exceedingly difficult to trace data, audit results, and provide remote support for Reps.

Detail

The KCBS-owned, and BYOD (Bring Your Own Device) structure proved problematic while performing root cause analysis. Aside from the inability to access Rep owned systems for auditing and investigation purposes, there are known issues with screen resolution, and Windows Operating system nuances that can affect the usability and stability of KCBScore.

Recommendation for Resolution

Only KCBS-owned & controlled laptops should be used. Hardware should be pre-configured and tested prior to the contest. Pre-installed remote monitoring & and management tools would allow remote support capability of technical staff to support the Reps, should they require help. At the end of the contest, the machines should return to the KCBS office if a deeper investigation is needed.

5. Contest Scoring Management & Oversight

Issue

Score corrective actions were uncoordinated and subsequent attempts to either re-key, or correct scores, resulted in increased human error.

Detail

In comparing versions of score files across multiple USB drives, at various points in time from 01 OCT – 02 OCT the initial key attempts were mostly correct. As the issues with 0 scored teams, tables with 7 entries, and merge files compounded, a centralized and cohesive recovery strategy was not developed. This led to some reps re-keying categories, some reps searching for root causes.

Recommendation for Resolution

The Rep-In-Charge should work in a managerial role only. They should coordinate all efforts and not participate in score tabulations. If an incident is declared, the Rep-In-Charge should work with reps overseeing the categories to determine if a re-key is necessary, or if corrections will resolve the issue.

6. Post-Contest Auditability

Issue

Scoring data is scattered across rep owned computers, USB drives, and KCBS assets. The disparate data impedes auditability and traceability.

Detail

The size of this contest necessitates multiple data entry workstations, each with their own copy of KCBScore and pre-populated KCBScore file. Completed data is exported into a common file type, physically transported via USB drive to a Master workstation, and subsequently merged into the Master file.

The number of staff and equipment involved hinders the investigative process, requiring a complex process correlating human interviews, metadata found on each device, and underlying score file data.

Recommendation for Resolution

Centralize all assets and create chain of custody processes. Only KCBS owned hardware should be used. Implement a process to track all Scoring assets (physical and digital) through the lifecycle of the contest.

7. Merge File Inventory Control

Issue

8 tables of Ancillary category "Sausage" were missing from the final contest results.

Detail

A single Merge scoring file with table numbers ending in "5" was not merged into the Master Score file.

Recommendation for Resolution

Provide an interface within KCBScore to display a list of merged files. This list will provide on-site auditability of which files have been merged.

Related Issues

- 9. Contest Merge File Naming
- 13. Enhanced Logging Within KCBScore

8. Judge Slips With >6 Teams

Issue

KCBScore "Team per Slip" selector defaults to 6. Where there are more than 6 teams at a table, and a Merge takes place, a blank row will appear. The rep must manually increase the number via the dropdown selector during the merge process.

Detail

The Merge operation requires manual intervention for tables with more than 6 teams. The current known workaround is to use the drop-down selector and select more than 6 teams per table. The Rep-In-Charge, however, addressed this by manually re-entering the affected scores.

Recommendation for Resolution

Update the KCBScore program to dynamically update the table count during the KCBScore file merge.

9. Contest Merge File Naming

Issue

Some Merge files were missing the requested naming convention "[Contest Name]-[Category Code]-[Open|Invitional]-[Keyer name]"

Detail

Merge files generated from Secondary computers are physically transferred to the Master computer by USB drive.

To assist with traceability, Reps were asked to use a specific naming convention when saving Merge files. A subset of the Reps failed to follow this process.

Though we do not believe that non-uniform file naming had a material effect on the contest outcome, the lack of standardized naming presents an unnecessary risk. In addition, the use of a descriptive naming convention combined with the recommendations for "Enhanced Logging" and "Merge File Inventory Control".

Recommendation for Resolution

As a component of the next release, KCBScore should auto inject the relevant information into the contest file.

Data Points to Capture:

- ContestID
- Category Code
- Keyer Name (place holder prompt)
- Timestamp with system time zone

Example:
   <ContestID>-<Code>-[Insert Your Name]-<02:00pm_EST>

Related Issues

- 7. Merge File Inventory Control
- 13. Enhanced Logging Within KCBScore

10. USB Drive Management

Issue

Failure to track USB drives used to transport merge files.

Detail

USB Drives are used to move files from Secondary machines to the Master KCBS Score file to perform merging functions. USB Drives were provided by various parties. One USB Drive is currently unaccounted for.

New USB Drives should be used for the Invitational & Open contests. USB drives should be labeled and returned to the KCBS office with all contest hardware for historical & auditing purposes.

11. File Reuse during Contest Re-keying

Issue

The initial Score entry data file was re-used during the re-keying process. Adjusted results were merged into the original master file, overwriting existing contest data.

Detail

The Master Score file contained data from initial keying entries. Secondary workstations were used to re-key and review results.

This new data was merged into the Master Score file, already containing existing imports, thus overwriting the existing data, and hindering review.

It may also introduce or exacerbate additional errors during the Merge process.

Recommendation for Resolution

If required, reps should start with a clean contest record for the re-key merge, preserving the original data for auditing.

12. Website Contest Results Instability

Issue

Increased website traffic on 02 OCT 23, specifically downloads of the Score Summary Sheet PDF, caused the page to intermittently crash.

Detail

When generating the contest results PDF, the website dynamically computes results.

As of early 2023, score summary sheets are no longer printed and distributed at the Contest. This increases the reliance on the website for results distribution.

Higher than average website traffic, combined with the dynamic nature of PDF production, causes site instability.

On 03 OCT 23, to reduce server load, the website vendor implemented a change that generates a static PDF from the contest file upload.

This introduced a bug that prevented the Score Summary Sheet from being **_re-generated_** when updated contest files are uploaded with corrected results.

Recommendation for Resolution

While the re-generation issue has been resolved, slowness has been noticed in downloading Score Summary Sheets for large contests. The website vendor is working on a fix to resolve this issue.

13. Enhanced Logging Within KCBScore

Issue

The combination of repeated edits to Score Files, file-reuse, the number of workstations, and use of merge functions hindered the investigative process.

Detail

The size of the event necessitates multiple data entry workstations, each with their own copy of KCBScore and pre-populated KCBScore file. Completed data is exported into a common file type, physically transported via USB drive to a Master workstation, and subsequently merged into the Master file.

The number of steps in the data entry process, participating staff, and equipment involved hinders the investigative process. This necessitates a complex process correlating human interviews, metadata found on each device, and underlying score file data.

An enhanced logging system within each copy of KCBScore will simplify the investigative process, aiding in issue identification and attribution.

Recommendation for Resolution

Modify KCBScore to use a logging library to create human readable per-device transaction logs.

Logs should utilize a standardized format that will aid in the identification of the Operation and provide Values in a parsable format.

Related Issues

- 7. Merge File Inventory Control
- 9. Contest Merge File Naming

14. Technical Support

Issue

Capable technical support staff were at the contest but were competing. Due to the perceived risk of conflict, support staff were unable to assist with scoring tabulations in the judging room.

Detail

Concerns were identified after the first key-in. These concerns, regardless of validity, were the result of the systems, processes, and events detailed in the previous sections.

A technical resource with knowledge of the rep software and tools was present at the contest. This technical resource was also a BBQ Team competing at the contest. To avoid potential conflicts, the resource was not contacted. This left the Rep team without support, making the decision to rekey parts of the contest.

Recommendation for Resolution

Have onsite, or on call / standby, remote capable technical support. Support resource must have an understanding of both the rep process and have the necessary technical skills to debug KCBScore activities. The technical resource will be further enabled by previous recommendations, including the addition of Enhanced Logging within KCBScore.

15. Alternate Table Numbers

Issue

The publicly displayed "Alternate Table Number" may be repeated across multiple tables.

Detail

To protect the identity of judges, posted scores include an Alternate Table Number, obfuscating the true table number from which scores were issued.

The obfuscation is performed within the KCBScore application; applied to distributed printouts and the public website.

For contests with a sufficiently large number of tables, the obfuscation algorithm fails to assign distinct Alternate Table Numbers. This results in the appearance of larger than expected team entries per table.

True table numbers are accurately tracked within the system. This issue is superficial in nature but can lead to diminished confidence in posted results.

Recommendation for Resolution

Improve the table number obfuscation algorithm within KCBScore to ensure distinct alternate numbers are generated.

Results Audited by the KCBS Office & Rep Staff

A complete 100% audit of all Sunday's tabulations was completed between 02 OCT 23 – 04 OCT 23 by the following KCBS staff and Reps.

- Rod Gray & Forrest Bruce Audited Pork & Brisket categories
- Dave & Peg Rogers Audited Chicken & Ribs categories
- Audrey Johns & Rod Gray audited Sausage categories
- Rod Gray, Taylor Drummond, Audrey Johns, and Rhiannon Dickerson audited Turkey categories

The following data represents the number of teams per category and keying errors identified during the in-office audit.

- Chicken:
  - 483 Teams
  - 11 Keying Errors
- Ribs:
  - 487 Teams
  - 5 Keying Errors
- Pork:
  - 481 Teams
  - 46 Keying Errors
- Brisket:
  - 484 Teams
  - 41 Keying Errors
- Sausage:
  - 280 Teams
  - 2 Keying Errors
- Turkey:
  - 219 Teams
  - 2 Keying Errors

Conclusion:

The Identified Issues & Events laid out demonstrate multiple failures throughout the scoring process. The size and complexity of this event contributed to the failures that occurred in tabulating results. The greatest contributing factor was the decision to re-key the contest.

The considerable number of no-show teams with "0" score entries, combined with the action to manually re-key table data to address the "Team per slip" setting, lead Reps to lose confidence in the accuracy of the results.

This loss of confidence caused the Reps to simultaneously attempt a re-key and / or perform ad hoc audits under self-imposed extreme pressure. In some cases, category results (Announcer Copies) were printed from Secondary workstations before Merge into the Master file. Post-merge, ad-hoc adjustments were made to the Master file and later uploaded to the website.

In many of the situations involving position changes across the top 25, the initial scoring key attempts were correct. The re-key and post-merge table adjustments, which occurred after the Announcer Copies were printed, caused most position changes.

**KCBS Action Plan for Large Contest Corrective Measures Based on
Park Road Technologies Root Cause Analysis Report**

KCBS has a rich 37-year history of successfully overseeing and determining the outcome of major barbeque contests. Based on the data entry and tabulation errors that occurred at the American Royal World Series of Barbecue Open Contest on Sunday, October 1, 2023, an investigation was launched to learn the exact happenings surrounding the scoring issues and ultimately announcing incorrect winners. Park Road Technologies was engaged to perform a thorough postmortem investigation of the actions of those assigned and pinpoint the breakdowns that influenced what occurred on that day. The resulting report sheds light on several factors unique to events of this size, elucidating the circumstances that led to the outcomes. In light of these findings, the following is a list of recommended implementations to prevent this situation from occurring at future large events.

Chain of Command:
- Create a chain of command to implement necessary corrective actions for events requiring four or more Contest Representatives and data entry personnel.
- The Lead Contest Representatives will be determined for the judging and tabulation areas of events.

Process for Identifying and Removing Teams from the SCORE Contest File:
- Develop a communication policy with large events to identify teams that do not complete the contest check-in process
- Develop a coordinated approach to remove these teams from the contest file prior to the final data entry and tabulation.

Control of Contest-Related Data:
- Utilize new USB drives for events where the merge feature of SCORE will be utilized.
- Observe a standardized and proper naming convention for all drives.
- Retain and store all USB drives by event at KCBS headquarters.

Contest Results Change of Custody:
- All contest results must be printed from the Master Computer, defined as the computer used to merge results.
- No results may be printed from other computers used for data entry at the contest.

Contest Data Audit:
- Create pods of data entry personnel (3) and auditors (2) for contest data entry and audit where data mergers are required.
- Suggest two (2) pods for contests with up to 200 teams, three (3) pods for contests from 201 to 350 teams, and four (4) pods for contests with more than 350 teams.

Develop Procedures for Situations Requiring Re-entry of Contest Data:
- If re-entry of contest data is required, use a new SCORE entry data file instead of the original file.

Technical Support:
- For contests where data mergers are required, coordinate remote technical support to be available during the contest timeframe of data entry and tabulation.

SCORE Tabulation Software Updates:

Level One:
- Update SCORE code to auto-populate the number of entries per table when merging data

Level Two:
- Update SCORE code to provide feedback for tables of missing data
- Update SCORE software to allow for unlimited Alternate Table numbers

Level Three:
- Incorporate more in-depth logging to track data manipulation

The procedural items listed will be implemented for all large contests where data file mergers are required. The software updates will begin now, with the level one change occurring sometime in November and tested in December. The level two and three updates will occur in the next six months.